

Cutting through Complexity

The Analytical Activist's Guide to Solving
the *Complete* Sustainability Problem
with Root Cause Analysis

A THWINK.ORG PROJECT

As we say at Thwink.org

Welcome to A Whole New Way of Thwinking

NOTE – This book is in progress.

Chapters 11, 12, 13, 14, and 22 are not yet written. These deal with solution elements. Until this book is completed, please see the *Common Property Rights* book for the missing solution elements.

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Printed by Lulu Press
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Key Illustrations

Skim these to immediately grasp the core content of the book.

- The System Improvement Process (SIP) matrix** 38
 SIP is a comprehensive problem solving process based on root cause analysis and feedback loop modeling. SIP first decomposes the one big problem into smaller subproblems. Each subproblem is then analyzed with a social force diagram.
- Root cause analysis results, unsustainable mode** 78
 This social force diagram shows the key analysis results at a glance. The highlight is the *main root cause*.
- Root cause analysis results, sustainable mode** 86
 This social force diagram shows how the system behaves after the *main root cause* is resolved. The natural behavior of the system changes radically.
- Summary of Analysis Results table** 88
 The key conclusions are that these are the important subproblems, their root causes, and the high leverage points for resolve the root causes. *This single page incorporates everything this book has to say.*
- The Basic Dueling Loops of the Political Powerplace** 111
 The model explains WHY society has been unable to solve the sustainability problem and how the problem can be solved, by pushing on the right high leverage point. This is *the* model to grasp because it explains so much.
- Solution Requirements Specification for Subproblem A** 144
 SIP allows social problem solving to be treated as social system engineering. Social systems are engineered incrementally, by producing solution requirements specifications for existing problems. As waves of solutions are specified, contracted, developed, and implemented, a social system reaches a successively higher state of improvement until the system goal state is achieved. This page contains a typical solution requirements specification.
- The World's Property Management System** 189
 This causal loop diagram explains how the Common Property Rights solution element can work efficiently. Common Property Rights is the mirror image of an existing system, private property rights, which is the most efficient system known for managing private property. It's worked spectacularly well for a long time, especially since the Industrial Revolution. While there are great *physical* differences between private and common property, their *managerial* differences are negligible. It follows that Common Property Rights will be just as efficient.

Foreword

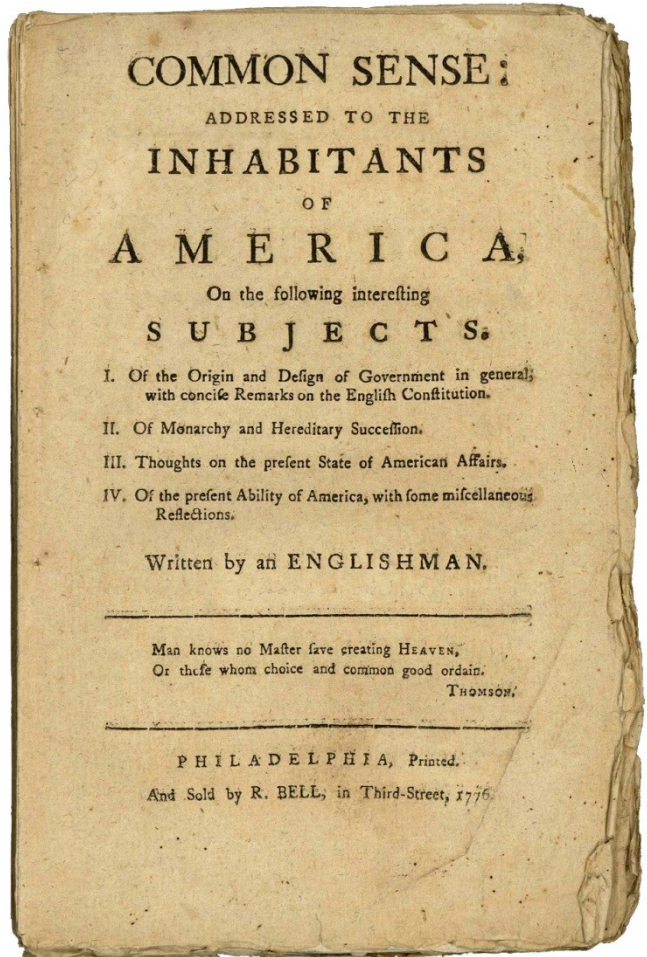
(To be written)

Introduction

Sometimes activism works

Time and time again, public interest activism has shaped the course of history. Who does not silently salute the twenty-five barons who opposed King John's ruinous reign, swore they would "stand fast for the liberty of the church and the realm," and forced the King to sign the Magna Carta in a meadow on the bank of the River Thames at Runnymede in 1215?

The political ripples from that valiant act of activism led ultimately to the birth of modern democracy in the late 18th century. Ignited by the fiery words and impeccable logic of Thomas Paine in the 48 pages of *Common Sense*, "the public sentiment which a few weeks before shuddered at the tremendous obstacles, with which independence was environed, overleaped every barrier," as Edmund Randolph, later Virginia's seventh governor, reported. A Connecticut reviewer of the pamphlet wrote "We were blind, but on reading these enlightening words the scales have fallen from our eyes." Or listen to the words a Bostonian wrote in a letter to a friend: "Independence a year ago could not have been publickly [sic] mentioned with impunity ... Nothing else is now talked of, and I know not what can be done by Great Britain to prevent it." *Common Sense* was first published on January 10, 1776. Six swift months later, on July 4, 1776 the American colonies signed the Declara-



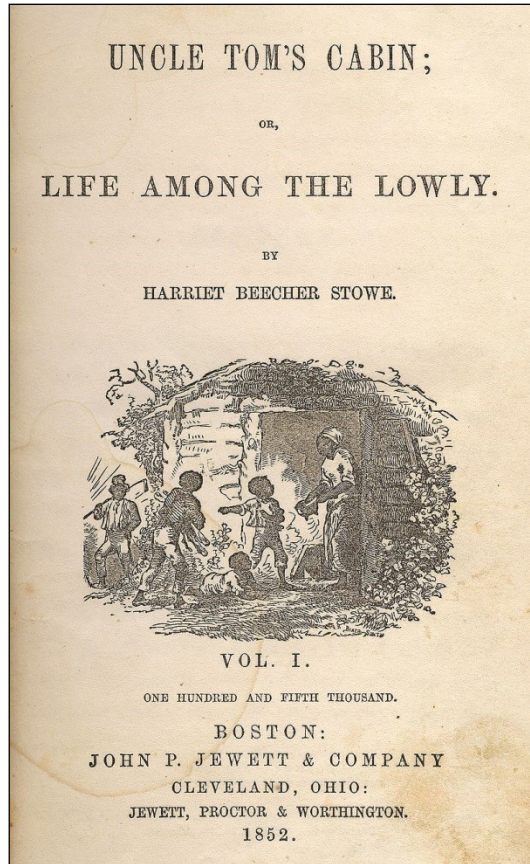
tion of Independence and established the world's first constitutional democracy in 1787. France followed in 1789 with the Declaration of the Rights of Man and the Citizen, today enshrined in its national motto of "liberty, equality, fraternity" for all.

And who does not thrill at the stalwart dedication of the multitude of activists who drove the abolitionist movement to end the inhuman practice of slavery, where man's fellow man was bought, sold, worked, and treated like muscular draft horses? The movement began in the late 18th century, when English and America Quakers began publicly questioning the morality of slavery. Soon anti-slavery sentiments were widespread, though nations that relied on slaves as agriculture machines continued the practice.

For France, it was not until Jacques Brissot founded the Society of the Friends of the Blacks in 1788 that French debate on the issue of colonial slavery began in earnest. In 1794 the French National Assembly passed the Universal Emancipation decree and freed all slaves in French colonies.

In the British Empire, poet William Cowper wrote: "We have no slaves at home—then why abroad? Slaves cannot breathe in England; if their lungs touch our air, at that moment they are free." The famous anti-slavery medallion of 1787, designed by Josiah Wedgewood, pleaded "Am I Not A Man And A Brother?" The forces of abolition grew. In 1807 parliament passed the Foreign Slave Trade Act, ending slave trade throughout the empire.

In the United States the work of thousands of activists, including the courageous underground activism of Harriet Tubman and the unforgettable words of Harriet Beecher Stowe's *Uncle Tom's Cabin*, led to the signing of the Emancipation Proclamation in 1863. Three million slaves were instantly freed from their chains of evil, though actual freedom for most had to await the end of the US Civil War.



And sometimes it fails

Public interest activism, however, does not always prevail. Some problems are too big and complex to solve, or so it seems. Environmental sustainability, in only the blink of a few decades, has become one such problem. The problem hovers ominously over our fragile planet and its seas of hard-working activists, casting a dark shadow that portends a most unpleasant outcome if the problem is not solved soon.

How soon? Not so long ago there was ample time for society to intelligently appraise the problem and mount an effective solution. In 1972 the first edition of *Limits to Growth* painted a picture of cautious optimism. It was still possible for “the world’s people to strive for [a sustainable future with no collapse]. The sooner they begin working to attain it, the greater will be their chances of success.” The question was *how to attain a sustainable future*. At the time it looked eminently possible.

But that window of opportunity soon closed. Only twenty years later in 1992 the second edition, appropriately titled *Beyond the Limits*, found the world was now in the early stage of overshoot. “The human world is beyond its limits. The present way of doing things is unsustainable. The future, to be viable at all, must be one of drawing back, easing down, healing.” The question had shifted to *how to ease back from beyond the limits*. Civilization, hurtling through history, had inadvertently crossed over the yellow line in the middle of the road. Now it had to veer back to the right side of the road. The dark shadow had expanded.

Today, 27 years later in 2019, no credible solution is in sight. Overshoot has passed the 50% mark and continues its unstoppable rise. Collapse lies dead ahead. The worst fears of the “business as usual” scenario of *Limits to Growth*, with environmental and economic collapse occurring sometime in the 21st century unless business as usual changes to sustainable behavior, seem on the cusp of becoming all too true. The dark shadow has spread and now envelops the globe with a sense of relentless foreboding and inescapable doom. Humanity, led by the foresighted soldiers of environmental activism, has been unable to solve *the* crises of our age. Solution after solution has been tried. Nothing has worked.

The question has thus shifted into a third form, one of stark desperation: *How can society avoid the worst effects of global collapse?* It’s as if every environmentalist on the planet, as a passenger on the Titanic, has peered through the fog of the night and has seen the iceberg just before the moment of impact. There remains only a small amount of time to steer clear. But the ship is so close that collision is unavoidable. How can society hit the iceberg with the least amount of force, so that ragged chunk of ice doesn’t rip a hole in the hull and sink the ship, and instead causes only a slow leak. Then there would be ample time to repair the leak and save the ship.

This book is an analytical attempt to answer that question.

The need for root cause analysis

The thesis of this book is that *the sustainability problem is too complex to solve without formal root cause analysis*.

The global environmental sustainability problem has become the top long-term problem of our time. We know the problem's general symptoms. If business as usual continues, civilization faces global environmental collapse. We know the problem's solution history. While some gains have been made, the overall problem continues to defy all attempts at solution.

But what do we know about WHY society has been unable to solve the sustainability problem? WHY has the United Nations been unable to put the planet on a path to sustainability, despite forty years of effort? WHY has the dominant paradigm of our time, capitalism, been able to bring us the miracle of the Industrial Revolution, yet has been unable to ignite the Sustainability Revolution? And finally, HOW can we change these patterns of behavior so that the Sustainability Revolution occurs immediately, in time to repair the leak and save the ship?

These are the questions I attempt to answer in this book. Let me say from the start that the answers are tentative and incomplete. But they are based on a much deeper look at these questions than other researchers have been able to take, due to use of a tool that has not been applied before to the sustainability problem. *The tool is root cause analysis*. The tool works by allowing analysts to solve activist problems in a step by step manner, by finding and resolving their root causes. A difficult problem's root causes are always counterintuitive and deeply hidden. Such root causes cannot be found by ordinary means. Only the powerful tool of formal root cause analysis can solve seemingly impossible-to-solve activist problems.

A **root cause** is the ultimate cause of a problem, rather than the more easily found superficial cause. **Root cause analysis** is the practice of solving problems by systematically finding and resolving their root causes. The tool works by starting at problem symptoms and tracing cause-and-effect relationships backwards until the root causes are found, just as a detective begins by carefully examining crime scene clues and then follows the trail backwards to the perpetrator, no matter how hard that trail may be to follow. Indeed, this is the procedure Sherlock Holmes himself employed in *A Study in Scarlet*:¹

There's the scarlet thread of murder running through the colorless skein of life, and our duty is to unravel it, and isolate it, and expose every inch of it. ... In solving a problem of this sort, the grand thing is to be able to reason backward. That is a very useful accomplishment, and a very easy one, but people do not practice it much. In the everyday affairs of life it is more useful to reason forward, and so the other comes to be neglected. There are fifty who can reason synthetically for one who can reason analytically.

WHY has society been unable to solve the sustainability problem? Because environmentalists do not use root cause analysis. As a result the root causes are unknown. This has forced environmentalists to base their solutions on common sense and guesswork, even when problem solvers base their work on scientific research. This has resulted in solutions that attempt, in vain, to solve intermediate causes. This approach fails because it does nothing to solve the root causes. To explain intermediate versus root causes, let's review a celebrated example.

On January 28, 1986 the NASA space shuttle Challenger exploded 73 seconds into flight, killing all aboard. A presidential commission was formed to investigate the disaster. The commission concluded that the cause of the explosion was O-ring failure due to unusually cold air temperature.

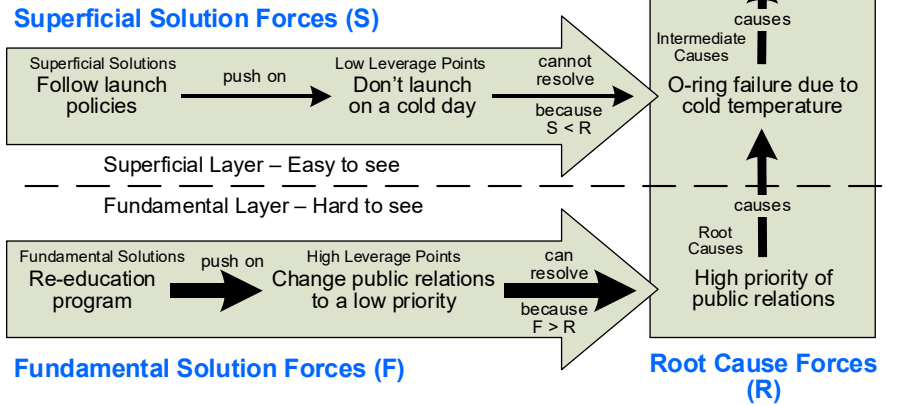
But was this the root cause? Nobel prize winning physicist Richard Feynman, an outsider appointed to the commission to broaden its thinking, quickly found the O-ring problem and how it was the direct cause of the explosion. During a live TV press conference Feynman ingeniously showed, using a glass of ice water, forceps, and a piece of O-ring material, that once compressed the cold O-ring remained deformed. It did not bounce back to its full shape immediately, which because of cold air temperature created the leak that allowed engine flames to reach and ignite the Challenger's fuel tanks. The demonstration cemented Feynman's reputation as the sharpest investigator on the commission.

Feynman did not stop there. He had his own scarlet thread to follow. NASA had policies in place that should have prevented launch on such a cold day, when air temperature was 36 degrees Fahrenheit, 15 degrees colder than any previous shuttle launch. Feynman found that engineers' warnings that it was too cold to launch had gone unheeded by management. WHY had management failed to listen to its own experts? After much digging he concluded the root cause was that public relations (such as no more launch delays!) had a higher priority than following launch policies and was the root cause. Feynman summed this up in his final report: "For a successful technology, reality must take precedence over public relations, as nature cannot be fooled."

The social force diagram on the next page shows how root cause analysis can be applied to the Challenger explosion problem. The diagram explains why the solution in place to prevent *O-ring failure due to cold temperature* was tragically superficial. The solution of *follow launch policies* didn't work. It failed to prevent launch because the root cause of *high priority of public relations* exerted a greater force on the intermediate cause. This demonstrates how root cause forces are always greater than superficial solution forces. Nature cannot be fooled.

The Challenger Explosion Problem

Social Force Diagram



NASA accepted Feynman's conclusion and later initiated a re-education program and other policies to resolve the root cause. This worked because fundamental solution forces are greater than root cause forces. The reason they are greater is that by clearly identifying the exact root cause, a high leverage point can be found for resolving it. In this case the high leverage point was *change public relations to a low priority*. Such high leverage points are invisible without root cause analysis.

NASA uses root cause analysis. So do 82% of the world's Fortune 100.² But the process is nowhere to be found in environmentalism. The United Nations Environmental Programme (UNEP), in its latest problem-solving report, examined "the drivers of environmental change" in order "to invest in solutions that will help tackle the root causes, not merely the symptoms." However, examination of the process used shows it is not actually root cause analysis.³ The closest we came to finding a case of all of the basic practices of root cause analysis being followed was a World Wildlife Fund's project completed in 2000. This presented a "framework for analyzing socioeconomic root causes of biodiversity loss...." Like the UNEP's process, the framework does not actually use root cause analysis.⁴

Moving to Analytical Activism

Until environmentalists begin using root cause analysis, they will continue to be thwarted by certain laws of physics that cannot be ignored. But once they start down that path, they will no longer be traditional activists. They will have transformed themselves into *analytical* activists and will, like Sherlock Holmes, be able to unravel, isolate, and expose every inch of the causal chain from a problem's symptoms to its root causes—no matter how difficult that causal chain may be to find.

Analytical Activism is the use of rigorous analysis instead of intuition and trial and error to solve difficult public interest problems. The process uses these four best practices:

1. **A true analysis of the problem is performed. Analysis** is breaking a problem down into smaller and smaller problems until each is easily solved. For a difficult problem this has the effect of slicing through a giant Gordian knot of incomprehensible complexity and deftly turning it into an organized collection of much simpler problems. Each problem is then solved individually. For example, on the social force diagram, after the problem was defined by describing its symptoms the diagram prescribed → six small problems to solve. What are the intermediate causes? Etc.
2. **A formal process that fits the problem is used. A process** is a repeatable series of steps and practices to achieve a goal, such as a recipe or Robert's Rules of Order. If a process fits a problem, like the way a recipe fits the problem of how to cook a dish you're unfamiliar with, then if correctly followed the process will lead to solution or to discovery the problem is insolvable. If the latter occurs, then the problem should be re-defined, if possible, to be solvable.
3. **The Scientific Method is used to prove all key assumptions.** The Scientific Method is the only known method for producing reliable cause-and-effect knowledge. Without it one cannot build reliable layers of knowledge, resulting in a castle of sand. But with the Scientific Method one can dig deep into problems and build a castle of stone that can soar to the height needed to solve the problem. If a process that fits the problem is continuously improved, the castle will grow high enough to solve the problem, regardless of how difficult the problem is—if of course, the problem is humanly solvable. → What about measurement?
4. **Learning from past mistakes and successes is maximized.** As George Santayana wrote in *The Life of Reason* in 1905, "Those who cannot remember the past are condemned to repeat it." Take a peek back at the social force diagram. Identification of the superficial solution forces lets us learn from past mistakes. If a solution succeeds, then it most likely worked because of the rest of the diagram. This knowledge maximizes learning from success.

Science can be roughly divided into the soft sciences, like economics and psychology, and the hard sciences, like physics, biology, and engineering. These four best practices can transform activism from the soft science it is now, with unpredictable results, low efficiency, and slow progress, to a hard science with predictable results, high efficiency, and rapid progress. What's been missing is practice 2. As far

as I can tell, there is no off-the-shelf process available that fits difficult large-scale public interest problems. I noticed this gap in 2001, when beginning work full time on the sustainability problem. The missing process quickly became the center of the work at Thwink.org. This book presents the fruits of that research.

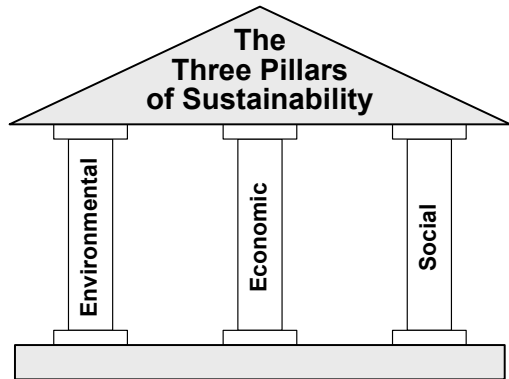
Now imagine what our world would be like if activists had a problem-solving process capable of solving big tough social system problems, like sustainability, recurring wars, and avoidable large recessions. Every one of these problems is presently insolvable. What could our world become if we activists could solve these problems and more, just as routinely as the hard sciences and the business world solve their own tough problems?

As impossible as it may seem, this can probably be done. The Thwink.org analysis uncovered a rather welcome surprise, one that was totally unexpected. I'd like to share it with you right away so you can see how it applies to the rest of the book and the future of activism.

The Broken Political System Problem

While I was peeling through layer after layer of the sustainability problem, a striking pattern emerged. (1) *Environmental sustainability is not the only large problem society has been unable to solve. There's also* (2) *recurring wars,* (3) *avoidable large recessions like that of 1929 and 2008,* (4) *excessive income inequality,* (5) *governmental corruption,* (6) *institutional poverty,* (7) *racial discrimination,* (8) *gender inequality, and more.* The pattern is that each of these eight problems would benefit the common good if solved. Patterns this strong do not happen by chance.

These problems can be organized into the **Three Pillars of Sustainability**, as shown. The three pillars are a widely used way to classify society's problems. For a society to be sustainable and meet the needs of its people, all three pillars must be strong and sustainable. History has shown that weakness in any one pillar will spread to them all.



The three pillars can be used to classify the eight problems listed above. Each fit neatly into one of the three pillars. Once this is done a further pattern appears. Each pillar is weak. Each has major unsolved problems. Yet for a healthy society, one that allows all of its citizens to flourish, all three pillars must be strong.

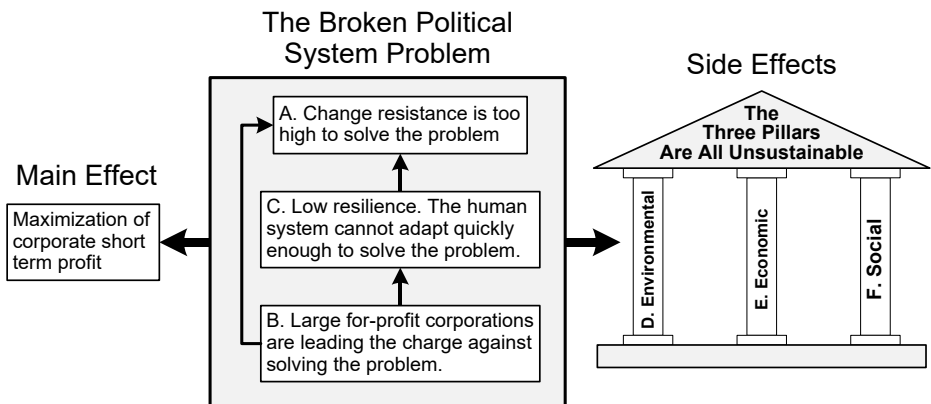
This leads to a deeper insight. The goal of democracy (and theoretically socialism) is to optimize the common good of the people. Most nations should therefore be

intently focused on solving the eight problems listed above. All three pillars of sustainability *should* be strong by now, given the abundance of the Industrial Revolution, the much higher quality of life it has allowed, and the ability of modern science to perform such dazzling miracles as putting a man on the moon in only ten years. But the three pillars are *not* strong. Why is this? Why are democracies around the world failing to make all three pillars strong and sustainable? That is *the* right question to ask and focus on, no matter how long it takes to answer.

The answer did not come overnight. Peeling the layers of the sustainability problem required seven years of exploratory analysis and simultaneous improvement of the analytical process used. With excruciating slowness, though thankfully much faster than it took to solve the slavery problem, an explanation began to crystalize. Pieces of the puzzle started snapping into place. Finally, when the full analysis stabilized and all the root causes were found, everything became clear. The last trace of the fog of complexity vanished. In its place was the simple structure shown on the next page.

Analysis of the environmental sustainability problem found four subproblems, A, B, C, and D. By adding subproblems E and F we get the Three Pillars of Sustainability. Subproblems A, B, and C combine to form what can be called the **Broken Political System Problem**. This problem is so systemic it causes the side effect of weakness and unsustainability in all three pillars. Until the Broken Political System Problem is solved, the eight common good problems listed above will remain insolvable. Let me briefly try to explain. (For a more complete explanation see the diagram on page 78. This omits subproblems E and F.)

Democracy is broken. Instead of working for the common good, it works for the uncommon good of large for-profit corporations. The diagram below shows that corporations are leading the charge against solving the sustainability problem. Corporations do this because of their overwhelming control of the human system, their superior financial power compared to citizens, and their obsessive goal of maximization of short-term profit. This goal conflicts with the goal of *Homo sapiens*, which is



the long-term optimization of quality of life for people. Because corporations dominate the system their goal prevails. This causes change resistance to solving problems whose solution would reduce short term profits.

Environmental sustainability is a long-term problem. Trying to solve it now, with solutions like carbon taxes or regulations, reduces short term profits. So does avoiding the bubbles that precipitate large recessions, because corporations make a fortune in those bubbles and are smart enough to not lose it when the bubble bursts. Solving the poverty problem requires serious amounts of short-term investment. And so on, for all eight problems listed earlier.

This discovery, if true, is exceptionally good news. The analysis found clear root causes for subproblems A, B, C, and D. Each root cause has a connected high leverage point that, if pushed on correctly with solution elements, would resolve the root cause. *None of these high leverage points has ever been pushed on before with large-scale solutions.* This implies the Broken Political System Problem is solvable. Analytical activists have a winning hand.

A little caution, however, is in order. Is this discovery true? Does the Broken Political System Problem really exist? Can it be efficiently and quickly solved by pushing on the high leverage points found?

The remainder of the book provides the knowledge that, I hope, will allow you to answer those questions for yourself.

How this book is organized

Part 1, *The Extraordinary Magic of Process Driven Problem Solving*, is not demanding material technically. But it's quite demanding intellectually because it requires a large change in the way you think. The goal of Part 1 is to move your headspace into naturally thinking in terms of process driven problem solving, centered on root cause analysis. This starts with a look at current processes and why they are unable to solve the sustainability problem. They don't fit the problem because it's so complex that root cause analysis is required. A process that does fit the problem, the System Improvement Process (SIP), is presented.

Part 2, *What Cutting through the Fog of Complexity Has Found*, is the meat and potatoes of the book. The results of applying SIP to the sustainability problem are presented in enough detail so that you can reach the same general conclusions Thwink.org has.

Part 3, *Sample Solutions for Pushing on the High Leverage Points*, presents a comprehensive collection of sample solution elements for pushing on the high leverage points. Most of these solutions are totally different from anything being seriously proposed today. Why? Because the sample solutions are designed to resolve root causes so subtle that they have remained undetected by present problem solving approaches.

Part 4, *Putting It All Together*, tries to do exactly that.

Welcome to the world of Analytical Activism.

Part 1

The Extraordinary Magic of Process Driven Problem Solving

“**[The] Power of Process** – At the heart of all remarkable innovations in any realm lies a rigorous routine, a disciplined methodology. And the learning cycle is at the core of that process. By codifying it, applying it, teaching it, and adopting it as your official *modus operandi*, you gain enormous benefits.

First, a common approach leads to common terminology. That terminology, if matched well to the task and goal, begins to build a common language. And language is so very important to creating the systems and structures that drive success.

Second, a common method focuses thought and action. It unifies them into a straight line that’s easy for people to understand and follow. That’s important, because everyone want a road map, especially for more challenging ventures.

Finally, a common technique lends itself well to use of supporting tools that help enhance the process. And tools often shape behavior.

Insist on a common approach, and it won’t be long before you’ll have an idea management system under development. And that’s the key to improving your idea quotient—ideas per capita.”

Matthew May

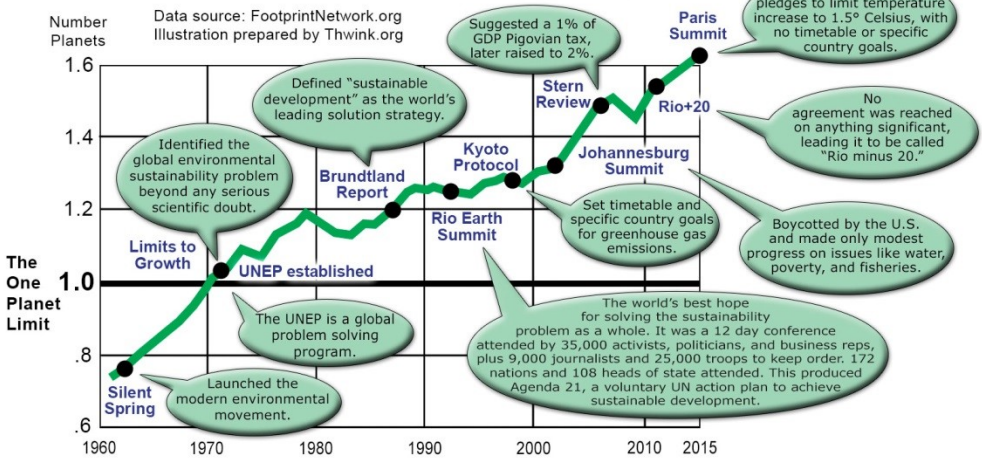
Toyota’s Formula for Mastering Innovation, 2007, p74-75

Navigating Solution Landscapes by Increasing Process Maturity

The magic begins when the process fits the problem

The life of an analytical activist is not easy. They are continually confronted with one big novel problem after another. Currently the biggest problem of them all, in terms of impact to the total human system, is the global environmental sustainability problem.

The World's Ecological Footprint



To date the problem has resisted all attempts at solution. While some progress has been made in areas like local pollution, the overall problem continues to grow worse with no credible solution in sight. The world's ecological footprint marches steadily upward, as unstoppable as the rising sun.

The **ecological footprint**⁵ measures how many planets it would take to provide the total ecological services being used. As soon as the graphed line grew past the one planet limit sometime around the 1970s, the world's environmental impact rate became unsustainable. We are now living on borrowed time.

The sustainability problem is so difficult to solve it literally runs off the chart. The latest updates were in 2003 and 2007. Both times the top of the graph had to be extended because footprint growth has become unstoppable. The footprint keeps right on rising and running off the chart.

Why is this? Why, despite over forty years of brilliant and often heroic effort by millions of people, has society been unable to solve the sustainability problem?

Common answers are lack of political will, market failure, this is a hard problem, human greed, and so on. But none of these answers help to solve the problem.

Our answer to this question signals Thwink.org's departure from mainstream thinking. Our research has taken an entirely different approach, one so different it may appear radical at first glance. The reason society has been unable to solve the sustainability problem lies in the problem-solving process itself. *It is the wrong process because it does not fit the problem.*

That the process must fit the problem has become *the* foundation of science. This mindset began in earnest with invention of the **Scientific Method** and its famous five main steps:

1. Observe a phenomenon that has no good explanation.
2. Formulate a hypothesis that explains the phenomenon.
3. Design an experiment(s) to test the hypothesis.
4. Perform the experiment(s).
5. Accept, reject, or modify the hypothesis.

The Scientific Method is a process for solving cause-and-effect problems. Until its invention scientists had no method for determining if new causal knowledge was reliable or not. Once it was invented the Scientific Revolution began, as one problem after another was rapidly solved.

Many of these problems required invention of a new problem-solving process. How can you systematically explain the financial behavior of a business? With double entry accounting, a process for measuring and organizing the causes of company profit. How can a chemist understand the differences between elements and how that explains their behavior? With the Periodic Table, a process for organizing the elements that worked so well it was able to predict discovery of new elements due to gaps in the table. Some processes grew so elaborate they became fields in themselves, like geometry, architecture design, mechanical engineering, and genetic engineering, which began with the first process for DNA modification.

Solution fitness landscapes

As the forces set in motion by the Scientific Revolution continued to solve an ever-expanding range of increasingly more difficult problems, the process of problem solving itself came under investigation. This culminated in 1972 in Newell and Simon's classic work, *Human Problem Solving*.⁶ The authors studied how people solve unfamiliar problems. Their central conclusion continues to drive research today. People engage in "selective search in a problem space." A **problem space** is the mental representation of the present situation, the preferred situation (the goal), and the many possible solutions that may or may not solve the problem. **Selective**

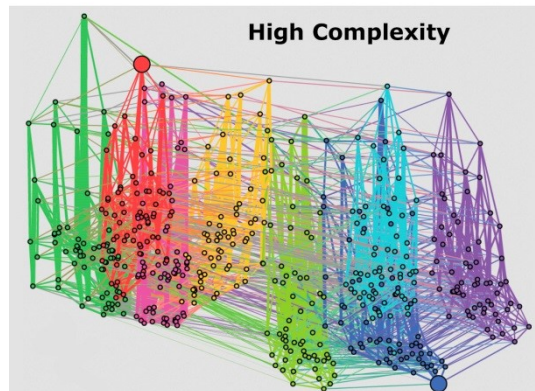
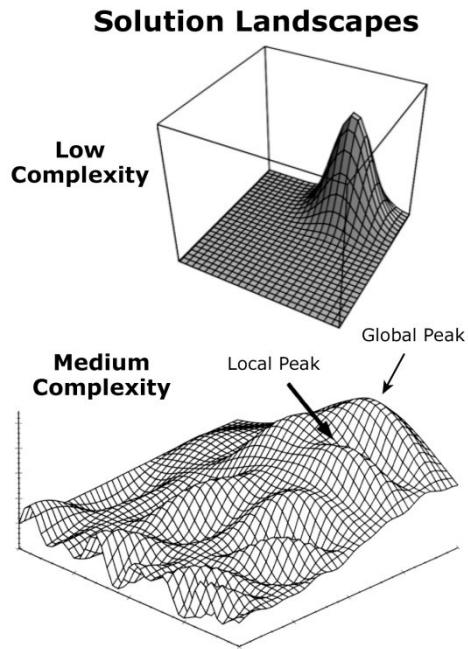
search is the process people use to search the problem space for solutions that will work. The more difficult the problem, the harder it becomes to search the problem space efficiently because the few solutions that will work are obscured by the complexity and size of the problem space, which is populated by huge numbers of solutions that will not work. For difficult problems the problem space is so large it cannot be exhaustively searched by trial and error. A search process of some kind, called a heuristic, is required. A **heuristic** is a set of rules for searching a problem space. In our terminology a heuristic is the same thing as a problem-solving process.

These concepts make it clear that society’s inability to solve the sustainability problem stems from lack of a process for efficiently searching the problem space. Let’s briefly examine the most common processes that have been tried.

The most common process is trial-and-error, with incremental improvement of solutions that work better than others. Also known as **hill climbing**, this works if the problem is simple because the problem space is small and easily navigated via trial-and-error. However, it fails if the problem space is large or complex and cannot be correctly navigated with trial-and-error, as illustrated.

A **solution landscape** (aka fitness landscape) represents a problem space by drawing a three dimensional landscape, as shown.⁷ Solutions are spread out all over the surface of the landscape. Closer solutions are more closely related. The higher the altitude, the better a solution can solve a problem. Good solutions are found at landscape peaks, called local peaks. The very best solution is found at the global peak.

Solution landscapes were developed to conceptualize how evolution caused species to evolve into successively higher levels of fitness. Evolution is a trial-and-



error process that landscape theory calls **hill climbing**. Trials occur when life reproduces. Each trial is a genetic mutation with one or more new behavior traits. Over time, the process of evolution leads life to slowly navigate the solution landscape by climbing up hill, since organisms with higher fitness will out replicate others. When a peak is reached further significant evolution ends and a species becomes stable. Large mutations may allow other peaks to be discovered.

The elegance of solution landscapes lies in the way they may be used to illustrate any process based on trial-and-error. This includes the way people approach many problems. If searching a solution landscape by trial-and-error leads to a high enough peak, then the solution will work. For the three landscapes shown the global peak is the optimal solution and works. All other peaks are suboptimal and may or may not work.

The top landscape is simple, with a single peak. The center landscape is of medium complexity. Hill climbing by “walking” uphill, with occasional brainstorming or creative leaps to escape local peaks, will eventually lead to the global peak. But the bottom landscape is so overwhelmingly complex that unless you miraculously start near the solution, you will rarely find it using hill climbing (trial-and-error). Remember, you cannot see a landscape as illustrated. You can only see the small area around where you stand or have been. The rest is hidden by the fog of complexity.

Problem solvers begin somewhere on a solution landscape and navigate using heuristics. Hill climbing is the most popular. If there is only one peak it will usually work, since large random jumps in a simple landscape can be made with **brainstorming**, the generation of as many solutions as possible. However, in a highly complex landscape hill climbing will not work because it leads to local peaks. These are solutions that work somewhat, leading to the conclusion that if the solution it somehow improved it will work better. But since the solution sits on a landscape peak, no variation will improve the solution. It will only make it worse, or if on a plateau, have little effect. *This is highly counterintuitive.*

Brainstorming fails in highly complex landscapes because the landscape becomes exponentially large as the number of nodes and relationships increases, and because each new guess is anchored on previous guesses and solutions. This seals off portions of the landscape that are not similar to areas already traversed.

Community lock-in (group think) to a solution strategy can occur due to being trapped on a local (suboptimal) peak. Indeed, this is the case for the sustainability problem. Solutions have clustered on a number of local peaks like conservation, regulations, pollution taxes, and tradable permits. None of these solution clusters have worked and no new significant clusters are on the horizon. This indicates that *present solution search techniques do not fit the landscape involved*. The extreme novelty and complexity of the landscape of the sustainability problem confounds present problem-solving processes.

Alternatives to hill climbing

The most popular general alternatives to hill climbing are comparative analysis and simulation modeling. **Comparative analysis** compares the independent and dependent variables of multiple cases using statistical correlation. High correlations in cases that have been partially or fully solved versus not solved can lead to identifying the independent variables that made the difference. This knowledge can lead to solution policies that will work on other cases. Examples of this approach are Jared Diamond's *Collapse* and the collective management research of Elinor Ostrom and others. While it has produced some interesting insights, this approach has failed.

Simulation modeling captures the important essence of a problem by building a model that mimics problem behavior endogenously. Once the model can do that, scenarios may be run by setting input (independent) variables to different values. By iteratively running scenarios and improving the model as needed, solutions that can theoretically solve the problem may be found. This is the approach models like *The Limits to Growth* and *Threshold 21* have taken. Sustainability solutions based on integrated models like these have not worked in the real world.

Why have hill climbing, comparative analysis, and simulation modeling all failed? Because as Newell and Simon found, some problem spaces are too large and complex for traditional search techniques. A wholly new approach is required, as so many historic inventions like double entry accounting and the Scientific Method itself have demonstrated. From this we conclude that to solve the global environmental sustainability problem, a radically new problem-solving approach is required.

Then again, it need not be radical if we can find an existing technique and modify it to fit the problem. By rather good fortune this is possible. We simply take the powerful business tool of root cause analysis and adapt it to fit social problems, particularly the environmental sustainability problem.

Root cause analysis does not employ hill climbing, modeling, or comparative analysis as its central rule. Instead, **root cause analysis** is a process for finding the essential causal structure of a problem by starting at problem symptoms and following the causal chain (which may involve feedback loops) backwards until the root causes are found. System **structure** is the nodes, relationships, and interacting feedback loops that compose a cohesive description of the causes and effects of interest. As each cause-and-effect relationship is identified the causal structure is drawn and if necessary modeled. When done a cause-and-effect diagram exists, usually augmented by a simulation model if the problem is difficult. This represents the simplest possible description of the knowledge needed to solve the problem. Everything else has been ignored because it doesn't matter. The signal has been separated from the noise. Once the root causes are found, solutions are designed to resolve the root causes. This strategy is identical to the way doctors first diagnose a patient's illness, and only then begin to design a treatment to solve the problem.

The exact reason root cause analysis differs from other problem space search techniques is that *if you follow the process, every step is guaranteed to take you closer to an acceptable solution* because you are building a cause-and-effect model of how the problem behaves, all the way down to root causes, by inspecting and tracing the actual structure of the system. It's like walking up to a building and inspecting it to determine its basic structural members. The exception to the guarantee would be if a problem is insolvable. Discovery of this case is part of normal root cause analysis, since by definition a root cause must be resolvable.

Root cause analysis differs from simulation modeling in how the driving rules of each technique work. In simulation modeling the driving rule is to construct a model that mimics problem behavior “for the right reasons.” This omits the root causes since root causes are not required to build a model that satisfies the driving rule. The omission explains why simulation modeling has failed to solve the sustainability problem. Model scenarios can show the problem is solved when certain input variables are changed. But when people attempt to change these same variables in the real world the solution fails. This indicates that the solution was not trying to resolve a root cause. Rather it was unknowingly attempting to resolve an intermediate cause, like population growth or sustainable technology efficiency, a point we will cover in detail later. Root cause analysis does not try to build a model of a system's interesting behavior. It only tries to find the root causes.

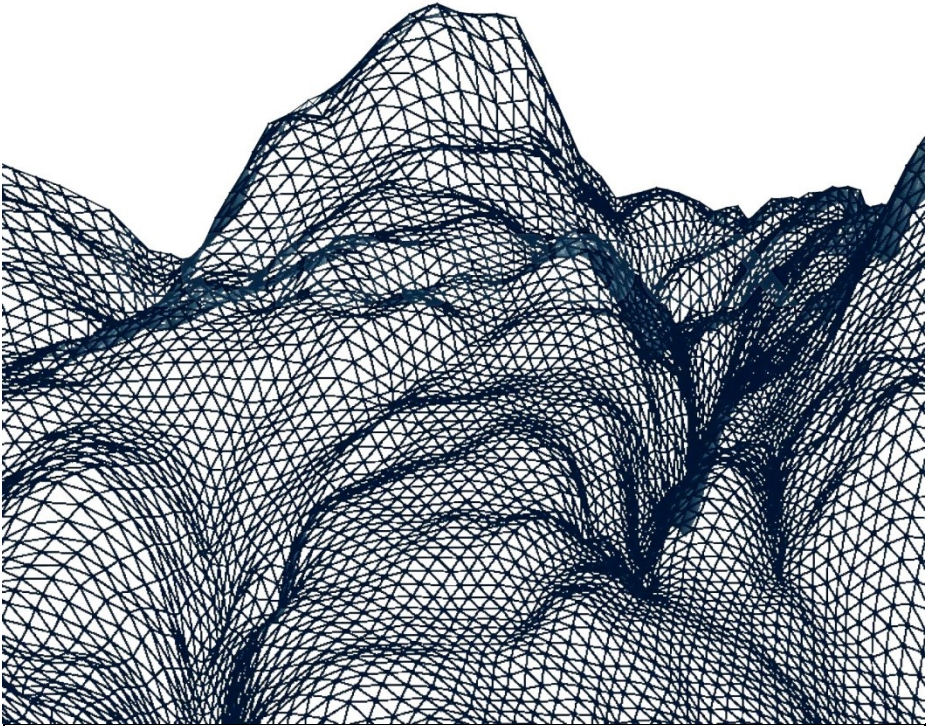
That's it. I've just explained what this book has to offer and why it can make a difference.

As far as the thwinkers at Thwink.org know, root cause analysis has never been applied to the environmental sustainability problem as a global whole. The reason is that root cause analysis was developed to solve business problems. These are so different from social problems that a customized form of root cause analysis is required. This we have done. The result is the System Improvement Process (SIP). SIP is generic and was designed to solve any difficult large-scale social problem whose solution would benefit the common good.

This book is all about SIP: what it is, how to apply it, and what's been discovered so far by applying it. Our journey has been long and transformational. I hope that by sharing our thoughts and discoveries, your journey can be short but just as transformational.

The four levels of process maturity

If I had to approximate how the solution landscape of the global environmental sustainability problem looks, it would look about like the image below.



Climbing Mount Sustainability - The image represents the ultra-high complexity of the solution landscape for the global environmental sustainability problem. At first glance climbing the mountain looks easy. But due to the fog of complexity, you can only see five feet in any direction.

Using hill climbing, Mount Sustainability is not as easy to climb as it appears because of the impenetrable fog of complexity. All you can see is the solution landscape right around your feet. You can't see the global peak or the local peaks. Nor can you see where the ridges are, where the sudden drop-offs are, or where the ice is so slick it's impossible to climb. Climbing the mountain under these conditions is impossible.

So what can you do? How can you reliably steer your way toward solutions with high fitness in a landscape so treacherously complex and so concealed by thick fog? Furthermore, how do you accommodate multiple root causes, which require multiple solution elements, which require multiple mountain peaks? And how do you handle a continually deforming landscape, due to adaptation by intelligent social agents and the hyper-change of new technology?

This is why we need root cause analysis. I’ve searched for years, but there appears to be no other method that can reliably search problem spaces of the size and complexity of Mount Sustainability.

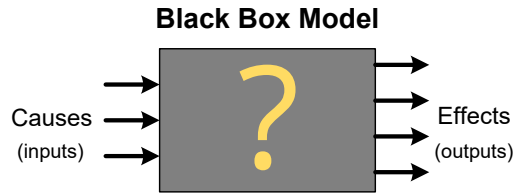
All problems arise from their root causes, so all forms of problem solving are essentially a form of root cause analysis. Formally basing a process on root cause analysis changes this form from implicit to explicit. This allows process users to focus on what matters most and ignore everything else.

Earlier I described the most popular general approaches to solving the sustainability problem: hill climbing, comparative analysis, and simulation modeling. Let’s examine how these approaches fit into a model of process maturity.

Level of Maturity	How the process handles the causal structure	Problem Solving Process
Level 1	Solutions → ??? → ??? → Symptoms	Hill climbing and comparative analysis
Level 2	Solutions → ??? → Intermediate Causes → Symptoms	Simulation modeling and many others
Level 3	Solutions → Root Cause → Intermediate Causes → Symptoms	Root cause analysis with single root cause
Level 4	<p>The diagram for Level 4 shows a horizontal arrow pointing right towards 'Symptoms'. Above this arrow, there are three vertical chains of boxes: 'Solutions' at the top, 'Root Causes' in the middle, and 'Intermediate Causes' at the bottom. Arrows point from 'Solutions' to 'Root Causes', and from 'Root Causes' to 'Intermediate Causes'. Below the horizontal arrow, there are three vertical chains of boxes: 'Solutions' at the bottom, 'Root Causes' in the middle, and 'Intermediate Causes' at the top. Arrows point from 'Solutions' to 'Root Causes', and from 'Root Causes' to 'Intermediate Causes'. All 'Intermediate Causes' boxes (both above and below the horizontal arrow) have arrows pointing to the horizontal arrow. To the right of the diagram, the text reads: 'Root cause analysis with multiple root causes and subproblems'.</p>	Root cause analysis with multiple root causes and subproblems
<p>The four levels of process maturity – The higher the level, the more complex a problem the process can reliably solve. For the sustainability problem most effort is currently at Level 1. Some is at Level 2. None that we have been able to find is at Level 3 or 4. Only at Levels 3 and 4 can the Two Laws of Root Causes be applied.</p>		

Solving difficult problems requires construction of a problem’s essential causal structure, which requires root cause analysis. **Essential causal structure** is the simplest possible cause-and-effect diagram and/or simulation model that describes, at the root cause level, why a problem occurs and how it will respond to changes in its root causes. The simplest possible essential causal structure is a single cause (a solution) and problem symptoms, as shown in Level 1.

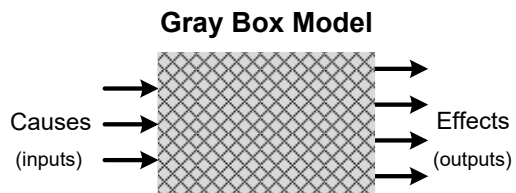
Level 1 is a black-box-based approach. All solution decisions are based on mental models of a problem. A **black box model** of a system knows only the relationships between inputs (solutions) and outputs (symptoms). Everything else is treated as too difficult or too expensive to model correctly. For example, society has long known you must eat to survive. But until modern medicine explained how food provided the nutrients and energy needed by the body and how these processes worked, no one knew why we had to eat to survive. Or they had shallow intuitively derived theories that were wrong.



Hill climbing (trial-and-error) uses a black box model. All a hill climber is concerned with is finding a solution that works to fix the problem’s symptoms. By cautiously trying solutions that are slightly different, and moving towards solutions that work better than the one before, a hill climber can solve a problem—if the solution landscape is simple. If it’s not, you can be climbing hills for a long time or forever. Examples of hill climbing are alchemy, the way an animal learns how to escape from a cage after much trial-and-error, many types of puzzle solving, natural evolution, and many simple problems we encounter regularly, like whoops, where did I leave my keys?

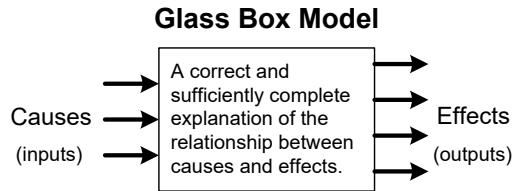
Comparative analysis also uses a black box model. The solution landscapes of multiple problems are searched for input factors that may explain varying levels of solution success by statistical correlation. For simple landscapes the process can be very efficient. However, when a problem is encountered that has not been solved before and is not similar to previously solved problems, comparative analysis does poorly because it has no way to intelligently search the landscape for the few input factors that may work. Comparative analysis is widely used in empirical studies, economics, the social sciences, etc.

Level 2 is a gray box approach. A **gray box model** knows some of the relationships between inputs and outputs. Some of the essential causal structure is known but not all, so much walking of the solution landscape is still required. Simulation modeling builds a gray box model by starting at symptoms and building a model that mimics those symptoms. These models always include the intermediate causes, because otherwise they would be unable to generate symptom behavior. However, they tend to not include the root causes because root cause analysis is not employed. Many other processes are at Level



2. Any process that considers the IPAT equation (explained on page 32) factors and their causes, but not the root causes, is a Level 2 process.

Level 3 is a glass box approach. In a **glass box model** you can “see” the entire essential causal structure of a problem. For example, after Newton discovered gravity and the mathematical laws governing the movement of bodies, astronomers had a glass box model of the universe. They could now accurately predict where heavenly bodies would be in the future (the effect) given their present location, speed, and other bodies whose presence affected them (the cause). A glass box model provides a correct and sufficiently complete explanation of the relationship between causes and effects.



Level 3 processes can solve problems with a single root cause. This is the most common case since most problems are simple. They can be easily inspected for causal structure and solutions.

Note that when moving to Level 3, the solution landscape is no longer searched. Instead, you inspect the physical system to determine its causal structure. The two approaches, solution search and structural inspection, are entirely different.

Level 4 is also a glass box approach. As problem difficulty increases multiple root causes become the norm. Problems of high difficulty require Level 4 process maturity. Each subproblem has one or more root causes. Due to landscape complexity the essential causal structure is inherently complex and counterintuitive, and can be found only by using root cause analysis and deliberately looking for subproblems. This is the strategy SIP employs. (The Level 4 diagram is a form of a cause-and-effect diagram, aka a fishbone or Ishikawa diagram.)

There is little doubt the global environmental sustainability problem is a Level 4 problem. Thus the challenge facing sustainability scientists is how to increase process maturity to Level 4, so that humanity can successfully navigate the problem’s solution landscape and thereby navigate its way to sustainability.

Tunneling Through Solution Landscapes with Root Cause Analysis

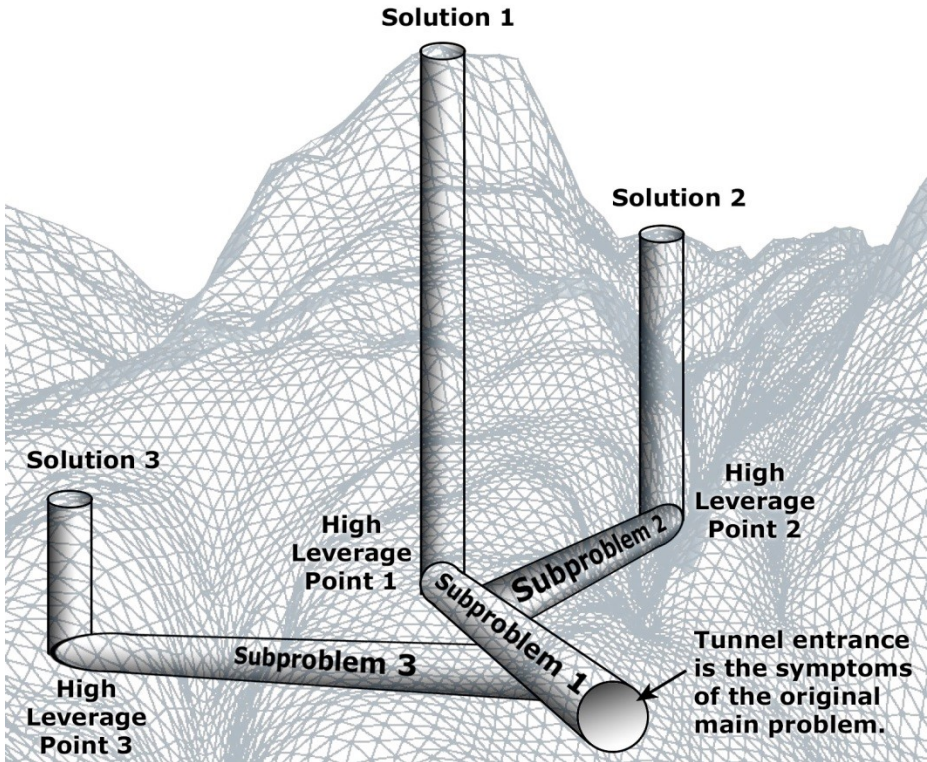
The powerful business tool of root cause analysis allows a monumental shortcut to solution landscape navigation. Instead of laboriously *walking* a landscape, you can rapidly *tunnel through* by inspecting the system and building a model of its essential causal structure.

Tunneling through instead of walking forever

As described in the previous chapter, Level 1 approaches, like hill climbing and comparative analysis, search the solution landscape for solutions in a trial-and-error manner. For difficult problems this can take a long time or forever. Simulation modeling and other Level 2 approaches search the landscape more efficiently, using knowledge of intermediate causes. However, for the sustainability problem Level 2 approaches have proven to be just as painfully slow, since none of them have solved the problem. Level 1 and 2 are primarily “walk the solution landscape” approaches. There is no alternative to the large amounts of guesswork involved since the root causes are unknown.

In stark contrast, Level 3 and 4 do not walk the landscape. Use of root cause analysis allows a completely different approach, one that doesn’t search the landscape at all. Instead, root cause analysis “tunnels through” the landscape mountain by systematically discovering the essential causal structure of the problem, in terms of its symptoms, intermediate causes, and root causes. Once that is known, only a small number of solution strategies make sense and need testing. The low efficiency of trial-and-error has been replaced by the high efficiency of physical inspection. How this conceptually works is shown on the next page.

Imagine that underneath the solution landscape mountain is the structure of the problem: its symptoms, intermediate causes, root causes, high leverage points, low leverage points, and so on. With the right process as your trusty guide, you can very efficiently find the problem’s structure with a minimum of tunneling. Once it’s found, solving the problem becomes somewhat trivial. All you do is tunnel upwards from the high leverage points to find the solutions that, because the behavior of the problem is well understood, will tend to work the first time, with a minimum of testing and modification.



How SIP tunnels through a landscape – Rather than laboriously walking the surface of a problem’s solution landscape, SIP tunnels through the earth below to efficiently discover the essential causal structure supporting the landscape. Once this is known it’s like we have a map of everything. The tunnel takes a ninety degree turn upward at each of the high leverage points. Like an air vent in real tunnels, the tunnel goes straight up and pops out right at the optimal peak for each high leverage point. After that all that’s necessary is to look around at the nearby solutions, test them, and select the ones that are most likely to resolve the related root cause.

A brief history of root cause analysis

The history of looking for a problem’s causes dates back to before the dawn of humanity. Our primitive ancestors, in their attempts to learn how to escape predators or how to stay warm at night, knew that causes lead to effects. A chilly night or winter causes you to feel cold. The feeling cold problem can be solved by anything that can sufficiently reduce the cause, cold air, such as a cave or fire.

But root cause analysis is not just somehow finding causes and resolving them, as our ancestors did and we do every day. **Root cause analysis** is a formal systematic approach for finding root causes and resolving them relatively *permanently*. The process works by starting at problem symptoms and methodically working backwards to the root causes. The process is conceptually designed to work in all cases, especially the more difficult problems, where normal problem solving methods fail.

Root cause analysis was invented in the early 1900s by Sakichi Toyoda (1887-1930), “king of Japanese inventors”, “the Thomas Edison of Japan”, and founder of Toyota. While still a young man, Toyoda developed the habit of consciously asking WHY something occurred until he arrived at its true root cause. The habit appeared in his youth when he was 20 years old. “Sometimes, I would spend all day watching the grandmother next door weaving. I came to understand the way the weaving machine worked.”⁸ Toyoda wasn’t understanding how the machine worked in the normal sense. He was silently asking himself WHY certain things happened. WHY, for example, was hand looming necessary? Couldn’t it be replaced by machine looms?

Toyoda went on to invent the most efficient machine loom in the world because he kept asking WHY. Early power looms were plagued by tread breakage, which necessitated one operator per machine. Toyoda asked WHY they were breaking. The causes were too numerous to completely control, so he asked a further WHY question: WHY is so much material and operator time wasted once thread breakage occurs? The correct answer, because the machine did not automatically stop, was a technical breakthrough. That insight, combined with loom improvements based on other WHY questions, quickly led to a 20-fold increase in productivity in Toyoda’s power looms compared to all previous looms.

Toyoda’s method went on to be called **The Five Whys**. The method asks WHY five times or until the root cause(s) of a problem is found. “When a problem arises... we repeatedly ask *why*. This is the scientific basis of the Toyota system.”⁹ The beauty of The Five Whys is it can be applied by anyone, anytime, to any problem. The trick is to not stop until you have found the true root cause. This rule is so crucial that Taiichi Ohno, in *The Toyota Production System*, begins chapter two this way:

Evolution of the Toyota Production System

Repeating *Why* Five Times

When confronted with a problem, have you ever stopped and asked *why* five times? It is difficult to do even though it sounds easy. For example, suppose a machine stopped functioning:

1. *Why* did the machine stop?
There was an overload and the fuse blew.
2. *Why* was there an overload?
The bearing was not sufficiently lubricated.
3. *Why* was it not lubricated sufficiently?
The lubrication pump was not pumping sufficiently.
4. *Why* was it not pumping sufficiently?
The shaft of the pump was worn and rattling.

5. *Why* was the shaft worn out?

There was no strainer attached and metal scrap got in.

Repeating *why* five times, like this, can help uncover the root problem and correct it. If this procedure was not carried through, one might simply replace the fuse or the pump shaft. In that case, the problem would recur within a few months.

To tell the truth, the Toyota Production System has been built on the practice and evolution of this scientific approach. By asking *why* five times and answering it each time, we can get to the real cause of the problem, which is often hidden behind more obvious symptoms.¹⁰

The Five Whys evolved into what is today known as root cause analysis. The process, in many sophisticated forms, has become a foundational element of business. NASA could have never put a man on the moon or a rover on Mars without its Root Cause Analysis Tool. In 1998 the U.S. Joint Commission Accreditation of Healthcare Organizations began requiring use of root cause analysis for all adverse events. The ISO 9001 quality management standards, a collection of guidelines for quality control, assume that effective correction action *is impossible* without knowing the root causes. Many governments and corporations require ISO 9001 certification of important suppliers. Many organizations also want certification to insure they are producing top quality at low cost. In 2013 over one million certifications of ISO 9001 performance were issued across 187 countries, with many other companies using the standard without certification.¹¹ Modern quality control, on which entire industries like high tech electronics, pharmaceutical manufacture, and auto manufacture are based, depends on root cause analysis to achieve consistent high quality by statistical control of the root causes of manufacturing defects.

Imagine that. Every time you drive a car or take a prescription drug, your life depends on root cause analysis.

The eight basic practices of root cause analysis

Long examination of dozens of mature root cause analysis processes discovered a common pattern. Eight basic practices are required for difficult problems:

1. Frequent use of the term “root cause” or an equivalent.
2. Definition of **root cause** as the deepest cause in a causal chain that can be resolved, plus additional criteria as needed for the problem type.
3. Strict adherence to the principle that problems can be solved only by controlling their root causes.
4. Following causal flow by starting at problem symptoms and working backward to the root causes.

5. Written description of the causal structure found.
6. Design of solutions to resolve specific root causes.
7. Continuous improvement of the process.
8. Detailed written description of the entire process.

The eight basic practices revolve around practice 2, which defines the core concept of “root cause.” If any practices are missing from a process it is pseudo root cause analysis and will usually fail on difficult problems. The more practices missing, the more likely the process will fail.

The eight basic practices are similar to a pilot’s pre-flight checklist. If any items do not pass inspection, the flight should be aborted until all items pass. The more items that do not pass, the more likely the flight will end in disaster.

The IPAT equation and intermediate causes

As we proceed to dissect how to tunnel through the mountain of complexity instead of taking forever to walk the mountain’s solution landscape, it helps to become familiar with the IPAT equation. This insightful equation, created in the 1970s, gives an accurate measure of a system’s total environmental impact using three factors. This allows all sorts of deeper causal insights.

The IPAT Equation

The IPAT equation is a widely used simplification of the factors causing environmental degradation. The equation is $I = P \times A \times T$. This is short for environmental **I**mpact = **P**opulation x **A**ffluence (consumption per person) x **T**echnology (impact per unit of consumption). It's crucial to remember that the three factors are intermediate causes, not root causes.

Impact =	Population	X	consumption per person	X	impact per unit of consumption
I	P		A		T

From a root cause analysis point of view, the PAT factors are intermediate causes. Deeper causes exist. For the *P factor*, over-population, the deeper causes could be lack of a demographic transition, poverty, rising life expectancy, mechanized agriculture, etc. The *A factor*, rising affluence in terms of consumption per person, has deeper causes, like “the common desire to improve quality of life”¹² and falling prices due to the industrial revolution and a myriad of production efficiency discoveries since then. The *T factor*, increasing environmental impact per unit of consumption due to the technology used, has deeper causes like the profit motive, globalization, and growth of science. All these deeper causes in turn have even deep-

er causes. Thousands of deeper causes of the PAT factors could be explored. Following the causal chain correctly would eventually lead to the root causes.

Time and time again, I've seen people speak of the P or the A or the T factor as a root cause. This error springs from unfamiliarity with what root causes really are. The error is so common that SIP gives it a name:

The Superficial Solutions Trap

The trap occurs when people assume intermediate causes are root causes. It's an easy trap to fall into because root causes can be deceptively hard to identify, as the sage of system dynamics, Jay Forrester, describes: (*Italics added*)

The intuitively obvious “solutions” to social problems are apt to fall into one of several traps set by the character of complex systems. ...people are often led to intervene at points in a system where *little leverage exists* and where effort and money have but slight effect.

...social systems are inherently insensitive to most policy changes that people select in an effort to alter behavior. In fact, *a social system draws attention to the very points at which an attempt to intervene will fail*. Human experience, which has been developed from contact with simple systems, leads us to look close to the symptoms of trouble for a cause. But when we look, we are misled because the social system presents us with an *apparent cause* that is plausible according to the lessons we have learned from simple systems, although this apparent cause is usually a coincident occurrence that, like the trouble symptom itself, is being produced *by the feedback loop dynamics of a larger system*.¹³

Forrester's “apparent cause” is what we call the intermediate cause. “Little leverage exists” if people assume the apparent cause is the root cause because that leads to pushing on low leverage points.

Examples of pseudo root cause analysis in action

Let's examine three examples of people using **pseudo root cause analysis**. This occurs when someone thinks they are performing root cause analysis but in fact is not, because the eight basic practices of root cause analysis are not followed. This results in intermediate causes being mistaken for root causes. They didn't know it, but each of these three examples fell into the black hole of the Superficial Solutions Trap. And they never escaped.

Example 1 – James Gustave Speth

The first example comes from the work of James Gustave Speth, cofounder of the Natural Resources Defense Council, founder of the World Resources Institute, and administrator of the United Nations Development Programme for six years. In a 1992 paper, Speth wrote that: (Italics and comments added)

I am convinced, after 20 years of working on environmental issues, that *present approaches will not accomplish the job*, because they do not focus enough on underlying problems at the *root* of our environmental troubles.

The [five] transitions I will mention briefly seek to deal with the *root causes* of environmental problems. ... The first transition ... is the need for a demographic transition to *population* stability [the P in the IPAT equation] ... The second transition is... a transition in technology to a new generation of *environmentally benign technologies* [the T in the IPAT equation] ... The third needed transition is an economic transition to a world in which *prices reflect the full environmental costs* [a balancing loop to put the brakes on the reinforcing growth loops of the IPAT factors, mostly the A and T, by internalizing externalized costs] ... The fourth transition is a transition in social equity to a fair sharing of economic and environmental benefits both within and among countries. Over much of the world, the greatest destroyer of the environment is *poverty*—because the poor have no alternative. ... None of these transitions is possible without a fifth—an institutional transition to different arrangements among governments, businesses, and peoples. These institutional arrangements are urgently needed to enlist the tremendous potential of the private sector in what must be an unprecedented *cooperative* effort....¹⁴

These are pseudo root causes, however. Why is it so hard to quickly put the brakes on global population growth by, for example, changing to a worldwide one-child-per-family policy for several generations? Why are technologies increasingly harmful to the environment? Why is the system so biased towards externalizing costs? Why isn't the industrialized world taking action for those trapped in extreme poverty? Why aren't governments, businesses, and peoples already cooperating? *Questions like these demonstrate these are in fact intermediate causes.* They are mere starting points for deeper analysis.

Example 2 – The UNEP

In its latest problem-solving report, the United Nations Environmental Programme (UNEP) uses the “drivers, pressures, state, impact, and responses (DPSIR) analytical framework” as its problem solving process.¹⁵ “Chapter 1 examines the drivers of environmental change—the overarching socio-economic forces that exert varying degrees of influence, or pressures, on the environment. ... The DPSIR framework asks three questions:

1. What is happening to the environment and why (pressure and state)?
2. What is the consequence of the changed environment (impact)?
3. If appropriate, what is being done about it and how effective is it (response)?”

What are the root causes? “GEO-5 identifies two major drivers... population and economic development....”

While the report stresses the need “to invest in solutions that will help tackle the root causes, not merely the symptoms (p483),” most of the eight basic practices of root cause analysis are missing. “Drivers,” used as a synonym for root causes, is not defined as what root causes actually are but as “overarching socio-economic forces.” This includes a wide range of forces, each of which could occur anywhere on a causal chain. Overarching forces like the invisible hand of economics, the constant struggle for survival of the fittest, gravity, and the biosphere’s sustainable limits are all present. Why are these not considered drivers? The two drivers found (population and economic growth) are the PAT factors in the IPAT equation. These are intermediate causes and have been known as such since the early 1970s. Thus the report offers no productive insights or solutions.

Without a correct definition of root cause the rest of the practices cannot be followed. Still, it is heartening to hear the UNEP recognizes the need to “tackle the root causes.” This is a critical first step.

Example 3 – A World Wildlife Fund project

The closest we came to finding a case of all the basic practices of root cause analysis being followed was *The Root Causes of Biodiversity Loss*,¹⁶ a book reporting on a World Wildlife project completed in 2000. The book presents a “framework for analyzing socioeconomic root causes of biodiversity loss....” (p11) The framework uses these four steps:

1. Perform a literature review to find the first hypothesis of the root causes.
2. Develop a first iteration conceptual model of the problem using these root causes.

3. Collect data to complete the model.
4. Revise the model as needed when new data disagrees with the model until the model is stable and complete.

The book uses the term “root cause” frequently, a good practice. However, it defines root cause as “the set of factors that truly drive biodiversity loss, but whose distance from the actual incidence of loss, either in space or time, makes them a challenge to identify and remedy.” (p3) This definition omits the concept that “a root cause is the deepest cause in a causal chain that can be resolved.” Instead the analyst searches for “factors that truly drive biodiversity loss,” with no means to find those factors since there is no description of where they may be found on a causal chain.

Nor does the framework follow basic practice 4: “Following causal flow by starting at problem symptoms and working backward to the root causes.” Instead it reviews the literature to find the initial root causes. This will not work and wrongly biases further analysis. *If a problem has not been solved, how can researchers realistically expect to find the correct root causes in the literature?* All they are likely to find is the wrong root causes or none at all. Our study of business root cause analysis found that, in every case, analysts did not first search the literature. They inspected the actual system, starting with problem symptoms. Only by “going to the gemba” can one find the data needed to solve difficult problems. Gemba is where the work is being done. “Going to the gemba” is a Japanese quality management maxim designed to drive managers out of their offices and onto the factory floor.¹⁷

The framework is based on political ecology, which does not employ root cause analysis but seeks “chains of explanation” related to political and economic factors and power. This appears to explain why the framework is an incomplete version of root cause analysis and why the root causes found, like population growth, poverty, immigration, inequality, and domestic market factors, are broad intermediate causes rather than focused root causes. Still, the project was a strong step in the right direction.

These three examples reveal how far away current problem-solving processes are from what’s needed. Three of the world’s most influential environmentalists or environmental organizations *thought* they were performing root cause analysis, but in fact were not.

Chapter 3

The System Improvement Process (SIP)

This book assumes that you, like me, have a strong, almost overwhelming desire to help solve the global environmental sustainability problem. SIP is a tool for doing that. To save you some time I'd like to bring what SIP is all about into sharp focus.

SIP is a unified theory of the key practices required to solve difficult large-scale social problems like sustainability. The theory is young and evolving. It consists of the following elements:

1. Definitions of root cause, root cause analysis, and process driven problem solving.

2. The principle that the extreme counterintuitive complexity of difficult large-scale social problems requires these techniques for efficient solution:

A. Root cause analysis.

B. Feedback loop modeling of key aspects of the analysis.

C. Decomposition of the one big problem into smaller subproblems, starting with the three standard subproblems and adding more as needed.

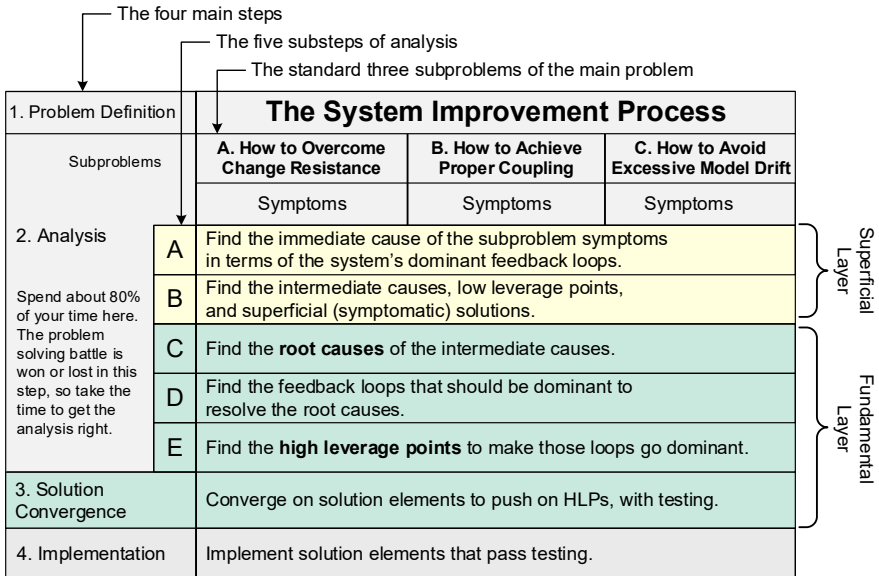
D. Analysis of each subproblem using social force diagrams and related definitions.

The rest of this chapter describes these elements and how the overall process works. Let's begin with the forest instead of the trees.

Overview of how SIP works

SIP is a comprehensive process for solving difficult large-scale social problems. The process first defines the problem to solve. The one big problem is then decomposed into smaller and hence easier to solve subproblems. Each subproblem is then analyzed using root cause analysis and the five substeps of analysis. Process output is not policy recommendation but a solved problem, since SIP includes implementation. Policy managers use SIP and are thus treated as an integral part of the process.

All problems are solved by use of mental models of the problem. SIP provides a high level mental model of a problem in the form of the SIP matrix, as shown on the next page. Please peek ahead to the completed matrix on page 88 so you can see where this concept is going.



Continuous Process Improvement – The foundation of the entire process

The SIP matrix – The matrix is *the* mental model of SIP. All work goes on inside a cell in the matrix. As the analysis proceeds the cells are filled in with results. SIP is a fill-in-the-blanks process. It asks the questions. You provide the answers. Each empty cell is a question waiting to be answered.

The power of SIP lies in the way it structures your analysis. SIP is essentially an engineering approach to building the knowledge required to solve the problem and keep it solved. At the project level what needs to be done, what has been done, and how it's been done are always shown by the matrix. SIP has four main steps:

Step 1. Problem Definition – This step defines the problem using a standard format: *Move system A under constraints B from present state C to goal state D by deadline E with confidence level F.* Moving from the present state to the goal state requires a mode change. SIP sees social problems as social systems stuck in the wrong mode. By finding and resolving the root cause forces holding a system in its present mode, and providing the necessary new forces to hold the system in its new mode, the system suddenly flips into the more attractive mode. SIP does this by engineering the feedback loop changes necessary for the mode change.

Step 2. Analysis – Finding the root causes and engineering the solution elements so that they efficiently cause the desired mode change takes quite a bit of work. The bulk of that work takes place in the Analysis step. Here the one big problem is decomposed into the three subproblems present in all difficult large-scale social problems, plus more subproblems as needed. This decomposition transforms the problems from insolvable to solvable, because you are no longer trying to simultaneously solve multiple subproblems and multiple root causes without realizing it.

Each subproblem then undergoes the five substeps of analysis. As this occurs a social force diagram and feedback loop model of the subproblem is constructed. The social force diagram is a high level summation of the model. The model is a low level explanation of the social force diagram. Usually a simulation model rather than a causal loop diagram is constructed. Model simulation allows rapid theoretical testing of the analysis via scenarios that would be slow, expensive, or impossible to test in the real world.

Step 3. Solution Convergence – This step uses analysis knowledge to rapidly converge on the few solutions that make sense. These become solution candidates. These are subjected to further theoretical testing and then small scale (pilot program) testing.

Step 4. Implementation – Here the most promising solutions are implemented. This tends to go smoothly, with a minimum of surprise and solution refinement, due to high predictability of how the system will respond.

Underneath the four main steps sits continuous process improvement, the most important step of all. This step has taken SIP, the analysis, and the sample solution elements to where they are today. Continuous process improvement is *the* foundation of any highly productive process, so it sits at the bottom.

What I've just described comes amazingly close to how entire industries perform root cause analysis today, every day, in order to solve their own tough problems. The difference is SIP fits social problems rather than business problems, and thus emphasizes mode change management rather than process control management of defects and incidents. However, as we shall see, the How to control excessive model drift subproblem *does* emphasize process control. This subproblem comes into play after a successful mode change. In the short term, SIP concentrates on mode change. In the long term, SIP concentrates on process control management, just as business processes do.

Elements

A comprehensive tool is only as good as its components. For SIP the definitions set the strategy. The techniques enable pursuing the strategy efficiently.

Definitions

To make finding root causes more efficient and reliable SIP uses the following definition: A **root cause** is the deepest cause in a causal chain that can be resolved. **Resolved** means a system's feedback loop structure is changed such that a root cause force no longer exists or is acceptably low. A **root cause force** is the force exerted on the connected nodes in a problem's causal chain structure.

To be more exact, a root cause is that portion of a system’s feedback loop structure that, using the checklist below, explains why the system’s behavior produces the problem symptoms. The checklist allows numerous unproductive or pseudo root causes to be quickly eliminated. The **five requirements of a root cause** are:

1. It is clearly a (or the) major cause of the symptoms.
2. It has no worthwhile deeper cause. This halts the asking of “Why did this occur? What is its cause?” at an appropriate point in root cause analysis.
3. It can be resolved. Sometimes it’s useful to emphasize unchangeable root causes in a model for greater understanding and to avoid trying to resolve them without realizing it.
4. Its resolution will not create other equal or bigger problems. Side effects must be considered.
5. There is no better root cause. All alternatives have been considered.

Now perhaps you can see why talented problem solvers like Speth, the UNEP, and the World Wildlife Fund have not been finding the root causes *even though they are looking for them*. They have nothing close to a checklist like this. Nor do they have the other elements of SIP.

The field of root cause analysis suffers from a terminology problem. “Root cause” really means “unfavorable root cause” (negative cause) and causes undesired symptoms. There are three additional types of root causes: (1) A **favorable root cause** (positive cause) is one that causes desired symptoms. The “new root cause forces” used in this paper are favorable root causes. (2) A **false root cause** is an intermediate cause treated as if it was a root cause. (3) An **unchangeable root cause** is one that cannot be changed (resolved), and may cause desired or undesired symptoms. Examples of unchangeable root causes for social problems are the pervasive force of struggle for survival of the fittest, human bounded rationality, and instinctual susceptibility to fallacious political appeals that provoke fear via the fight-or-flight response, by painting a false threat of some type.

Earlier we defined **root cause analysis** as a formal systematic approach for finding root causes and resolving them permanently. We can now tighten that definition considerably and make it an operational definition. For difficult large-scale social problems, root cause analysis is the use of the eight basic practices of root cause analysis as listed on page 31.

Process driven problem solving is the use of a formal continuously improved process as your main approach to solving problems. The main advantages are:

1. The process can much more easily be executed by a team of problem solvers. This makes the approach *scalable*.

2. Since the process is formally defined it can be *continuously improved*. Over time the process can evolve to be so powerful it's your most important asset, as it is for many of the world's largest companies like Toyota, Intel, and Exxon, and for all of science via the Scientific Method.

For those new to process driven problem solving, this is a mind bender. *It's not anyone's personal brilliance, or heroic effort, or a grand stroke of luck, or all three that solves big hairy audacious impossible-to-solve problems, whether social, business, or scientific. It's obsession with a process that fits the problem so well it can be used by all and continuously improved until it's good enough to solve the problem.*

The three steps of process driven problem solving are:

1. Identify the problem.
2. Choose or develop a suitable process for solving this type of problem.
3. Execute the process, which must include continuous improvement.

There are no more steps after step 3. Once you enter that step, you are *always* executing the process.

For most people, process driven problem solving for difficult problems is a new paradigm that's terribly hard to deeply grasp and accept. Academics in particular are baffled by it, because they see the Scientific Method as THE fundamental process for their work. What they miss is that for difficult social problems they lack a process (like SIP) for producing productive hypotheses to test with the Scientific Method. Business has not made the same mistake, which is why RCA and process driven problem solving thrive in the business world.

Following the above three steps, we discovered there was no suitable process, so Thwink.org was forced to develop one. NASA encountered the same situation:

The NASA Root Cause Analysis Tool (RCAT) is designed to facilitate the analysis of anomalies, close calls, and accidents and the identification of appropriate corrective actions to prevent recurrence. The RCAT software provides a quick, easy, accurate, and repeatable method to perform and document root cause analysis, identify corrective actions, perform trending, and generate data usable in precursor analysis and probabilistic risk assessment.

After extensive review, NASA found that none of the commercially available tools and methods would support a comprehensive root cause analysis of all the unique problems and environments NASA faces on the Earth, in the ocean, in the air, in space, and on moons and planetary bodies. Existing tools were designed for a specific domain (e.g., aviation), a specific type of activity, a specific type of human error (e.g., errors of omission) or had a limited set of cause codes. The NASA RCAT, a paper-based tool with companion software (now available

free to government Agencies and contractors), was designed to address the shortcomings identified in existing tools.¹⁸

Problems vary, so to apply root cause analysis to a particular class of problems a custom process is required. The business world has developed and evolved a number of custom processes for this, called wrappers. A **wrapper** packages something to make it more transportable, cohesive, and useful. Root cause analysis has achieved extensive success in business using generic process wrappers like Six Sigma, Lean Production, Kaizen, and the ISO 9001 quality management standards. Custom process wrappers are also used, like Intel's Manufacturing Quality Process, The Toyota Production System, and NASA's Root Cause Analysis Tool as described above.

Root cause analysis wrappers typically reduce defect rates (problem occurrence rates) by an order of magnitude or more. The most common wrapper, Six Sigma, routinely cuts defect rates by two orders of magnitude, from roughly 6,210 defects per million transactions to 3.4.¹⁹

Numerous root cause analysis wrappers exist for business problems, but no such wrapper exists for social problems. Business problems suitable for root cause analysis usually consist of unacceptable defect or incident occurrence rates, as well as general behaviors like how to lower costs or reduce throughput time, in manufacturing or services. Difficult large-scale social problems (like sustainability, war, endemic poverty, and large recessions) consist of a large part or all of the human system being in the wrong mode, such as being unsustainable or being at war. This very different class of problems requires a very different process.

To fill the process gap Thwink.org created SIP by adapting the powerful business tool of root cause analysis to fit social problems. The process was created over a seven-year period, from 2003 to 2010, as it was iteratively developed and applied to the environmental sustainability problem. Any process that fits the sustainability problem will do. SIP is a mere example of what's possible.

In difficult problems the limiting factor is usually process maturity, rather than the dozens of other things people typically blame, like this is a hard problem, lack of money, lack of time, low personal skills, strong opposition, deceitful opposition, competing problems, etc. Another way to look at this is:

$$\text{process maturity} \times \text{quality of effort} = \text{quality of results}$$

If millions of smart activists are trying as hard as they can to solve a problem whose solution would improve the common good and are failing repeatedly, then the bottleneck cannot lie in quality of effort. It must lie in process maturity.

Technique A. Root cause analysis

The key technique is root cause analysis, as already described. The other techniques are methods for performing root cause analysis better and faster.

Technique B. Feedback loop modeling

Understanding why complex social systems behave the way they do requires understanding the dynamic structure of the system. This requires feedback loop simulation modeling or for simple cases, causal loop diagrams.

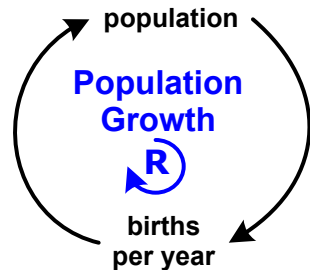
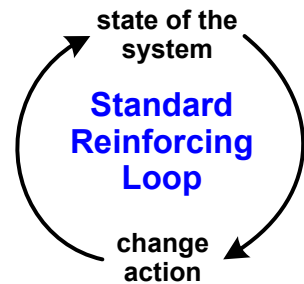
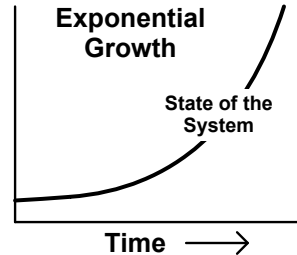
A **feedback loop** occurs when a change in something ultimately comes back to cause a further change in the same thing. If the further change is in the same direction it's a positive or **reinforcing loop**. If it's in the opposite direction it's a negative or **balancing loop**, also called a goal-seeking loop. All feedback loops are either reinforcing or balancing.

Let's review several causal loop diagrams to understand how feedback loops work. Arrows indicate one node influences another. Solid arrows are a direct relationship. If A goes up then so does B, or if A goes down then so does B. Dashed arrows are an inverse relationship. If A goes up then B goes down and vice versa. Dotted arrows are constants.

As simple as models like these are, they can allow problem solvers to understand the relevant behavior of complex systems well enough to solve surprisingly difficult problems. Feedback loop modeling and design is an indispensable tool in the analytical activist's toolbox.

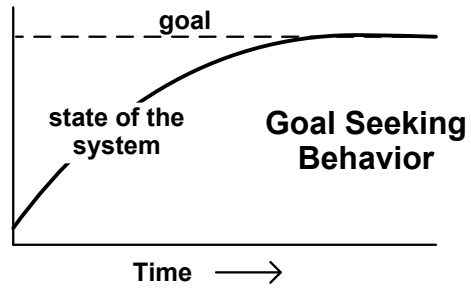
Feedback loops control behavior of a system over time, as shown in graphs. Reinforcing loops cause either runaway **exponential growth** or exponential decay (not shown). In the **Standard Reinforcing Loop**, the state of the system starts at some non-zero amount. This state causes a change action, which in turn increases the state of the system, which in turn increases the change action even more. The loop grows exponentially due to its self-reinforcing nature. The graph illustrates the resulting exponential growth.

A real world example of a reinforcing loop is **Population Growth**. As population goes up, so does births per year. As that goes up, so does future population. This increases births per year still further. The loop goes round and round, growing exponentially until the loop hits its limits to growth, which are not shown.

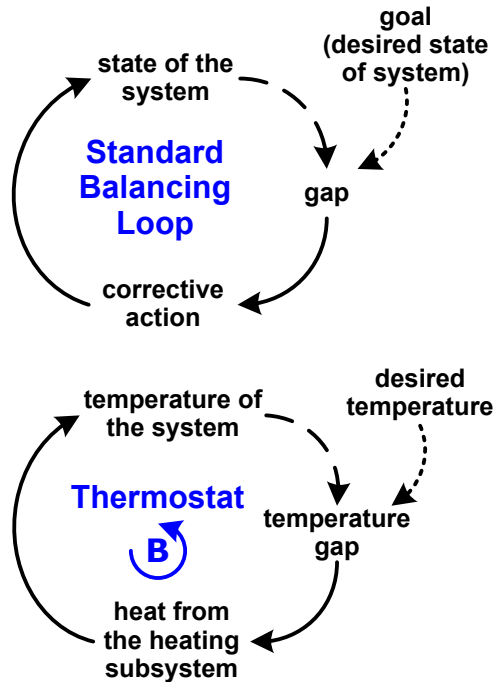


The other type of feedback loop is a balancing loop. Balancing loops, also known as goal seeking loops, have a goal. The loop “balances” its behavior so as to reach the goal.

In the **Standard Balancing Loop** the gap equals the goal minus the current state of the system. Suppose the loop starts with a low state of the system as shown in the graph. The goal is much higher, so the system starts with a high gap. The greater the gap, the larger the corrective action. As corrective action increases, so does the state of the system.



Here’s where balancing loops differ from reinforcing loops. As the state of the system goes up, the gap goes down. This reduces the corrective action. The loop continues until the gap is zero, at which point the loop has reached its goal. The graph illustrates this behavior.



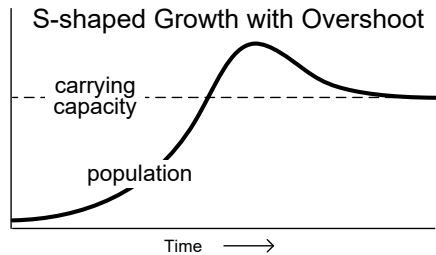
A common example of a balancing loop is a **Thermostat**. Suppose you set the desired temperature to 70 degrees Fahrenheit but the current temperature of the system is 65. That causes a temperature gap of 5 degrees. The greater the gap the greater the heat from the heating subsystem that flows into the system. This increases the temperature of the system. As this goes up the temperature gap goes down. The loop goes round and round until the gap is zero, at which point the thermostat system has reached the goal. (The example assumes the heating subsystem is capable of variable output instead of on/off behavior.)

The toughest challenge in social problem analysis is figuring out what the most important feedback loops driving a system’s behavior are and should be. While large social systems contain millions of loops, the decisive behavior of a specific problem is controlled by only a few loops. These determine the basic **structure** of a system, which is the shape of the important loops defining the system’s behavior of interest. The **First Law of Modeling** states that if you don’t understand a system’s key

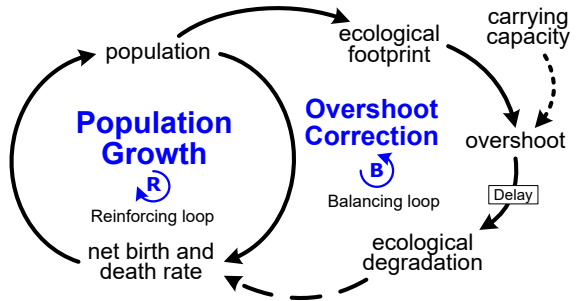
feedback loops then you don't understand the system. But once you do you are a giant step closer to controlling the system's behavior.

The beauty of thinking in feedback loops becomes apparent when reinforcing and balancing loops are combined. This allows modeling any problem, since the dynamic behavior of all problems arises from their feedback loops. An example is the environmental sustainability problem, as modeled below with a *causal loop diagram*. This illustrates how the P factor (Population) in the IPAT equation (see page 32) works.

The **Population Growth** loop behaves as before, though births per year has become the net birth and death rate. In the **Overshoot Correction** loop the goal imposed by the biosphere and the AT in the IPAT equation is carrying capacity. This limits population to a sustainable number. As population rises, so does the ecological footprint. Once the footprint exceeds carrying capacity, the system goes into overshoot mode. This causes overshoot to begin to exceed zero. As overshoot increases, so does ecological degradation. As degradation increases, the net birth and death rate decreases. This reduces population.



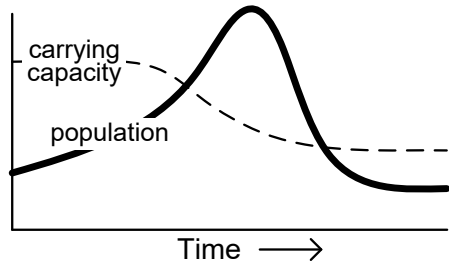
The P Factor of the IPAT Equation



Note the delay between overshoot and degradation. This tiny little detail has a gigantic life or death impact on the problem. If there was no delay the sustainability problem would not exist. It would be self-correcting as civilization evolved. Farmers would instantly know that to avoid soil nutrient depletion, they must recycle all output from their fields and avoid topsoil erosion. Families relying on wood for fuel and building material would instantly realize that unless forests are sustainably managed, their wood will run out. And so on. But delays exist. Their presence dominates the behavior of the sustainability problem. The dynamic result is the **S-shaped growth with overshoot** graph shown. Population grows exponentially at first. Then, as it approaches and passes carrying capacity, the population curve slows down. After the delay, it begins to fall until it reaches carrying capacity, where it stays as shown in the graph.

However, that graph is overly simplified. In the real world prolonged overshoot causes the biosphere's carrying capacity to erode, leading to population collapse. A more realistic graph would look like the one on the right. This graph is so central to understanding the sustainability problem that it's on the cover of the third edition of *The Limits to Growth*. The graph optimistically shows

S-shaped Growth with Overshoot and Carrying Capacity Erosion



how once civilization has collapsed and learned its lesson, population stays well under carrying capacity to avoid further capacity erosion.

SIP recommends a particular form of simulation modeling known as **system dynamics** due to its emphasis on identifying the right key feedback loops, preference for the simplest model possible, and its clean elegant visual language. For sub-problems where deeper understanding of dynamic behavior is not an issue, a causal loop diagram is sufficient.

Technique C. Problem decomposition

Once the problem is defined analysis begins. The first step is to decompose the one big problem into smaller and hence easier to solve subproblems. This step is hugely important, because what subproblems are chosen makes or breaks the entire analysis. To ease this burden SIP strategically decomposes problems into the **three standard subproblems** present in all difficult social problems, plus more as needed:

- A. How to overcome systemic change resistance
- B. How to achieve proper coupling (of two or more systems)
- C. How to avoid excessive solution model drift

This standard decomposition allows problem solvers to search the solution landscape much more efficiently, by what we estimate is several orders of magnitude. Standard decompositions are the norm for mature processes. For example:

The four Ps of marketing: Product, Place, Promotion, Price ²⁰

The original four Ms of manufacturing: Materials, Methods, Machines, Measurement ²¹

The nine Ms of quality control: Markets, Money, Management, Men, Motivation, Materials, Machines and mechanization, Modern information methods, Mounting product requirements ²²

During our research we found that without the right decomposition the sustainability problem was impossible to analyze. We expect this holds for all difficult large-scale social problems. Studying the ones we are familiar with, environmental sustainability, over population, recurring wars, recurring large recessions like those of 1929 and 2008, endemic corruption, excessive wealth inequality, and the class of difficult large-scale social problems itself, we concluded that all had a common set of three subproblems plus additional subproblems as needed. To leverage this potent pattern SIP suggests beginning with the standard three subproblems found in all difficult large-scale social problems and adding more as necessary. Exceptions to starting with three standard subproblems would be problems not of this class, such as small-scale problems, new problems where solution failure has not yet occurred, problems with low change resistance, etc.

Problem decomposition absolutely must be done. Otherwise the bewildering complexity of the one big problem will overwhelm all attempts at correct analysis, because analysts will be attempting to solve multiple problems simultaneously without realizing it. It would be like listening to multiple conversations at the same time. The incoming signal is gibberish until the focus is on one conversation at a time. Then the signal is clear.

If a difficult large-scale social problem is not decomposed into multiple subproblems, analysts have fallen into the **One Subproblem Trap**. This occurs when problem solvers assume a single subproblem is the only one to solve, which makes the problem impossible to solve because it remains too complex to analyze correctly. The standard subproblems listed above are examples of how mature processes avoid the deadly effect of the One Subproblem Trap.

The **three standard subproblems** work like this:

Subproblem A – How to overcome change resistance

Change resistance is the tendency for a system to continue its current behavior, despite the application of force to change that behavior. Change resistance is the most important problem to solve (in the short term) and must be solved first. The origin of the concept is described by Dent and Goldberg:²³ (*Italics added*)

The notion of resistance to change is credited to Kurt Lewin. His conceptualization of the phrase, however, is very different from today's usage. [which treats resistance to change as a psychological concept, where resistance or support of change comes from values, habits, mental models, and so on residing within the individual] For Lewin, resistance to change could occur, but that resistance could be anywhere in the system. As Kotter (1995) found, it is possible for the resistance to be sited within the individual, but it is *much more likely to be found elsewhere in the system*.

Systems of social roles, with their associated patterns of attitudes, expectations, and behavior norms, share with biological systems the characteristic of *homeostasis*—i.e., tendencies to resist change, to restore the previous state after a disturbance.

Lewin had been working on this idea, that *the status quo represented an equilibrium between the barriers to change and the forces favoring change*, since 1928 as part of his field theory. He believed that some difference in these forces—weakening of the barriers or strengthening of the driving forces—was required to produce the unfreezing that began a change.

Today’s “status quo” is, alas, an unsustainable world. When problem solvers attempt to solve the sustainability problem, their strengthening of “the forces favoring change” causes the system to maintain homeostasis by automatically increasing the “barriers to change.” This is a natural and expected adaptive response that must be expected and taken into account.

We hypothesize that one way to do this is to decompose difficult social problems into two sequential subproblems: (A) *How to overcome change resistance* and then (B) *How to achieve proper coupling*. (Proper coupling is defined later.) This is the timeless strategy of divide and conquer. By cleaving one big problem into two, the problem becomes an order of magnitude easier to solve, because we can approach the two subproblems differently and much more appropriately. We are no longer unknowingly attempting to solve two very different problems simultaneously.

There’s a simple reason this decomposition works so well: change resistance is usually what makes social problems difficult. In fact, regardless of whether change resistance is high or low, it is impossible to solve the proper coupling part of a social problem without first solving the change resistance part. This is nothing new, however. As the old joke goes, “How many psychologists does it take to change a light bulb? Just one. But first the light bulb has to want to change.”

In difficult social problems problem solvers spend a long time trying to overcome change resistance. Once that occurs proper coupling is achieved relatively quickly by introduction of new norms/laws and related mechanisms, and is refined still further over time. This pattern has occurred in countless historic social problems whose solution benefits the common good, like universal suffrage, slavery, racial discrimination, the dangers of smoking tobacco, the rule of colonies by other countries, the recurring wars in Europe problem (solved by creating the European Union, which properly coupled member nations together to reduce pressures for future wars), and the non-benevolent ruler problem (solved by invention of democracy, which properly coupled the people and their rulers via the voter feedback loop). True to form, the pattern is occurring again in the sustainability problem.

To illustrate the critical importance of change resistance, let's listen in on an interview with Al Gore, published in the September/October 2006 issue of *Sierra Magazine*. The interview began this way: (*Italics added*)

Question: How do you feel about the reception to *An Inconvenient Truth*?

Al Gore: I'm gratified that the reviews have been 99 percent positive because more people will be exposed to the message. I've seen times in the past when there was a flurry of concern about global warming, and then, like a summer storm, it faded. But this time, it may be different.

Question: Jeb and George Bush have said they won't see your film, and I'm sure they speak for many who just don't want to hear your message. *How do you get past that resistance?*

Al Gore: That's a question I've been trying to answer for 30 years, and part of the answer is persistence. *And part of the answer I don't know yet.*

In other words, Al Gore doesn't know how to solve the change resistance part of the problem. The same can be said for the entire sustainability movement. The world knows what to do to live sustainably. The problem is the world doesn't *want* to do it, due to change resistance.

Let's examine an important aspect of leverage. A **high leverage point** is a place in a system's structure where a small amount of change force causes a large amount of favorable system response. **Change force** is the total effort required to prepare and then make a change. *In activism the effort required to prepare for a change usually dwarfs the effort to finally make the actual change.* For example, in many nations it took decades to create a groundswell of public opinion about the dangers of smoking tobacco. Then it took decades of lobbying and bargaining to get politicians to support legislation to do things like require health warnings on cigarette packages and ban smoking in certain public places. All this required immense effort and resources. The actual effort to make the change was easy. The politicians wrote the new legislation, voted on the change, it passed, and was signed into law.

The higher the leverage point, the less the change force needed to induce a system to accept a solution element.

Subproblem B – How to achieve proper coupling

Proper coupling occurs when the behavior of one system affects the behavior of one or more other systems in a desirable manner, using the appropriate feedback loops, so the systems work together in harmony in accordance with design objectives. For example, if you never felt hungry you would starve to death. You would be improperly coupled to the world around you.

In the environmental sustainability problem the human system is improperly coupled to the greater system it lives within: the environment. In a war problem two

groups of people are improperly coupled. In a recession problem producers are improperly coupled to consumers. In a poverty problem the poor are improperly coupled to the economic system. And so on.

The original problem to solve is usually a proper coupling subproblem. This is the case in our analysis of the sustainability problem, where the original problem is the *environmental proper coupling subproblem*.

In difficult social problems, overcoming high change resistance is the crux. It must be solved first because until change resistance is overcome proper coupling is impossible. But that's not how problem solvers are working. For example in the environmental sustainability problem, in all cases we know, activists are attempting to solve the proper coupling part first and are treating change resistance as a minor hurdle that can somehow be overcome. This is being done without realizing it. Hence the need for the right decomposition.

Environmentalism has fallen into the One Subproblem Trap by assuming that the only significant subproblem to solve (and hence to formally analyze) is the environmental proper coupling problem. This is a fatal error because it omits the other two standard subproblems or possible additional subproblems.

Subproblem C – How to avoid excessive model drift

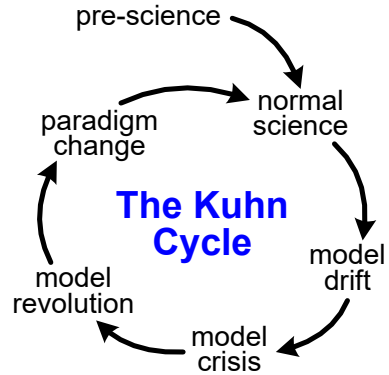
Next comes a more subtle concept: model drift. All conscious decisions are based on mental models of the world around us. As individuals and groups develop solutions to problems, we develop mental models (frequently augmented with physical models) of the problem and solution. When the model is sufficiently mature we implement the solution. If something goes wrong we go back to the model, improve it, and try again. Large mental models are a synonym for paradigms.

Model drift occurs when situations appear that a solution model cannot handle and the model is not or cannot be patched up to accommodate them. If the exceptions are relatively small, the model is still useful and model drift is said to have occurred. But if the exceptions accumulate and become major, then the model is now a hindrance to those using it. Excessive model drift has occurred and the model is broken. It's so useless the field is in crisis. This may or may not be noticed by some or even the majority of model users, who often erroneously claim the present model still works.

In order to more fully understand model drift we need to review the Kuhn Cycle, as described by Thomas Kuhn in 1962 in his magnum opus, *The Structure of Scientific Revolutions*. Kuhn showed that scientific revolutions go through a predictable pattern consisting of one pre-step to initiate the cycle and four steps for each revolution of the cycle.

The result of a scientific revolution is radical paradigm change. According to Kuhn, “A **paradigm** is what members of a scientific community, and they alone, share.” The cycle applies to any shared paradigm used by a group to achieve its mission.

To make the cycle more applicable to SIP we’ve added a fifth step, model drift, to clarify what precedes model crisis. This leads to a key insight: *If excessive model drift can be prevented, such as by continuous self-improvement of a solution or governance system, then model crisis will never occur.*



The Kuhn Cycle – This approximates the cycle of revolutionary change scientific fields occasionally go through as they grapple with their difficult problems.

Step 0 – Here’s how the Kuhn Cycle works: Before a paradigm first exists it’s in pre-science. According to Kuhn, **pre-science** is

“disorganized and unstructured activity characterized by total disagreement and constant debate over fundamentals, such as optics before Newton.”

Step 1 – But once that confusion crystallizes into a clear vision of how to move forward together, the field’s first paradigm is born and the cycle moves into the normal science step. To Kuhn **normal science** is “structured activity that is directed by a single paradigm, which is uncritically accepted by the vast majority of the scientific community.”²⁴

Step 2 – Paradigms/models are rarely stable because social systems are always evolving and new knowledge is always being discovered. Particularly when a paradigm is young, **model drift** will soon begin as anomalies appear. An **anomaly** is a violation of “paradigm-induced expectations that govern normal science.” Anomalies are situations the model cannot handle or phenomenon it cannot explain. If the anomalies are small the model can be patched up, which takes the state of the model back to normal science. But over time, the exceptions the model can’t handle may accumulate. When they become excessive, the model crisis step begins.

Step 3 – In the **model crisis** step the model can no longer serve as a reliable guide to decision making (or in the case of a self-managing solution, as a driver for system behavior). This throws those using the model into confusion and crisis, because now they have nothing to base rational decisions on. They are intellectually lost when it comes to interpreting the world and deciding how to solve problems, and are forced to either guess or do nothing. As the crisis grows, new models are proposed that may or may not accommodate the anomalies. Once some of these models begin to look

promising and debate shifts to how to perfect one that can accommodate the major anomalies, the next step, model revolution begins.

Step 4 – The **model revolution** step is revolutionary because it takes radical change to conceive of the totally new ideas necessary to accommodate the accumulated anomalies. This step can be quite tumultuous and prolonged. It can take years, decades, or even centuries for innovators to arrive at a new model that successfully integrates most of the anomalies into a new conceptually complete model. This step ends when the new model is agreed upon by the leading innovators in a field. The new model may not yet be mature, but it's clearly better than the old one. This causes the next step to begin.

Step 5 – In the **paradigm change** step the innovators begin spreading the new model to others. People's mental models change from the old to the new paradigm. This is usually difficult for most individuals and groups due to long habit, social norms, and invested egos. In many cases change is impossible, so this step remains incomplete until most influential believers in the old model have died off and the new model has been taught to the new generation. In other cases intense pressures may hasten paradigm change, such as if catastrophic failure faces a field if it cannot solve a central problem.

The next Step 1 – The Kuhn Cycle completes when the new paradigm becomes the new **normal science**. It's the normal way most of a field's members look at the world. The old paradigm has been tossed on the rubbish heap of history. The field is now productive again, but this time even more so. The cycle then continues because *Homo sapiens*, knowing man, is always learning.

The tremendous problems encountered in moving rapidly through the cycle are explained in this passage from the Wikipedia entry on Kuhn's work:²⁵

According to Kuhn, the scientific paradigms preceding and succeeding a paradigm shift are so different that their theories are incommensurable — the new paradigm cannot be proven or disproven by the rules of the old paradigm, and vice versa. The paradigm shift does not merely involve the revision or transformation of an individual theory, it changes the way terminology is defined, how the scientists in that field view their subject, and, perhaps most significantly, what questions are regarded as valid, and what rules are used to determine the truth of a particular theory. The new theories were not, as the scientists had previously thought, just extensions of old theories, but were instead completely new world views.

Such incommensurability exists not just before and after a paradigm shift, but in the periods in between conflicting paradigms. It is simply not possible, according to Kuhn, to construct an impartial language that can be

used to perform a neutral comparison between conflicting paradigms, because the very terms used are integral to the respective paradigms, and therefore have different connotations in each paradigm. The advocates of mutually exclusive paradigms are in an invidious position: *"Though each may hope to convert the other to his way of seeing science and its problems, neither may hope to prove his case. The competition between paradigms is not the sort of battle that can be resolved by proof."*

Hence the need for a self-improving solution or governance system, so that excessive model drift does not occur and we can avoid the problem of incommensurable new and old solution models. If we cannot build robust self-managing solutions, then large social problems will continue to go through endless cycles of solution, model drift, and solution failure.

This leads to a key rule of social system behavior, one that can be called the **Rule of Problem Recurrence**: *If the model drift subproblem is not permanently solved then the overall problem will eventually recur.* If you are dealing with multiple problems, which all large social systems contain, multiple problem recurrence will eventually exhaust the resources available to solve the problems.

This is the state many nations find themselves in today. They are barely able to cope with chronic old problems and a steady stream of new problems, and are forced into triage. Such nations are highly vulnerable to sudden collapse, because when one more new problem appears it can overwhelm a nation's problem-solving capacity. This fate is not limited to poor nations. It also occurs in developed ones due to hitting various system limits and/or the cyclic re-emergence of dominant races to the bottom, a point explained later.

Avoiding excessive model drift equates to the process control phase of industrial root cause analysis. After initial solution success, "don't be too hasty to declare victory. The last battle has yet to be fought. The battle against creeping disorder, the battle against entropy. The battle to ensure the gains you made are permanent."²⁶

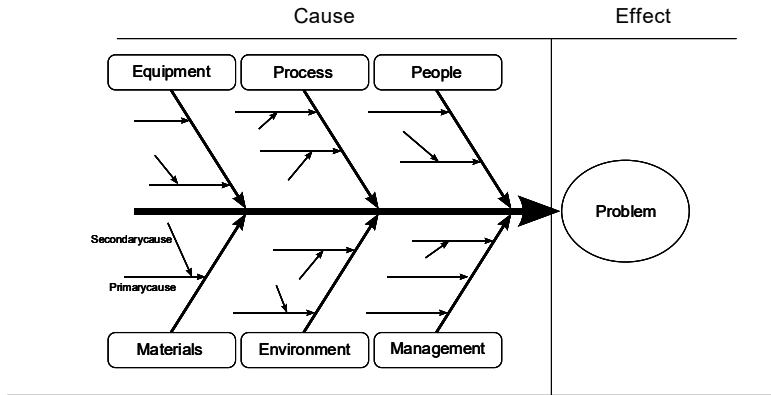
Avoiding excessive model drift also equates to resilience. Subproblem C could just as well be named *How to avoid low resilience*. "**Resilience** is the capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organization, learning and adaptation."²⁷ A social system with excessive model drift cannot adapt fast enough to solve pressing problems, which is low organizational resilience at the system level.

In the short term, *How to overcome change resistance* is the most important subproblem to solve and must be solved first. In the long term, *How to avoid excessive model drift* is the most important subproblem because once it is solved the system is permanently resilient.

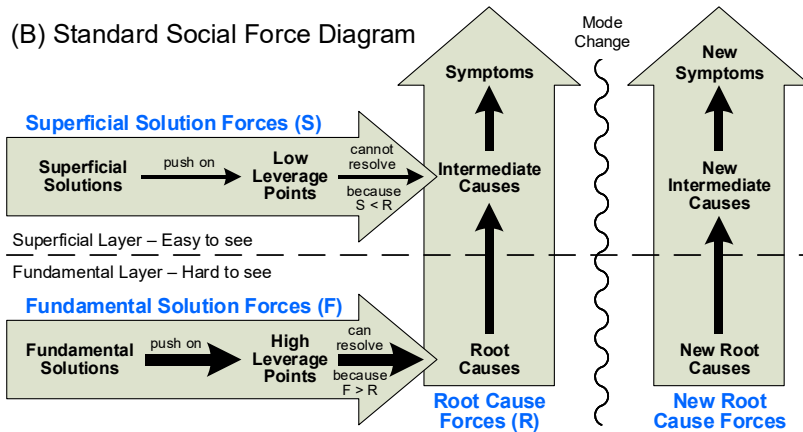
Technique D. Social force diagrams

A popular visual business tool for finding root causes is cause-and-effect diagrams, also called fishbone or Ishikawa diagrams. SIP uses a modified form called **social force diagrams**, as shown.

(A) Standard Cause-and-Effect Diagram



(B) Standard Social Force Diagram



Standard cause-and-effect and social force diagrams

(A) Cause-and-effect diagrams show the causal tree leading to a problem. The six standard industrial subproblems are shown.²⁸

(B) Social force diagrams rearrange the causal tree of cause-and-effect diagrams into a format emphasizing the superficial and fundamental layers of the problem, the three main forces that must be understood to solve the problem, and the mode change that occurs when a problem is solved.

The monumental challenge of problems like sustainability is how do you cut through the overwhelming complexity? Social force diagrams reduce confusing complexity to clear simplicity by organizing the main forces involved into a standard format that, once understood, shines the light of clarity on the problem.

Social force diagrams show at a glance what is causing a problem. In Fig. 2B the eight line arrows represent cause-and-effect forces. The large box arrows represent the three main forces. Difference in force strength is illustrated by line arrow thickness. Correct application of fundamental solution forces causes a system mode change, resulting in the new mode on the far right.

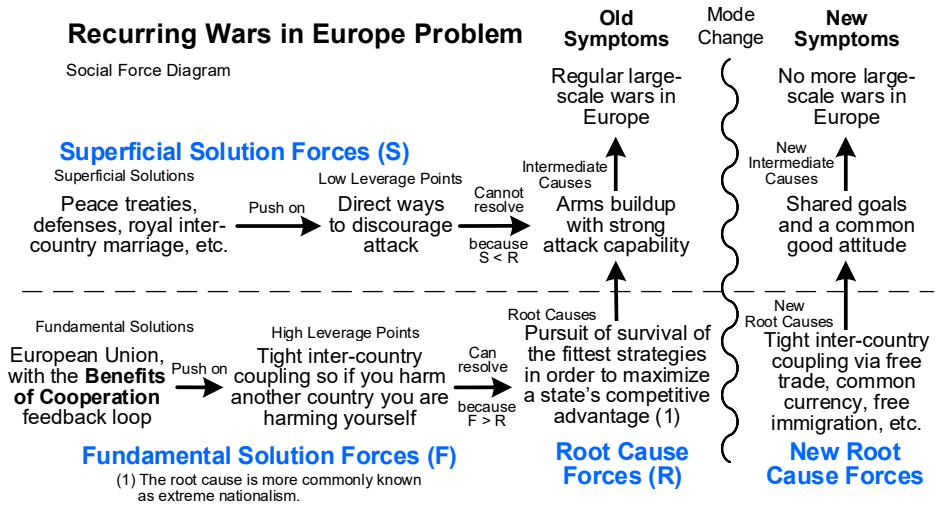
Social force diagrams simplify difficult social problems to their three main forces. The first is the **root cause forces** causing the problem. In difficult problems this systemic force is so strong it causes mode lock-in and inherently high change resistance. **Systemic** means “originating from the system in such a manner as to affect the behavior of most or all social agents of certain types, as opposed to originating from individual agents.”²⁹ The central role of lock-in in the environmental sustainability problem has long been noted, such as by Garrett Hardin in *The Tragedy of the Commons*: “Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited.”

Working backward from the symptoms, problem solvers identify what they believe are the causes and develop solutions based on that assumption. If it’s a difficult problem the solutions fail at first because they are **superficial solution forces** attempting to resolve intermediate causes. This is the second type of force.

All problems solvers can clearly see in the initial phase of solving a difficult problem is the superficial layer. But with root cause analysis problem solvers can penetrate to the fundamental layer and see the complete problem. There they will find the root causes. Once the root cause forces are known the third type of force can be employed. **Fundamental solution forces**, if properly designed, resolve the root cause by changing the feedback loop structure of the system such that a new homeostasis (aka dynamic equilibrium) becomes more attractive. Lock-in to the present mode ends, causing the system to quickly transition to the new mode. The system stays locked into the new mode due to the new root cause forces introduced by the fundamental solution forces. If the analysis (including testing) is done well, the solution force will solve the problem rapidly, efficiently, and relatively permanently.

A **leverage point** is the exact place in a social system structure a solution pushes on. SIP advocates modeling difficult problems, so the point is a node in the model corresponding to points in the real world. A **low leverage point** is connected to an intermediate cause (aka false root cause or proximate cause) in such a manner that pushing on the low leverage point will reduce, but not resolve, the intermediate cause. **Superficial solutions** (aka symptomatic solutions) push on low leverage points. A **high leverage point** is connected to a root cause such that pushing on the point with **fundamental solutions** will resolve the root cause.

Below is a social force diagram for the **Recurring Wars in Europe Problem**. The diagram shows at a glance why traditional solutions didn't work. They didn't resolve the root cause. But after the horrors of two successive world wars on European soil, problem solvers said never again and looked deeper for the root cause. They found it. The resulting solution, the European Union, caused a permanent mode change. Today no member of the union would even consider war against another member since that would be terribly self-destructive.



The superficial solutions failed because they pushed on a low leverage point. All those peace treaties, military defenses, royal marriages between countries, and so on did nothing to resolve the root cause. The drive to maximize a state's competitive advantage was a much stronger force than the superficial solutions.

The fundamental solution worked because it pushed on a high leverage point. A high leverage point is connected to a root cause in such a manner that pushing on the high leverage point greatly reduced the root cause force to an acceptable level or eliminates it altogether. This resolves the old root cause forces and creates new root cause forces.

The new root cause forces resulted from careful design of the fundamental solution. Once member states took the first strong step toward tight inter-country coupling, a new reinforcing feedback loop began. The European Union started with market integration and proceeded to further integration (for most members) via a common currency, membership in NATO, military integration, open borders between member states, common policies on agriculture, fisheries, and regional development, etc.

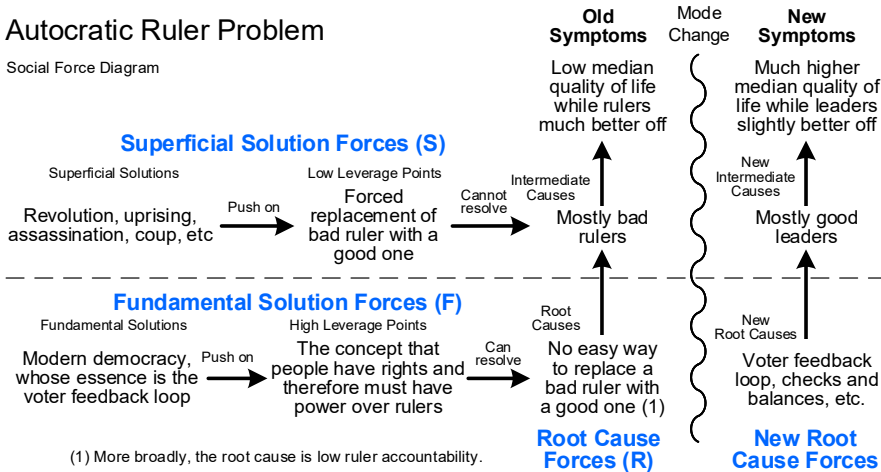
The diagram explains why the United Nations has failed to prevent war between its member states. The United Nations' work does not push on the high leverage point sufficiently.

As a second example, consider one of history’s most intractable problems: autocratic rule by countless warlords, dictators, and kings. **The Autocratic Ruler Problem** was eventually solved by the invention of modern democracy. This took thousands of years and much painful trial and error because the root cause was unknown. However, now it is known. This allows the retrospective social force diagram shown below to be constructed.

The diagram shows at a glance why superficial solutions failed to solve the problem for so long, why the fundamental solution worked, and why, once the mode change occurred, political systems have tended to stay in the new mode due to the right new balancing feedback loop. Like the other examples, the diagram is simplified. It is not the summary result of full application of SIP, which would involve a social force diagram for each subproblem, a filled in SIP matrix, and simulation models as needed.

Autocratic Ruler Problem

Social Force Diagram

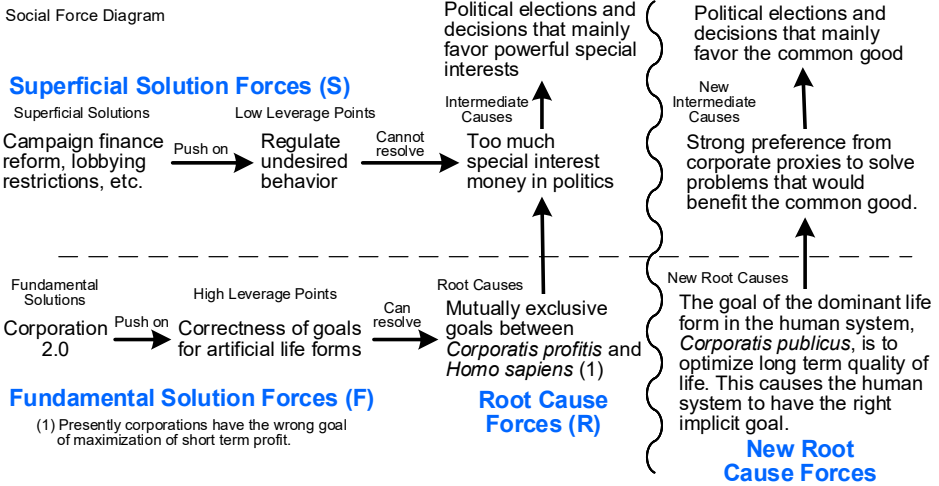


Simplified social force diagrams like this one can roughly explain how past social problems were solved from a root cause analysis perspective, thus illuminating what really happened. Simplified diagrams can also be used to take a quick first pass at a current problem to arrive at a well-structured pre-analytic vision, which Schumpeter³⁰ held is necessary for any new science to take place. “...analytic effort is of necessity preceded by a pre-analytic cognitive act that supplies the raw material for the analytic effort.”

A third example is the **Money in Politics Problem**. The problem has plagued democratic systems ever since they were born, though it has grown more acute in the last several centuries due to the appearance of large for-profit corporations, labeled *Corporatis profitis* in the diagram.

The symptoms are that political elections and decisions mainly favor powerful special interests, notably large for-profit corporations and the rich. The problem is widely called the corruption or “money in politics” problem, since it’s obvious there’s too much special interest money in politics. If that’s the cause, then the leverage point strategy is also obvious: regulate the undesired behavior. This has been attempted with campaign finance reform, lobbying restrictions, etc.

Money in Politics Problem



But serious reform via new laws doesn’t work in most countries, especially large ones like Russia, the United States, and India, for two reasons. First, the foxes are guarding hen house, so they oppose such legislation, causing it to pass in weakened form or not at all. Second, if it is passed, politicians and special interests adapt and find new ways to circumvent the new laws. Continual solution failure indicates there must be a deeper cause of too much special interest money in politics.

If one drills down for that deeper cause, armed with a process like SIP, eventually you will find the root causes. This we have done as presented later. Briefly, the main root cause is mutually exclusive goals between *Corporatis profitis* and *Homo sapiens*. The goal of *Corporatis profitis* is maximization of short term profit. The goal of *Homo sapiens* is optimization of long term quality of life for people, for those living and their descendants. These goals are so mutually exclusive they cannot be achieved in the same system. Currently the corporate life form dominates the human system to such an extent that *its goal has become the implicit goal of the*

system, as demonstrated by system behavior. The inevitable result is the superficial solutions don't work.

But if problem solvers direct their efforts to fundamental solutions that can resolve the root cause, everything changes. Once the root cause is resolved the system undergoes a mode change, to the new symptoms as shown. All this requires is correct knowledge of the problem's root causes.

This completes review of the definitions and techniques that comprise SIP. Next let's examine:

The four main steps of SIP

The System Improvement Process is derived from the natural way people go about solving problems. They intuitively apply these four steps:

The Universal Problem Solving Process

1. Identify the problem
2. Understand the problem
3. Decide how to solve it
4. Implement the solution

The process of solving any kind of problem consists of first noticing the problem, then understanding the problem, then deciding what to do, and then doing it. People routinely zip through these steps so fast they solve little problems in seconds, like the sudden appearance of a puddle of spilled milk. Bigger problems take longer, but the basic process is always the same.

This is the process everyone has used millions of times to solve problems. We do it so fast we rarely consciously enumerate the steps. But what if we're working on a problem where it doesn't work and solutions fail? Then what process should we use? We can't just wing it. All that will lead to is more solution failure.

Instead, we need to stop, improve the process to where it's capable of solving the problem, and only then return to solving the problem. Once we do this, we have broken through into the mindset of *process driven problem solving* (see page 40), where *once you've selected a process, you are always doing only two things: improving the process or executing the process.*

Using the universal problem solving process as a starting point, let's rename the above steps to nouns representing major project milestones. This gives the four main steps of SIP.

The Four Main Steps of SIP

1. Problem Definition
2. Analysis
3. Solution Convergence
4. Implementation

The strategy is to continually amplify the value of your work as it flows through these steps, until by the time it gets to the last step it's so productive it has a high probability of solving the problem. This amplification is accomplished by following the guidelines in each step.

This is not a "waterfall" process. Frequent iteration is the norm. When a step bogs down it's usually due to an error in a previous step. Back up, do the portion of that step again that is causing the later step to fail, and then continue. Much less often, but much more important, correcting the error requires improving the process.

Here's a summary of each step:

1. Problem Definition – The problem to solve is formally defined. Problem definition identifies the problem in terms of the desired goal state of the system, which is the state a solution will move the system to. The standard problem definition format is "*Move system A under constraints B from present state C to goal state D by deadline E with confidence level F.*" A problem is solved when a solution is created that will move the system to goal state D by deadline E with confidence level F and keep it there.

2. Analysis – First the one big problem is decomposed into subproblems. Then, using social force diagrams and modeling as necessary, you inspect, measure, and experiment to capture the system's relevant structure. Analysis continues until the system's key cause-and-effect relationships are well understood. In particular, this step finds the *root causes* of the problem and the *high leverage points* for resolving those causes.

3. Solution Convergence – Solution elements push on high leverage points. Using knowledge from the previous steps, this step converges on a set of solution elements by logical deduction, artificial world or small-scale real world experimenta-

tion, and further modeling as necessary. If the system is well understood this step will be relatively straightforward.

4. Implementation – Here the solution elements are implemented. In traditional problem solving processes this step is the hardest. But in SIP it's the easiest, because by the time you get this far your cause-and-effect knowledge is so sound that how the system will respond to solution intervention is fairly predictable.

Here are the four main steps of SIP in detail.

Main Step 1. Problem definition

Solving a formidable social problem begins with defining the problem in a manner that enhances all subsequent effort. The guiding principle of this step is that the more correctly a problem is defined, the less work required to solve it. Difficult social problems are best defined with this standard format:

Move system A under constraints B from present state C to goal state D by deadline E with confidence level F.

The letters are the variables that are filled in to define a problem. C and D are present and desired symptoms. D, E, and F are the solution goal, the most important part. Constraints B include human resources, budget, conflicting goals, uncertainty, authority limitations, and so on. Once you've filled in the blanks you have clear targets on which to focus your work in the remaining steps.

An example of defining a problem using this format is "Given you are downtown and have lost your wallet and car keys, get home by 6:00 PM today with a 90% probability." Here system A is implied. It's the normal world you live and work in.

The **goal state** is the preferred state of the system, as opposed to the undesirable **present state**. The **state** of a system is the current values of the system's elements, such as your current location and who you know downtown. Implied is once the system enters goal state D, it must stay there. A problem is "solved" when a solution is created that will move the system to goal state D by deadline E with confidence level F.

In many cases goal state D must be expressed as a range, with lower and upper bounds. For example, you may want to keep from \$1,000 to \$5,000 in your checking account. Anything less is too risky, because who knows what expenses might appear suddenly? Anything more is losing money, because you could put it in an investment account and draw more interest.

Implied is the system will remain in the goal state indefinitely or until the end of the system's natural life. If the goal state needs to be maintained only temporarily, then modify the problem definition format. Use the format "...move to goal state D for X period of time..."

If a problem does not fit the standard format well then devise a suitable format. The important thing is to have a written, unambiguous, *measurable* definition of solution success. This allows subsequent work to be much more focused and efficient.

Main Step 2. Analysis

Once the problem is defined, problem decomposition begins. This uses the three standard subproblems found in all difficult large-scale social problems, plus more as needed:

- A. How to overcome change resistance
- B. How to achieve proper coupling
- C. How to avoid excessive model drift

The main problem to solve is usually proper coupling. What's making the problem difficult is usually high change resistance, though sometime it can be excessive model drift or both. Subproblems A and B are sequential and must be solved in that order. Subproblem C can be solved anytime and is usually solved last so as to achieve proper coupling as soon as possible. Thus the three subproblems are solved in the order given. *All three must be solved for the problem to be fully solved.* In the short term change resistance is the crux. But in the long term the crux is model drift.

SIP views proper coupling as the relatively easy part of solving difficult social problems. It's easy because once high change resistance is overcome the system will "want" to be properly coupled. It will stay that way indefinitely if excessive model drift does not occur. Change resistance and model drift solutions form a stable sandwich that holds proper coupling solutions where they should be. It's a tasty sandwich, once assembled.

The power of the three subproblems arises from the way they are far more easily solved separately. If difficult social problems are not decomposed in a manner similar to the one presented here, they are Gordian knots of insolvability.

The goal of analysis is to understand the problem's essential causal structure so well that its important behavior becomes obvious. This will cause two supremely powerful insights about the problem to emerge. (1) Because the system's *intermediate causes* and *low leverage points* are now so clearly revealed, it becomes perfectly obvious why we have been failing to solve the problem. (2) Because we can now see where the *root causes* and *high leverage points* are, how to solve the problem becomes a straightforward matter of determining how to best push on the correct high leverage points.

Once these two insights are achieved a problem is considered well understood. After that the remaining steps, solution convergence and implementation, are relatively easy. This strategy forms the very heart of why the System Improvement Pro-

cess is so powerful. To execute this strategy, problem solvers should spend approximately 80% of their time or more in the analysis step.

The behavior of complex social systems, from families all the way up to world civilizations, is driven by feedback loops. It follows that *if you don't understand a social system's feedback loops, then you don't understand the system*. Normally these loops are invisible, which is what makes solving social problems so challenging. Problem solvers are trying to influence something they can't see. It's as if we were up against an invisible opponent who can see us but we can't see him. The outcome of such a lopsided contest is a foregone conclusion. That outcome changes once we can clearly see the key feedback loops and how they work.

To find the key feedback loops, root causes, and high leverage points, SIP builds a social force diagram for each subproblem, using the five substeps of analysis. A subproblem is defined by describing its symptoms.

In what follows, "problem" means "subproblem." The substeps are deliberately designed to be as much of a cookbook checklist approach as possible, for efficiency, repeatability, and improvability. Considerable thoughtfulness and creativity is still required, as it always is in a first-of-its-kind pioneering endeavor.

I need to make a small confession here. The lively substep descriptions (and much of this book) may sound like I've solved many problems with SIP before, but I haven't. In fact I haven't even solved one. The analysis results and sample solution elements presented later, as well as SIP itself, are theoretical. However, based on twenty years as a business manager and consultant, I've solved hundreds of important problems with similar approaches. Process improvement was one of my specialties. Thus I can visualize how SIP would work with some degree of predictability. This book is a humble attempt to share my vision of what is possible with you.

Here's how the five substeps of analysis work:



Substep A. Find the immediate cause of the problem symptoms in terms of the system's dominant feedback loops.

Given the problem symptoms, create a feedback loop model that produces the symptoms. Next study the model to see which loops are dominant and causing the symptoms. Those loops are the immediate cause.

This step differs dramatically from common sense approaches to solving social problems. For example, it's commonly assumed that the immediate cause of climate change is rising greenhouse gas emissions, and therefore we must stop those emissions. But SIP says no, that's a superficial non-structural viewpoint, so shallow it will not help much in solving the problem. Better is to identify the feedback loops causing those emissions to rise, which, for example, is exactly what the World3

model in *The Limits to Growth* did. The model’s Industrial Growth loop is the dominant immediate cause feedback loop.



Substep B. Find the intermediate causes, low leverage points, and symptomatic solutions.

If we want to find out what to do right, it helps to first find out what we’ve been doing wrong and why. The superficial layer of the social force diagram must be thoroughly understood before attempting to pierce through the fog of complexity surrounding the fundamental layer. Documenting the superficial layer will give you (just as it has us) the confidence that later substeps are correct, because you have a *complete* explanation of the problem’s behavior.

First, using the immediate cause dominant feedback loops from substep A, determine what the intermediate causes are. These will be in or related to the loops. This is the hardest part of substep B. Next, working from the intermediate causes, determine the low leverage points. These should be fairly obvious. Finally, list the solutions that have been pushing on the low leverage points.

This substep is fairly easy because you are working with a single well-defined subproblem, and because the many solutions that have failed provide a wealth of clues. The social force diagram on the Recurring Wars in Europe Problem was sketched out with pencil and paper in an hour. So was another one, the Autocratic Ruler Problem. The upper left portion of the Money in Politics Problem was sketched out in ten minutes. The rest of that diagram came from the analysis results presented later.

Personally, the crew at Thwink.org found substep B to be the most liberating of all the substeps. Once we could clearly see why conventional sustainability solutions were failing, we knew it would not be long before we found the root causes. Substep B gave us rational hope that the problem was solvable. This was a much needed psychological boost, as the analysis ended up taking seven years, with plenty of false leads and frustrating errors, all wrapped in a thick fog of seemingly endless complexity. The early results of substep B on several of the subproblem gave us what we needed most at that stage: hope.

Why do conventional solutions push on low leverage points? Because problem solvers have no better options. And why is that? Because due to lack of root cause analysis, the intuitively attractive intermediate causes are mistakenly assumed to be the root causes. This leads to superficial solutions that *should* work but don’t.

Superficial solutions are more commonly known as symptomatic solutions. Pushing on low leverage points fails because **symptomatic solutions** treat the symptoms rather than the root cause. Here are three examples of symptomatic solutions that made a problem worse instead of better:

1. The early welfare programs of the United States increased dependency on the program, instead of decreasing it. The root cause was it was more financially attractive to not have a job, or not have a husband, etc., and to depend on welfare than it was to do the opposite.
2. Another example was early solutions to the urban decay crisis in the United States in the 1960s. Analysis by Jay Forrester of four of the top solutions revealed that none were making the problem better and some were making it worse. The most favored solution of them all, low cost housing, actually increased urban decay the most. Forrester's model explained this counterintuitive result so convincingly that these policies soon changed.
3. Environmentalists have long pushed on the intuitively attractive but low leverage point of *more efficient technology*, such as with the green revolution, more efficient cars with higher gas mileage, and renewable energy. This reduces environmental impact. But more efficient technology does not decrease population growth appreciably. Nor does it address the deeper causes of economic growth. The root causes of impact growth have thus not been resolved, which will inevitably cause impact to rise. Thus all more efficient technology does is *delay* overshoot and collapse. Furthermore, when collapse finally does come it's much bigger and more expensive to deal with. In the long run more efficient technology makes the problem worse, not better.³¹



Substep C. Find the root causes of the intermediate causes.

This is *the* key step of the analysis. Starting with the intermediate causes, employ Kaizen and the model to find the root cause(s). Don't, as many do, use just Kaizen.

Kaizen is gradual unending process improvement based on asking why. It teaches "problem solvers to ask why not once but five times. Often the first answer to a problem is not the root cause. Asking why several times will dig out several causes, one of which is usually the root cause." In the "Repeating Why Five Times" example discussed earlier on page 30, "it was possible to identify the real cause and hence the real solution: attaching a strainer to the lubricating pump. If the workers had not gone through such repetitive questions, they might have settled with an intermediate countermeasure, such as replacing the fuse."

A **root cause** (defined in full on page 39) is that portion of the model's structure that explains why, at the root cause level, the system's present behavior produces the problem symptoms. As the Kaizen example shows with its five questions, you must dig deep to find the real root cause(s). As you dig you model. As you model you come to understand the system correctly more and more. This *analytical based*

understanding gradually replaces the unsound knowledge that resulted from problem solvers' earlier *intuitive based* understanding.

Digging for root causes is so important, so tricky, and so fraught with potential for hair pulling, frustration and failure, that the System Improvement Process employs three reusable subproblems. Each subproblem will have enormously different dominant loops, root causes, low leverage points, and high leverage points. Finding these separately for each subproblem is several orders of magnitude easier than finding them by examining one big jumbled mess of a problem, which for difficult problems like sustainability has proven to be impossible.

A trap to avoid is treating social problems as technical problems with easy quick technical solutions. Social problems have *social* root causes that require *social* solutions. As you go digging for root causes ask insightful questions like these: What are the dominant social agent types? What patterns of memetic transmission and infection are driving social agent behavior? What strategies for maximizing competitive advantage are social agents using?

The root causes of a difficult complex system social problem must be systemic because “Only a system level cause can actually be considered the root cause of a problem...”³² Recall that for social problems, **systemic** means “originating from the structure of the system in such a manner as to affect the behavior of most or all social agents of certain types, as opposed to originating from individual agents.” Whenever you see most of a system's social agents misbehaving in the same manner, what you have is a systemic problem with systemic *social* root causes.

In this substep the analysis and its simulation model is extended to include the root causes of the intermediate causes. This step is easier than one might expect because the process is not asking a hopelessly broad question, like “What are the root causes of the sustainability problem?” Instead the process focuses with “What are the root causes of the intermediate causes of a single subproblem?” This is a decidedly easier problem to solve.

Like an intermediate cause, a root cause may be a node value that's too high or low, a feedback loop that's too strong or weak, a relationship between two nodes that's undesirable, and so on. *In SIP a root cause is never a vague generalization like lack of political will or over-population. It's always a specific, quantified, testable feature of a model.*



Substep D. Find the feedback loops that should be dominant to resolve the root causes.

In this step you find the feedback loops that, if you could change them to be dominant, would resolve the root cause and solve the problem. These loops usually already exist but are weak. In some cases these loops may not exist at all, such as the way the voter feedback loop did not exist before the invention of democracy.

If you have developed a model that mimics the problem symptoms and correctly pinpoints their root causes, the loops that need to go dominant are usually obvious.



Substep E. Find the high leverage points to make those loops go dominant.

Here you find the high leverage points that when pushed will make the feedback loops found in step D go dominant and solve the problem. This is the primary output of the analysis step, so be sure to take the time to get it right.

This step takes some ingenuity and contemplation, because you have many points to choose from. The trick is to take your clues from where the loops that need to go dominant are. They should be close by. If not, you are veering toward a solution strategy that is going to be tenuous, because it will depend on too many structural connections from high leverage points to dominant loops. Your modeling assumptions behind each connection have to be correct. The connections have to hold throughout the life of the solution. The path of connection has to be such that it is not easily circumvented by clever agents or destroyed by disruptions to the system. The longer the path, the more likely it is that model behavior will differ from that in the real world, and the more work you will have to do to reduce that uncertainty to an acceptable level. So try to pick short paths from the high leverage points to the loops that need to go dominant to solve the problem.

If your model is sound the right high leverage points should be surprisingly easy to find. They are much easier to find than root causes. If you have found the true root cause then your model either already has the high leverage points or will need only a modest amount of modification to add them.

The key output of the analysis step of SIP is the high leverage points. A high leverage point is a specific place in a system's feedback loop structure that solution elements push on in order to efficiently resolve the connected root cause. A high leverage point is thus a high level solution strategy. It may also be seen as a solution requirements specification: *To solve the (name) subproblem, solution elements must resolve the root cause of (description of root cause) by (description of how to push on high leverage point)*. For example, later in Analysis Results the solution requirements specification for the change resistance subproblem is found to be: "To solve

the change resistance subproblem, solution elements must resolve the root cause of the inherent advantage of the Race to the Bottom by raising general ability to detect political deception from low to high.”

How the five substeps allow building a sound mental model

The five substeps are a process for replacing a defective mental model (or no model at all) with a sound one. This goal is the same one that Jay Forrester, the inventor of system dynamics, had in mind when describing his study of urban decay:³³ (Italics and comments added)

Enhancing Mental Models – Because of errors of dynamic interpretation in *mental models*, policy changes have often led to ineffective results, or worse, to the opposite of the intended results. [For example] A policy giving the opposite of the intended result was identified in *Urban Dynamics*. Economic distress in declining American cities in the 1960s generated symptoms of high unemployment and deteriorating housing.

It appeared natural enough [due to a defective mental model] to combat such symptoms by government intervention to build low-cost housing. But the modeling study showed, as events have since confirmed, that such urban areas already have more low-cost housing than the economy of the city can sustain. Public policy to build more such housing merely occupies land that could instead have been used for job-creating businesses, while at the same time the housing attracts people who needed jobs. A low-cost housing program introduces a powerful double force for increasing unemployment, both by reducing employment while at the same time attracting people seeking work.

Low-cost housing programs in inner cities became a social trap. The policy of building low-cost housing actually creates poor and unemployed people, rather than alleviating personal hardship. *The lesson here is to avoid attacking symptoms of difficulty until the [root] causes of those symptoms have been identified, and a high leverage policy has been found that will cause the system itself to correct the problem.*

That last sentence says everything this chapter has been trying to say. SIP allows problem solvers to “avoid attacking symptoms of difficulty” by finding the root “causes of those symptoms” and then the right “high leverage policy” for resolving those root causes. If the process is executed well enough, the solution will “cause the system itself to correct the problem.” The improved system will be in the right self-managing mode indefinitely, which is the strongest and most stable solution possible.

Main Step 3. Solution convergence

Using Analysis step results, this step converges on the solution elements that can push on the high leverage points effectively. By comparison to step 2, step 3 goes quickly. In a large complex social problem there are countless possible solutions. But there are only a few realistic ways to push on a single high leverage point. By building the essential causal structure of the problem and identifying its high leverage points, searching the solution landscape for solutions becomes an almost trivial task.

High leverage points are high level solution strategies. Solution elements are tactical plans for implementing those strategies.

Once again the process focuses and structures your work. SIP allows solution hypotheses to be constructed using a standard format: *Solution element A pushes on high leverage point B to resolve root cause C in model D in order to eliminate symptoms E in subproblem F.* By contrast, current processes employ a much less sophisticated standard format or none at all.

Solution element hypotheses require extensive testing. This can be done by expert opinion, calibrated modeling, artificial world experimentation (like on groups of volunteers), and real-world experimentation (pilot programs). For difficult problems much iteration with the Analysis step will be required.

Main Step 4. Implementation

SIP was designed for solving difficult large-scale social problems. Such problems are so large and systemic that their management falls under the responsibility of government. *SIP is a tool for better governance, to be used by policy managers to analyze problems and generate optimal policies.*

The output of SIP is not policy recommendations but solved problems. SIP solves problems by inducing a systemic mode change. The Implementation step moves a system from its present mode to its preferred mode. This is done by scaling up solution elements after they have passed small-scale testing in the Solution Convergence step. The mode change will normally go smoothly and predictably. This is the payoff for using a process that fits the problem.

Implementation results in feedback on solution fitness. Any significant deviations from anticipated system behavior should be used to update the analysis. This is crucial because large-scale problems tend to be ongoing and need perpetual management, ideally via a strong solution to the model drift subproblem.

The importance of pushing on high leverage points

The key output of the Analysis step of SIP is what high leverage points should be pushed on to solve the problem. Solving difficult social problems is all about leverage.

Leverage is the ratio of change in output to change in input. A **leverage point** is a place in a system where force can be applied. A **low leverage point** is a place in a system where a small amount of force causes a small change to system behavior. A **high leverage point** is a place in a system where a small amount of change force (the effort required to prepare and make a change) causes a large amount of favorable system response. To keep the term simple it's a “high leverage point” rather than a “favorable high leverage point.” The formula for calculating leverage is:

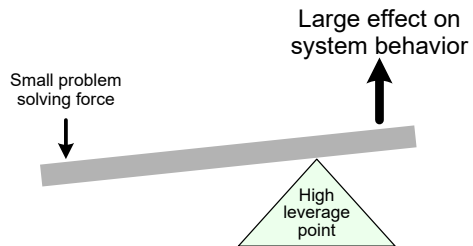
$$\text{output force} / \text{input force} = \text{leverage}$$

An example of a low leverage point would be pushing on the side of a ship to change its course. This would require a large amount of force to have the intended effect. But if the high leverage point of pushing on the rudder is used instead, it takes only a small amount of force to achieve the same effect.

At a favorable high leverage point a small structural change to a system can cause the system to behave much more favorably. *Only the use of the correct high leverage points can solve a difficult complex social system problem, because if a low leverage point is used, system resistance cannot be overcome.*

Environmentalists have long been pushing on the low leverage point of more of the truth, as explained later in the chapter on How to overcome change resistance. But they do not have enough force, in terms of numbers, influence, and wealth, to make pushing there work. Instead, they must find the high leverage points and push there.

The concept of leverage points is so powerful that Peter Senge, in *The Fifth Discipline: The Art and Practice of the Learning Organization*, devotes an entire chapter to the subject. The chapter, titled *The Principle of Leverage*, opens with these words: (italics added)



The choice of the right **high leverage point** (HLP) allows a small problem solving force (the total effort required to prepare and make a change) to have a large effect on system behavior. This requires choosing the right change force and the right application point. In a complex social system, leverage is the use of *indirect* force rather than *direct* force. The highest leverage is achieved by pushing on HLPs such that feedback loop dominance changes radically. This requires seeing the social structure involved.

The bottom line of systems thinking is leverage—seeing where actions and changes in structures can lead to significant, enduring improvements. Often leverage follows the principle of economy of means: where the best results come not from large-scale efforts but from *small well-focused actions*. Our nonsystematic ways of thinking are so damaging specifically because they consistently lead us to focus on *low leverage changes*: we focus on symptoms where the stress is greatest. We repair or ameliorate the symptoms. But such efforts only make matters better in the short run, at best, and worse in the long run.

It's hard to disagree with the *principle of leverage*. But the leverage in most real-life systems, such as most organizations, is not obvious to most of the actors in those systems. They don't see the 'structures' underlying their actions.

The chapter closes with this keen summation:

The essence of mastering systems thinking as a management discipline lies in *seeing patterns* where others see only *events and forces to react to*.

“Seeing patterns” is so hard that the trap of trying to intuitively find high leverage points occurs frequently. I’ve seen it many times. When problem solvers are first exposed to the concept of high leverage points a common phenomenon transpires: they start thinking and talking about: Where are the high leverage points? Is this solution one? No, probably not. Well, what about this one? Or this one?

At that point what a person is really doing is the same thing they were doing before: creating solution strategies intuitively. They are trying to brainstorm high leverage points, which is the same as brainstorming solutions.

This behavior is misguided. High leverage points cannot be identified by intuitive hard thinking. Correct high leverage points can be found *only* by structured analysis, such as with a process like SIP. Otherwise, you will be forced to fall back on what Morgan Jones called “events and forces to react to.”

Part 2

What Cutting through the Fog of Complexity Has Found

“Exactly what does *structuring one’s analysis* mean? The word *analysis* means separating a problem into its constituent elements. Doing so reduces complex issues to their simplest terms.

“We settle for partial solutions because our minds simply can’t digest or cope with all of the intricacies of complex problems. We thus tend to oversimplify....

“If we are to solve problems, from those confined to a single individual to those affecting whole nations, we must learn how to identify and break out of restrictive mindsets and give full, serious consideration to alternative solutions. We must learn how to deal with the compulsions of the human mind that, by defeating objective analysis, close the mind to alternatives. Failure to consider alternatives fully is the most common cause of flawed or incomplete analysis.

“In other words, we must learn how to keep an open mind—one of the most difficult things we human beings can do. So any technique we can impose on the mind to force it open is helpful. It should come as no surprise, then, that *all* of the techniques presented in this book have the effect of opening the mind. The fact is, structuring one’s analysis is the quickest, surest path to opening the mind to alternatives.”

Morgan Jones, former intelligence analyst with the CIA
The Thinker’s Toolkit: 14 Powerful Techniques for Problem Solving
1998, pages xi, xii, and xiii, italics are in the original

Overview of Analysis Results

Many environmentalists believe the sustainability problem is beyond solving. It's too complex. People are too greedy and too set in their ways. If the world was capable of solving the problem, it would have solved it by now, especially the climate change crisis.

I believe otherwise, and have invested the last fifteen years of my life into helping to find a better way forward. The message of this book is that the sustainability problem *can* be solved, with the right tools. This chapter begins description of what those tools have found. Remote canyons have been explored. Fossils have been unearthed. An entire skeleton has been assembled that has remarkable properties.

Part 1 described the need for a process that fits the problem and a process that does fit, the System Improvement Process (SIP). Part 2 begins documenting the details of what was found by applying SIP to the environmental sustainability problem.

To my knowledge, this is the first comprehensive root cause analysis of the environmental sustainability problem as a global whole. *The main conclusions are that the problem appears to be solvable and may be solved relatively quickly, by pushing on certain high leverage points that have not been pushed on before by solutions in a focused large-scale manner.*

This is good news but an extraordinary claim, so I have been over and over the analysis. Particularly with the assistance of Philip Bangerter, I've pored over every step of the analysis many times, trying to verify each conclusion. Does it agree with observed system behavior? Does it fill its slot in the social force diagram well? Does it make logical and practical sense? What's missing? Where is the overall analysis weak? Where might the process be leading us astray? And so on.

But the biggest questions were at a higher level. How well does the overall analysis explain several debilitating anomalies that the present problem solving paradigm cannot? The analysis comes out quite well here, as I will now briefly summarize. Recall that Thomas Kuhn defined an **anomaly** as a violation of "paradigm-induced expectations that govern normal science."

Anomalies the analysis results can explain

1. Why have conventional solutions failed to solve the environmental sustainability problem for over forty years?

Because those solutions pushed on low leverage points. The SIP analysis decomposed the one big problem into four subproblems using social force diagrams. Reviewing the history of environmentalism up to the present, I was able to assign *all*

solutions to one of the four subproblems. Nearly all solutions, which I'd estimate to be over 95%, were superficial solutions. The other 5% were only vaguely fundamental, since the root causes are unknown. In other words, no solutions were explicitly designed to push on specific well-analyzed root causes. *For example, when was the last time you encountered an environmental sustainability solution that described in persuasive cause-and-effect detail what root cause it was designed to resolve?* Your answer is probably the same as mine. Never.

To me this is *the* smoking gun of the analysis. It so clearly explains why the world continues on a trajectory of environmental collapse, despite the best efforts of millions of scholars, activists, NGOs, agencies, and politicians.

2. Why has maximum economic growth become the dominant imperative of our time, for both developing and developed nations, when it is so obviously environmentally self-destructive?

Because the implicit goal of the human system has become one that supports the maximum amount of economic growth possible. Why? Because of the unresolved main root cause of the sustainability problem.

The dominant life form in the human system has become *Corporatis profitis*, the modern large for-profit corporation. An important principle of social system behavior states that over time, the goal of the dominant agent in a social system becomes the goal of the system. The goal of *Corporatis profitis* is maximization of short term profit. Applying the principle, this goal has become the implicit goal of the human system. This wrong goal is the **main root cause** of the sustainability problem. Pursuit of this goal causes maximum economic growth, because that maximizes sales and hence profits. This insight explains so much.

3. Why do so many citizens want to maximize personal wealth rather than quality of life or anything else?

Because that behavior supports the implicit goal of the human system, as described above. The richer citizens are, either in income or wealth, the more profit *Corporatis profitis* makes because the more it sells.

4. Why do so many difficult large-scale social problems persist, like environmental sustainability, recurring large recessions, war, excessive inequality of wealth, and large-scale poverty, when clear solutions to all these problems exist?

Because these problems are all side effects of the unresolved main root cause. While solving these problems would benefit the common good, not solving them benefits the goal of *Corporatis profitis* because not solving them is more profitable in the short term.

In the short term, sustainable practices cost more than unsustainable. Large recessions could be avoided, but that would reduce the high profits of periods of high growth and would reduce average growth. Preparation for war, and occasional war itself, is immensely profitable.

The chief ally of *Corporatis profitis* is the rich, because as corporate stockholders they receive a portion of profits. The richer the rich are compared to the rest, the more powerful they are. Excessive income inequality is thus highly advantageous to corporations. An unfortunate side effect is the tendency toward surprisingly large amounts of relative poverty in developed nations, and the low priority developed nations give to the absolute poverty problems of developing nations. Here “developed” means a nation’s dominant life form is *Corporatis profitis*.

These are powerful, incisive explanations for some of the world’s most critical phenomenon. No other theory we know of can explain these anomalies as well. This includes the work of economists, environmentalists, political scientists, sociologists, and others. None offer a cohesive theory of why these anomalies occur.

The theory this book presents is not only *explanatory*. It is also *predictive*, in the form of predicting how the system will respond when solution elements are used to push on high leverage points. Why can’t other paradigms be deeply explanatory and predictive? Because other approaches to large-scale public interest problems do not employ a process that fits the problem.

Problem definition

(This section gets a little complicated. You can safely skip it.)

In order to give a proper overview of analysis results, let’s begin with the first main step of SIP. This is Problem Definition. The standard problem definition format is *Move system A under constraints B from present state C to goal state D by deadline E with confidence level F*. Plugging the problem into the format leads to this problem definition for the global environmental sustainability problem:

The *system* is the biosphere. Since this is a global life or death problem of the utmost importance, the only *constraints* are the limits of system behavior and the imagination and skills of problem solvers. In the *present state* many critical environmental properties (levels of pollution and depletion of natural resources) are outside their “safe zones.” In the *goal state* all critical environmental properties are being held in their safe zones or are moving there within a predictably safe time span, none of which should exceed an overall *deadline* of 100 years. Some time spans will be well under 100 years, since some problems (like climate change) need to be solved sooner than others. The total *confidence level* for all properties meeting their deadlines shall be at least 99.9999% over the next 10,000 years.

While this is a complex problem definition, it's also a tight, unambiguous, measurable one. Compare it to the **Brundtland definition** of sustainability, from the Brundtland Report of 1987: ³⁴

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

The drawback to Brundtland definition is it's more inspirational than practical. It's not precise and measurable, so no one can agree on what it means. This caused the definition to be plagued by controversy from the day it was published. The definition has also fallen into the trap of scope creep by including solving the global poverty problem. (This and the promise of development were included to bring undeveloped countries on board. Otherwise they were against solving what they perceived to be a problem created by developed countries.³⁵)

Should poverty really receive “overriding priority” over environmental sustainability? No, because if the environmental sustainability problem isn't solved, then no other problem will matter due to catastrophic collapse. If the poverty problem is not solved, the world changes little. The poverty problem has existed for as long as *Homo sapiens* has. It's nothing new. But the global environmental sustainability problem is new and threatens existence of our species. That's why it deserves top priority. Thus, the Brundtland definition is too flawed to use.

The confidence level of 99.9999% over the next 10,000 years was chosen to allow the solution to last for at least one million years. The reign of dinosaurs lasted 160 million years. *Homo sapiens* appeared about 200,000 years ago, so shouldn't we strive for at least one million more years? A 99.9999% confidence level over 10,000 years would be what confidence level over a million years? $1,000,000 / 10,000 = 100$, so there are 100 ten thousand year periods in a million years. To calculate the confidence level over one million years, multiply 99.9999% times itself 100 times. This equals 99.99%, which is fine. Suppose we wanted to last half as long as the dinosaurs, 80 million years. Then we get a confidence level of only 99.2%.

Suppose we had used 99.9% instead of 99.9999%. Then we would get only a 90% chance of the solution working for one million years and an appalling .02% chance of working for 80 million years. This explains why we specified a confidence level of 99.9999% for a 10,000 year period, which is not as impossible as it may seem. Many companies have routinely achieved quality success levels of 99.9999% by the use of the quality control process of Six Sigma.

Note how the sample problem definition is so noncontroversial as to be almost dull. It includes no social factors. It says nothing about development. All it says is what state must be achieved to consider the problem solved.

Who sets the safe zones and deadlines? What are the critical environmental properties? How can we do this fairly? These and other questions are all part of the problem to solve. Healthy well running democratic governments can answer these questions. If solution of the sustainability problem is correct and complete, one beneficial “side effect” will be healthy governments because they are no longer controlled by corrupting special interests. This important point is addressed later in the chapter describing analysis results for the How to avoid excessive model drift subproblem.

Problem decomposition

The second main step of SIP is Analysis. The first step of Analysis is to decompose the one big problem into the subproblems that shine the brightest light on the root causes. The three standard subproblems were used, plus a second proper coupling subproblem. The result was these four subproblems:

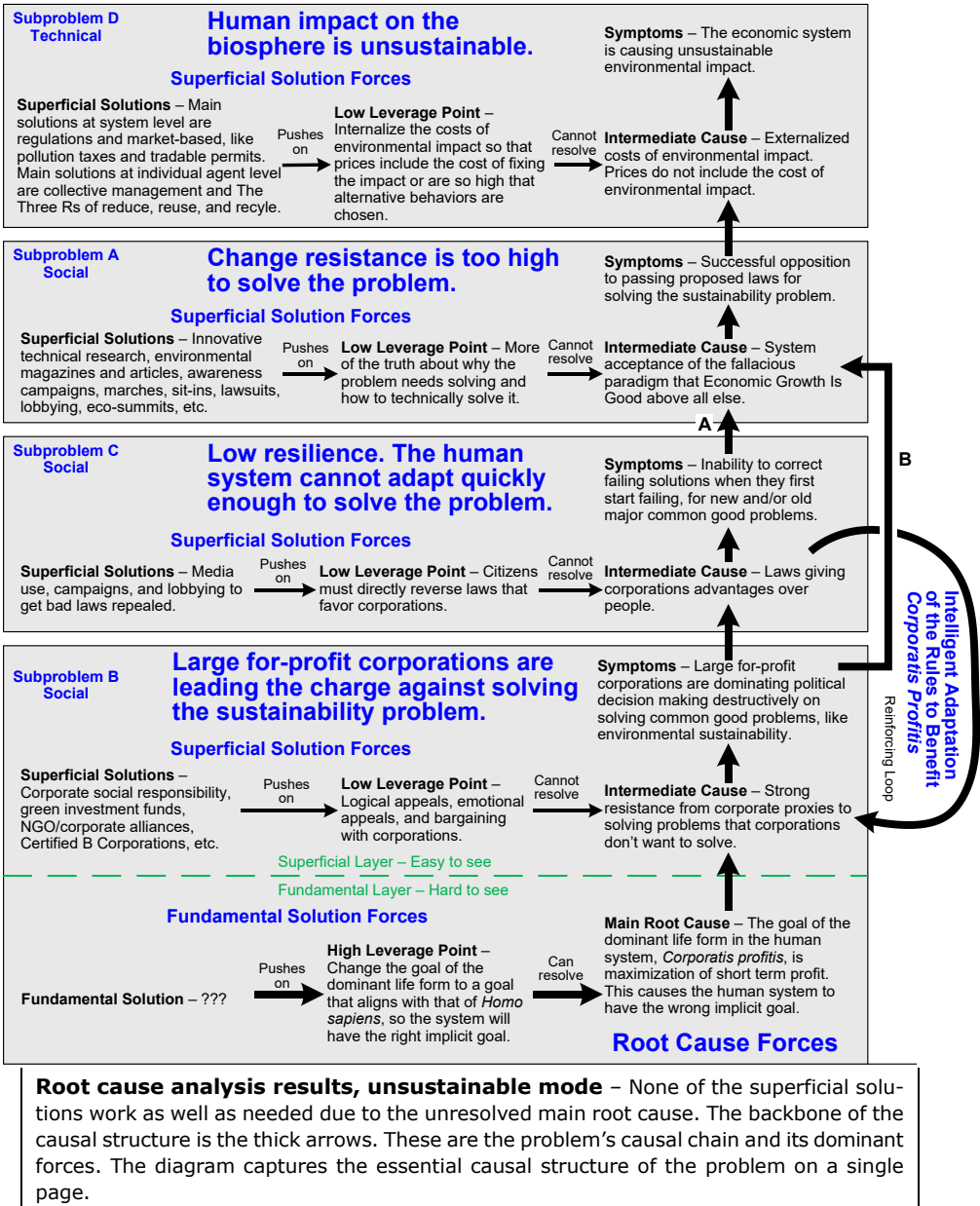
- A. How to overcome change resistance
- B. How to achieve life form proper coupling
- C. How to avoid excessive model drift
- D. How to achieve environmental proper coupling

“Life form proper coupling” refers to fact that the top two dominant life forms in the human system, *Corporatis profitis* and *Homo sapiens*, are presently improperly coupled. *Corporatis profitis*, the modern large for-profit corporation, is dominating political decision making destructively on the environmental sustainability problem. *Homo sapiens* (better known as people) wants to live sustainably so as to avoid catastrophic environmental collapse. These two life forms are locked into a struggle for niche dominance. The winner can impose its goal on the human system. Presently *Corporatis profitis* is dominant, so its will prevails. This epic conflict indicates improper coupling.

“Environmental proper coupling” refers to the way the human system is improperly coupled to the greater system it lives within, the biosphere. The human economic system is causing unsustainable environmental impact.

Root cause analysis results, unsustainable mode

Forgive my enthusiasm. Now we arrive at what I personally think is a tremendously exciting diagram because it says so much so clearly. It’s a complete high-level model of main root cause of the sustainability problem. See the next page.



The analysis drilled down through four superficial layers until it found the main root cause, which lies in subproblem B. The other three subproblems each have their own root cause. For simplicity these are not shown. They are automatically resolved when the main root cause is resolved.

Subproblem D – Human impact of the biosphere is unsustainable

Let's summarize the diagram starting at the top. Subproblem D is the original problem to solve. It's a technical subproblem since the symptoms, physical impact on the biosphere, are technical.

Root cause analysis always starts with a problem's symptoms. These are The economic system is causing unsustainable environmental impact. WHY is this? The immediate physical cause is the PAT factors in the IPAT equation. But that's trivial well known knowledge. We are asking WHY at the systems thinking level. At that level the cause is widely assumed to be Externalized costs of environmental impact. Prices do not include the cost of environmental impact. If so, then the leverage point for resolving the cause is obvious. We must Internalize the costs of environmental impact, so that prices include the cost of fixing the impact or are so high that alternative behaviors are chosen. This has been attempted with a large number of solutions, such as regulations, market-based instruments like pollution taxes and tradable permit, and the Three Rs of reduce, reuse, recycle.

But while they have helped some, especially in local problems, these solutions have failed to solve the overall sustainability problem and are thus superficial solutions. WHY is this? What is the deeper cause of the intermediate cause? WHY are there so many externalized costs? *This is a question few problem solvers are asking, because their paradigms are not driven by root cause analysis*. Consequently, what you're about to read next differs from conventional thinking.

Subproblem A – Change resistance is too high to solve the problem

WHY are so many costs externalized? Because solutions to internalize costs are being rejected by the system. Change resistance is too high to solve the problem. This indicates subproblem A. Its symptoms are Successful opposition to passing proposed laws for solving the problem. The symptoms are social, since they deal with people and organization behavior.

The analysis has now moved to the *social side* of the problem, where the real opportunities for solving the problem lie. That's what social force diagrams were designed for. They encourage digging deeper and discovering how the behavior of social agents causes a problem, either by superficial solutions that don't work, or by deeper causes that are first not apparent. In difficult large-scale social problems the deeper causes, and especially the root causes, tend to result from the behavior of social agents.

Continuing with our Five Whys of Kaizen questions, WHY is there so much Successful opposition to passing proposed laws for solving the problem? What is the cause of high change resistance?

The analysis found the main intermediate cause is System acceptance of the fallacious paradigm that Economic Growth Is Good above all else. The worst thing that

can happen to a country, short of war, is a recession or depression. The worst global event between the two World Wars was the Great Depression of 1929. The worst global event after World War Two was the Great Recession of 2008.

Herman Daly, in *Beyond Growth*, 1996, addressed this fallacious paradigm directly. The book is one long challenge to “the conventional notion that growth is always good.” (back cover) Daly posed his own WHY question: “So why is this undisputed fact [that the economy cannot grow forever and that nothing but growth matters] ignored in the circular flow paradigm? ...[because] many economists hang on to the infinite-resources assumption in one way or another, because otherwise they would have to admit that economic growth faces limits, and that is unthinkable.” (page 34)

Environmental activists think otherwise. They know economic growth is not good above all else. How can activists convince the public of that truth? With More of the truth about why the problem needs solving and how to technically solve it. This leverage point has been pushed on with innovative technical research, though most of this is already done as part of subproblem D. The major thrust has been social solutions, ones designed to get social agents to want to change their behavior. These solutions employ elements like environmental magazines and articles, awareness campaigns, marches, sit-in, lawsuits, lobbying, eco-summits, etc. Once again these solutions are not working. They are the superficial solution forces of subproblem A.

The next question is WHY is change resistance so high? WHY has Economic Growth Is Good above all else become so universally accepted? The analysis found two causes, shown by **arrows A and B**. These lead to subproblems C and B. Let’s examine subproblem B first.

Subproblem B – Large for-profit corporations are leading the charge against solving the sustainability problem

WHY has Economic Growth Is Good above all else become so universally accepted? Who is promoting this environmentally destructive value?

If you’ve read books like George Monbiot’s *Captive State: The Corporate Takeover of Britain*, David Korten’s *When Corporations Rule the World*, Sharon Beder’s *Global Spin: The Corporate Assault on Environmentalism*, and another of Beder’s books, *Suited Themselves: How Corporations Drive the Global Agenda*, or you have followed the news and “followed the money,” the evidence is too strong to ignore. The promoter of the Economic Growth Is Good meme is the modern large for-profit corporation. While corporations provide many benefits, Large for-profit corporations are dominating political decision making destructively on solving common good problems, like environmental sustainability. These are the symptoms of the deeper problem of subproblem B. Large for-profit corporations are leading the charge against solving the sustainability problem.

WHY are these symptoms happening? Because of Strong resistance from corporate proxies to solving problems that corporations don't want to solve.

Confronted with this resistance, problem solvers have conceptualized the leverage point strategy of Logical appeals, emotional appeals, and bargaining with corporations. Many solutions, like Corporate social responsibility, green investment funds, NGO/corporate alliances, Certified B Corporations, and so on have been tried. But these solutions have failed. WHY is this? What is the deeper cause of strong resistance from corporate proxies?

This is where the analysis made a conceptual breakthrough. The resistance is so strong and so systemic it must be related to the definition of systemic. **Systemic** means “originating from the system in such a manner as to affect the behavior of most or all social agents of certain types, as opposed to originating from individual agents.” What we have here is strong resistance from the dominant social agent in the human system, *Corporatis profitis*. That life form's goal is maximization of short term profit. We know that over time, the goal of the dominant agent is a social system becomes the goal of the system. Therefore the goal of the human system has aligned with and become the goal of *Corporatis profitis*.

The effect of this goal on human system behavior is so fundamentally systemic and has no deeper worthwhile cause that we have not only found the deeper cause of strong resistance from corporate proxies. We have at last drilled down to the **main root cause** of the sustainability problem: The goal of the dominant life form in the human system, *Corporatis profitis*, is maximization of short term profit. This causes the human system to have the wrong implicit goal.

This is the wrong goal because of its opposition to the goal of *Homo sapiens*: to optimize long term quality of life for those living and their descendants. These two goals are mutually exclusive and cannot be achieved in the same system. One goal is “right” and one is “wrong.” Which is right or wrong to a particular person depends on whether they are a corporate proxy or not.

If the system has the wrong goal then the high leverage point is obvious: Change the goal of *Corporatis profitis* to a goal that aligns with that of *Homo sapiens*, so the system will have the right implicit goal. This is a clear, well defined high leverage point. It will not be hard to design a fundamental solution for pushing on this point.

Subproblem C – Low resilience. The human system cannot adapt quickly enough to solve the problem.

Next we describe subproblem C. Looking at arrow A, WHY has System acceptance of the fallacious paradigm that Economic Growth Is Good above all else persisted for so long, when it is so obviously self-destructive? Thinking at the system level, WHY has the human system allowed an intermediate cause this important to go unsolved for so long? This behavior reveals another distinct subproblem. The fact that the sustainability problem has gone unsolved for over forty years indicates ex-

cessive model drift, aka low resilience. This gives subproblem C. Due to low resilience, the human system cannot adapt quickly enough to solve the problem, which prevents solution of the intermediate cause of subproblem A.

Resilience is the ability of a social-ecological system to successfully adapt to problems of any kind. Low resilience is the same as excessive model drift.

The symptoms of low resilience are Inability to correct failing solutions when they first start failing. WHY is this? Few people even ask the question, since their attention is elsewhere. Following the mindset of root cause analysis, that there *are* deeper reasons for everything until you arrive at the root causes, the analysis found that the most productive answer, because it connects subproblem C to subproblem B, is that *Corporatis profitis* has grown so powerful he has been able to consistently pass Laws giving corporations advantages over people. Those laws are the intermediate cause of subproblem C.

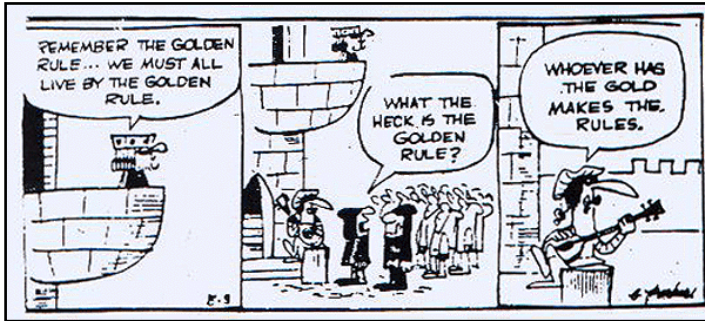
Examples of these laws are limited liability, unlimited lifespan, and personhood rights. When combined with the relative financial power of large corporations versus people, these laws bias the system toward solving problems that would benefit *Corporatis profitis*, such as the “problem” of infinite maximum economic growth. This bias neglects common good problems, leading to the symptoms of subproblem C, Inability to correct failing solutions when they first start failing, for common good problems. Solutions are best corrected when a problem is young and easier to solve. Solutions are generally much more difficult or impossible to correct later, when the problem is bigger, more systemic, and in some cases has passed system threshold points of irreversibility.

To summarize, due to the unresolved main root cause the human system is biased to low resilience for common good problems, the ones important to people. Resilience is high for uncommon good problems, the ones important to *Corporatis profitis*.

If too many laws giving corporations advantages over people exist, then the leverage point is obvious: Citizens must directly reverse laws favoring corporations. This has been attempted through the use of media (articles, books, talk show appearances, etc.), campaigns, and lobbying to get the bad laws repealed. As in the other subproblems, none of these solutions have worked.

The power and incentive to pass laws advantageous to corporations creates the **Intelligent Adaptation of the Rules to Benefit *Corporatis profitis*** feedback loop. This reinforcing loop, which has been operating for centuries, has tremendous impact. The loop works this way: The stronger the laws giving corporations advantages over people become, the stronger resistance from corporate proxies to solving problems that corporations don’t want to solve becomes. The stronger that becomes, the greater the destructive effect of large for-profit corporate domination on solving common good problems. As that dominance grows, even more laws are passed giving corporations advantages over people, and the loop starts over again.

The loop has a humorous nickname: “Whoever has the [most] gold makes the rules.”
36



This feedback loop is particularly troublesome because it causes systemic lock-in to the status quo of *Corporatis profitis* dominance. This in turn causes many common good problems to go unsolved, as well as many opportunities to go unseized. Problems like environmental sustainability, inequality of wealth, high amounts of absolute or relative poverty, avoidable large recessions like those of 1929 and 2008, racial or religious discrimination, recurring wars or severe conflict, and failed nation states fester along instead of being solved. The opportunity of the high quality of life enjoyed by most citizens of industrialized nations is an impossible dream for most other citizens, none more so than those living in the 58 failed nation states described by Paul Collier in *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*, 2007. Until the power of this feedback loop is eliminated, the human system will remain locked into its present mode of environmental, economic, and social unsustainability.

Discussion

Perhaps you'd like to perform your own investigation. Go back and take a close look at the unsustainable mode diagram. Examine the superficial solutions for all four subproblems. Now think of other solutions that have been tried in a widespread manner. Can you think of any that do not fit into these four categories?

The diagram reveals how the fog of complexity has prevented correct understanding of the causal structure of the sustainability problem. There's even an interesting pattern. Starting at the top subproblem, the further down you go, the less the solution effort. The closer you get to the main root cause, the thicker the fog. As the causal chain passes into the fundamental layer the fog thickens to the point where it has prevented clear understanding. The result is that *all* significant solution effort has been directed to low leverage points, which explains the historic pattern of repeated solution failure. We have detected no large-scale solution effort using the high leverage point shown.

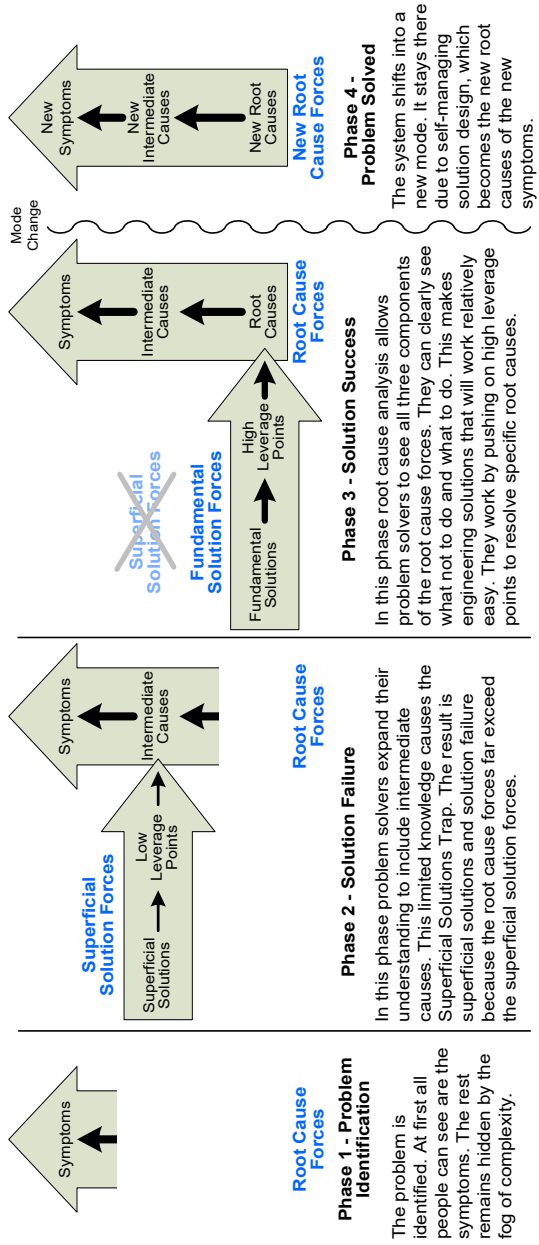
The four phase model

Social force diagrams incorporate the concept of mode change. Difficult large-scale social problems occur because a system is in the wrong mode. Solving the problem requires fundamental change that can induce the system to move the right mode. How this works is illustrated.

Over time, a difficult large-scale social problem goes through as many as four phases. A different force characterizes each phase. In phase 1 the *root cause forces* cause the undesired symptoms and lock the system into that mode. In phase 2, *superficial solution forces* lead to repeated solution failure. In phase 3, root cause analysis allows application of *fundamental solution forces*. These forces cause the system to transition to the new mode of phase 4, where the *new root cause forces* cause the desired symptoms and lock the system into the new mode.

Typically a long delay occurs in phase 2 due to the One Subproblem and Superficial Solutions Traps. Unsolved problems stay in phase two indefinitely, which is where the sustainability problem is. The challenge facing sustainability scientists is how to trigger the transition needed to move the problem from phase 2 to phase 4.

How do we know if a horrendously difficult problem, one that's been stuck in phase 2 for a long time, is solvable? The same way that business processes do. SIP determines if a problem can be solved as a normal part of process execution. A root



The four phase model of social problem solving – These are the steps difficult large-scale social problems pass through on the way to eventual solution.

cause must be resolvable. Whether this can be done is initially determined by logical analysis, including simulation and examination of past system behavior. Then the root cause hypothesis is subjected to laboratory experimentation (small groups of subjects) and real-world experimentation (pilot projects) testing as needed. Because the hypothesis is precisely defined and is part of a comprehensive analysis model, testing is focused, efficient, and quick.

Root cause analysis results, sustainable mode

The unsustainable mode diagram on page 78 shows a single main root cause and its high leverage point. A variety of solutions could push on the high leverage point. If properly designed, fundamental solutions would introduce the right new balancing feedback loops, causing transition from the present unsustainable mode to a sustainable mode to occur quickly. The unsustainable mode diagram would shift to that of the sustainable mode diagram on the next page, where the old *unfavorable* main root cause has been replaced by a new *favorable* main root cause. The fundamental causal chain (the thick arrows) has changed considerably. It now includes the technical solutions environmentalists have long promoted but were blocked from implementing. Due to the new root cause forces these solutions would now be rapidly implemented because that's in the best interests of the dominant life form in the human system, *Corporatis publicus*. In subproblem D what were superficial solutions in the previous diagram are normal solution policies in the new one. They are normal because the paradigm of how to solve the sustainability problem, sustainability science, has moved from pre-science to normal science.

Since the system now follows the right implicit goal, change resistance has largely vanished. The system is trying as hard to solve the problem as it tried to not solve it before. Thus the superficial solutions for subproblem A, high change resistance, are no longer needed. Neither are the superficial solutions for subproblem C, low resilience, since corporations no longer want laws favoring themselves over people. And neither are the superficial solutions of subproblem B, opposition from corporations, since corporations now want to do the same things people want to do.

The feedback loop that was previously driving the system to ruin has changed to a beneficial loop: **Intelligent Adaptation of the Rules to Benefit *Homo sapiens***. This loop causes a key node, strong preference from corporate proxies to solve problems that would benefit the common good, to grow stronger and stronger. The stronger this node becomes the more the entire human system focuses its effort on solving common good problems. At the top of the list sits the global environmental sustainability problem. It is a pleasant thought experiment to imagine how fast that problem would now be solved.

Subproblem D
Technical

Human impact on the biosphere is sustainable.

Symptoms – The economic system is causing sustainable environmental impact.

Normal Solution Policies – Main solutions at system level are market-based, like pollution taxes, tradable permits, and common property rights. Only minor solutions are needed at the individual agent level since we have a systemic solution.

Leverage Point – Internalize the costs of environmental impact so that prices include the cost of fixing the impact or are so high that alternative behaviors are chosen.

Intermediate Cause – Internalized costs of environmental impact. Prices now include the cost of environmental impact.

Pushes on → Causes →

Subproblem A
Social

Change resistance is low because the system wants to solve the problem.

Symptoms – Proposed laws for solving the problem are passed quickly.

Solutions – Not needed since this subproblem is solved at the fundamental level. The brick wall of change resistance has vanished.

Leverage Point – More of the truth about why the problem needs solving and how to technically solve it.

Intermediate Cause – System acceptance of the valid paradigm that Quality of Life is Good above all else.

→ →

Subproblem C
Social

High resilience. The human system adapts quickly enough to solve the problem.

Symptoms – Ability to correct failing solutions when they first start failing, for new and/or old major common good problems.

Solutions – Not needed since corporations no longer want laws favoring themselves over people.

Leverage Point – Citizens must directly pass laws that favor corporations.

Intermediate Cause – Laws giving people advantages over corporations.

→ →

Subproblem B
Social

Large non-profit corporations are leading the charge to solve the problem.

Symptoms – Large non-profit corporations are dominating political decision making constructively on solving common good problems.

Solutions – Not needed since this subproblem is solved at the fundamental level. Corporations now want to do the same things people want to do.

Leverage Point – Logical appeals, emotional appeals, and bargaining with corporations.

Intermediate Cause – Strong preference from corporate proxies to solve problems that would benefit the common good.

Superficial Layer – Easy to see
Fundamental Layer – Hard to see

Fundamental Solution – Corporation 2.0. This replaces *Corporatis profitis* with *Corporatis publicus*, a trusted servant whose goal is the long term optimization of quality life. It does this by providing its master, *Homo sapiens*, with needed goods and services.

Fundamental Solution Forces

High Leverage Point – Change the goal of the dominant life form to a goal that aligns with that of *Homo sapiens*, so the system will have the right implicit goal.

Main Root Cause – The goal of the dominant life form in the human system, *Corporatis publicus*, is to optimize long term quality of life. This causes the human system to have the right implicit goal.

New Root Cause Forces

Pushes on → Causes →

Intelligent Adaptation of the Rules to Benefit *Homo sapiens*

Reinforcing Loop

Root cause analysis results, sustainable mode – Resolution of the old *unfavorable* main root cause has led to a new *favorable* main root cause, causing solution of all four subproblems. The fundamental solution used is described in a later chapter.

Summary of Analysis Results table

Social force diagrams are a supplemental technique for the SIP matrix of page 38. Social force diagrams allow a standardized visual approach to building the main information required in the Analysis step for each subproblem. What has been presented so far is a partial version of what's in the matrix. The completed matrix for Thwink.org's analysis of the sustainability problem is shown on the next page.

The subproblems are highly interconnected. Some share simulation models. The columns are arranged to show this sharing. Subproblems A and B share the Dueling Loops of the Political Powerplace model. Subproblems B and C share an extended version of this model.

Following the call of Occam's razor, to not multiply entities beyond necessity, we've taken the simplest approach possible in this analysis. There are only four subproblems. Each has one intermediate cause, one root cause, one low leverage point, and one high leverage point. The analysis threatened to become overly complex many times. Repeated refactoring to a simpler abstraction saved the day over and over, and kept the thwinkers at Thwink.org from losing their razor sharp mental model of the problem and calling the problem too complex to solve. That high level mental model, as far as I can tell, is crisply captured in the completed matrix, plus various social force diagrams for better visualization.

The table suggests three important conclusions:

1. These four subproblems are the main subproblems to solve.

This strategic slice right through the Gordian knot of problem complexity vastly simplifies the problem. It provides an entirely different perspective for further analysis. In my humble opinion as a systems engineer, this decomposition has changed the problem from insolvable to solvable.

2. These are the root causes that matter. It's certainly too soon to tell if they really are, since we've not done pilot testing. But all the evidence and logic points to these root causes, and particularly the main root cause in subproblem B, as being the true root causes.

3. Pushing on these high leverage points will lead to rapid solution of the problem. This conclusion leads to so much potential it's intoxicating. None of the four high leverage points have been pushed on before in a large-scale manner. This indicates that if the high leverage points are anywhere close to correct, then the sustainability problem can be rapidly solved. This is rather good news.

Summary of Analysis Results of Executing SIP on the Global Environmental Sustainability Problem						
1. Problem Definition		How to achieve global environmental sustainability in terms of the desired system goal state				
Subproblems		A. How to Overcome Change Resistance	B. How to Achieve Life Form Proper Coupling	C. How to Avoid Excessive Model Drift	D. How to Achieve Environmental Proper Coupling	
2. Analysis	A. Find immediate cause loops	Subproblem symptoms	Successful opposition to passing proposed laws for solving the environmental sustainability problem	Large for-profit corporations are dominating political decision making destructively	Inability to correct failing solutions (1) when they first start failing	The economic system is causing unsustainable environmental impact
		Improperly coupled systems	Not applicable	Corporate and human life forms	Not applicable	Economic and environment systems
		Analysis model	Basic Dueling Loops of the Political Powerplace	Complete Dueling Loops model. This adds the Alignment Growth loop.		The World's Property Management System
		Immediate cause dominant loops	The Race to the Bottom among Politicians		Intelligent Adaptation loop in evolutionary algorithm model	Industrial Growth and Limits to Growth (the IPAT factors)
	B. Find inter. causes, LLPs, SSS	Intermediate causes	System acceptance of the fallacious paradigm that Economic Growth Is Good above all else	Strong resistance from corporate proxies to solving problems that corporations don't want to solve	Laws giving corporations advantages over people	Externalized costs of environmental impact
		Low leverage points	More of the truth: identify it, promote it, magnify it	Logical and emotional appeals and bargaining	Citizens must directly reverse laws that favor corporations	Internalize costs
		Symptomatic solutions	Technical research, environmental magazines and articles, awareness campaigns, marches, sit-ins, lawsuits, lobbying, etc.	Corporate social responsibility, green investment funds, NGO/corporate alliances, etc.	Media use, campaigns, lobbying to get bad laws repealed	Main solutions at system level are regulations and market-based. At agent level main solutions are 3 Rs and collective mgt.
	C. Find the root causes of the intermediate causes	The inherent advantage of the Race to the Bottom, which causes that loop to be dominant most of the time	Mutually exclusive goals between top two social life forms, <i>Corporatis profitis & Homo sapiens</i>	A high rate of defects in the political decision-making process	High transaction costs for managing common property sustainably	
	D. Find the loops that should be dominant to resolve root cause	You Can't Fool All of the People All of the Time	Alignment Growth	A Politician Decision Making Feedback loop of some kind	Sustainability Growth and Impact Reduction	
	E. Find the high leverage points to make those loops go dominant	Raise general ability to detect political deception from low to high.	Correctness of goals for artificial life forms. These must align with the goal of <i>Homo sapiens</i> .	Raise maturity of the political decision-making process from low to high.	Allow firms to appear to lower transaction costs for managing common property sustainably.	
3. Solution Convergence		Several solution elements	Corporation 2.0, <i>Corporatis publicus</i>	Politician Decision Ratings	Common Property Rights	
4. Implementation		Not yet ready for implementation because process execution is incomplete.				

(1) to the environmental sustainability problem

An interesting property of the analysis is that *resolving any one root cause resolves them all*, IF they could be solved one at a time. Consider each subproblem:

Subproblem A – Suppose change resistance is overcome. Now the other three root causes are easily resolved, because there is no longer any systemic resistance to solving common good problems.

Subproblem B – Next, suppose correctness of goals for artificial life forms, like corporations, is achieved. Now the strongest, richest, and most intelligent life form on the planet, large corporations, would be trying as hard as it can *to* solve common good problems as it was trying to *not* solve them before. This would include resolving the other three root causes, since that would enhance problem solving efficiency.

Subproblem C – Now imagine that the root cause of How to avoid excessive model drift has been resolved. The root cause is a high rate of defects in the political decision making process. The high leverage point is raise maturity of the political decision making process from low to high. Once the root cause is resolved the quality of political decisions will go high, with a small delay. Once quality goes high, politicians will be cooperatively competing to see who can make the best decisions in order to optimize the long term common good of all. A good first step will be to resolve the other root causes.

Subproblem D – Finally, imagine the root cause of the original problem to solve is resolved. The high leverage point is Allow firms to appear to lower transaction costs for managing common property sustainably. These firms, called stewards in the sample solution, would be responsible for managing common property of any type. They would start with environmental common property, like watersheds, natural resources, and pollution sinks. Due to self-replicating solution design stewards would quickly cover the planet and solve the environmental sustainability problem.

Before long, environmental stewardship would be the largest industry on the planet. Stewards, who are non-profit to avoid conflict of interest, would be setting a stellar example of what's possible if corporations have the right goal. That example, combined with encouragement from the stewardship industry, would lead to mass recognition that the root cause of subproblem B must be resolved. Otherwise Space-ship Earth faces too much long term risk on its long journey into and beyond the Age of Sustainability. This recognition would lead to resolving the root cause of subproblem B, which cascades into resolving the root causes of subproblems A and C.

This completes the overview of analysis results. The next four chapters present analysis details for each subproblem. As you read, note how the decomposition chosen makes correct analysis *so* much easier. Gone is the suffocating fog of complexity. In its place is a clear view of the fundamental layer of the problem. This view opens up a whole new frontier of what I believe are *realistic* possibilities for solving the sus-

tainability problem soon, in a matter of decades, because a vital knowledge gap has been filled. We now know the root causes.

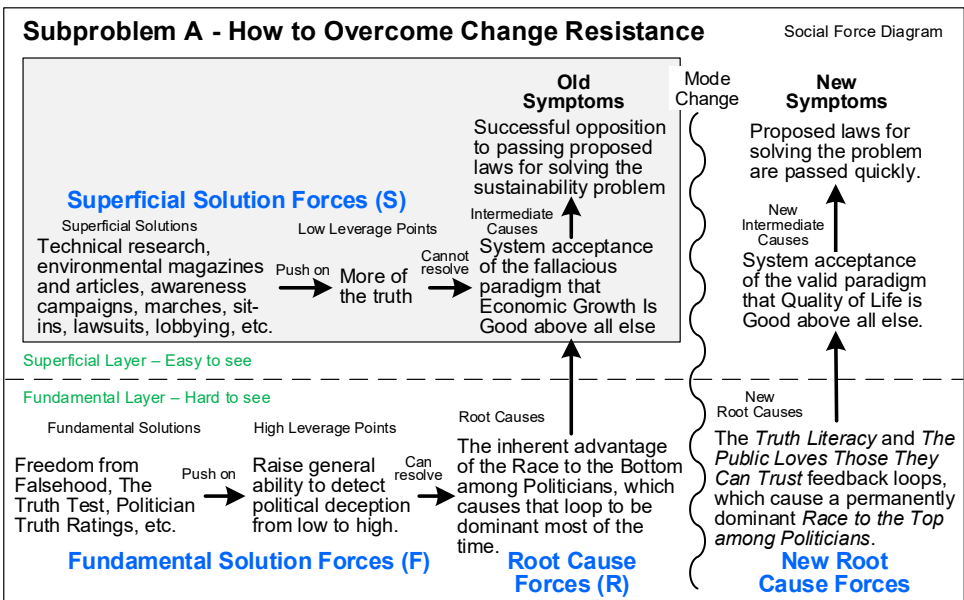
Chapter 5

Subproblem A How to Overcome Change Resistance

The crux of a difficult social problem is almost always how to overcome system change resistance. Once that's overcome the system will "want" to change. It will now eagerly accept the same solutions it was so vigorously resisting before. Therefore analysis must begin with change resistance and give it the greatest attention of all the subproblems. That strategy has caused this chapter to be the longest one in the book, because it has the most to say about what was found when instead of attempting the impossible task of climbing Mount Sustainability, we tunneled through it.

Inside the mountain was a feedback loop structure so simple and elegant it still makes me nod my head in silent respect, many years later as I write this chapter. Once the key loops were identified it was not hard to build a simple model, something to get started with. And then it was not hard to add the details needed to take SIP's Analysis step to its logical conclusions, though this took years because SIP itself was also undergoing construction. With slow cautious digging the model reluctantly emerged. It was a heady time when the full model, and not the little pieces, finally snapped into life with the first few simulation runs that made sense and suddenly explained so much. A flock of WHY questions now had solid answers.

The model is *The Dueling Loops of the Political Powerplace*. What the Analysis and Solution Convergence steps found using the model is summarized below.



To me the most striking feature of the diagram is how totally different it is from conventional thinking. All environmentalists can currently see is what's in the gray box. Their thinking, and thus their solutions, is trapped on the superficial layer. This makes overcoming change resistance an impossible problem to solve.

But there is a way forward. This chapter patiently builds the Dueling Loops model one step at a time by drilling down from the old symptoms to the intermediate cause, and on to the root cause and its high leverage point. A later chapter then performs the Solution Convergence step to find the fundamental solutions and fill in the right side of the social force diagram, which shows the new root cause forces.

Another striking feature of the diagram is its reliance on feedback loops to explain the fundamental layer. The root cause cannot be identified without identifying *The Race to the Bottom among Politicians* loop. Resolving the root cause requires strengthening two existing feedback loops, *Truth Literacy Promotion* and *The Public Loves Those They Can Trust*, and understanding *The Race to the Top among Politicians*. These are deep insights with powerful implications. The biggest, I would like to think, is that understanding a system's key feedback loops at the root cause level allows solving *any* difficult large-scale social problem, if the problem is solvable.

In order to do that, let's review the analysis model for this subproblem.

The Dueling Loops of the Political Powerplace

This consists of two feedback loops dueling for control of a political powerplace. One loop, **The Race to the Bottom among Politicians**, battles it out against **The Race to the Top among Politicians**. It's a simple model with two main loops.

Here's the real insight the analysis unearthed. The Race to the Bottom contains an easily exploited inherent advantage. This causes that loop to be the dominant loop most of the time in politics, as it is now in most countries. As long as The Race to the Bottom remains dominant, resistance to solving public interest problems like sustainability will remain stubbornly high. This is a dire situation. Unbeknownst to most, the world's political systems are wrapped in what amounts to iron chains dragging these systems down a long slow slide to environmental collapse, since these systems are currently *inherently* incapable of solving the sustainability problem.

Fortunately the analysis also discovered a nugget of good news. The Dueling Loops model contains a promising high leverage point that has *never* been pushed on before with focused large-scale solutions. If problem solvers can see what we've seen—how the model works and why this is such an advantageous leverage point—they might very well unite and push on the high leverage point with proper solutions. Once they start doing that, the model makes a remarkable prediction: The political powerplace will flip from a dominant Race to the Bottom to a dominant Race to the Top, which will lead to quick solution of the sustainability problem.

Back in 2004 I was using pencil and paper to sketch possible feedback loop structures. All of a sudden one loop started to answer more WHY questions than anything I'd tried before. Shifting nodes and arrows around, it answered even more. That loop became the Race to the Bottom. The rest of the model grew from that loop, so let's begin there.

The Race to the Bottom

There are two feedback loops in the human system that, in the large, affect citizen's lives more than anything else. They are the loops that politicians use to gain supporters.

Over time, social evolution has pared the many strategies available for gaining political support into just two main types: the use of truth (**virtue**) and the use of falsehood and favoritism (**corruption**). For example, a virtuous politician may gain supporters by stating, "I know we can't balance the budget any time soon, but I will form a panel of experts to determine what the best we can do is." Meanwhile, a corrupt politician is garnering supporters by saying, "Economics is easy. You just put a firm hand on the tiller and go where you want to go. I can balance the budget in four years, despite what the experts are saying. They are just pundits. Don't listen to them. A vote for me is a vote for a better future." The corrupt politician is also saying to numerous special interest groups, "Yes, I can do that for you. No problem." Guess who will usually win?

The use of corruption to gain supporters is the dominant loop in politics today. **Corruption**, as the analysis defines it, consists of falsehood and favoritism. Most politicians use rhetoric, half truths, glittering generalities, the sin of omission, biased framing, outright lies, and many other types of falsehood to make themselves look as appealing as possible to the greatest number of people possible.

Particularly when an election is drawing near, most politicians use the *ad hominem* fallacy to attack and demonize their opponents. An **ad hominem** (Latin for against the man) fallacy is an attack on a person's character rather than the positions he or she supports. The attacker attempts to change the subject from what really matters to what matters far less or not at all.

For example, the use of the Swift boat ads in the 2004 US presidential campaign to attack John Kerry's character were an *ad hominem* fallacy, because they had nothing to do with Kerry's political reasoning or positions. Other terms for the *ad hominem* fallacy are demagoguery, shooting the messenger, negative campaigning, smear tactics, and sliming your opponent. Finally, once in office nearly all politicians engage in acts of favoritism, also known as patronage. Bribery also plays a role in corruption, but this is illegal and so is not included in the analysis.

Politicians are forced to use corruption to gain supporters because if they do not they will lose out to those who do. This causes **The Race to the Bottom among Politicians** to appear.

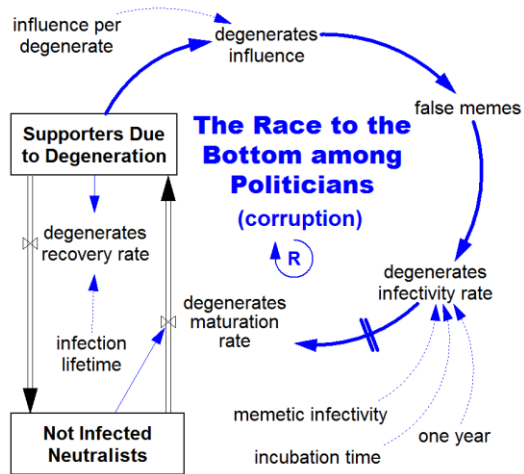
The model uses the concept of memes. A **meme** is copied information capable of affecting behavior. All memes are learned from others, either directly from other people or indirectly through a transmission medium, such as books or television. All words, unless you made one up yourself, are memes. All learned values, such as “trustworthiness is good,” are memes. Reading, writing, and arithmetic, because we learned them from others, are gigantic sets of interrelated memes. Thus the entire foundation of all fields of traditional knowledge, such as biology, physics, and mathematics, are memes.

To understand how the Race to the Bottom works, let’s start at false memes. Rather than show the falsehood and favoritism that corruption relies on, the model is simplified. It shows only falsehood.

The more false memes transmitted, the greater the degenerates infectivity rate. The model treats arrival of a meme the same way the body treats the arrival of a virus: it causes infection. After the “mind virus” incubates for a period of time (a *delay*), the infection becomes so strong that maturation occurs. This increases the degenerates maturation rate, which causes supporters to move from the pool of Not Infected Neutralists to the pool of Supporters Due to Degeneration as they become committed to the false memes they are now infected with. Supporters Due to Degeneration times influence per degenerate equals degenerates influence. The more influence a degenerate politician has, the more false memes they can transmit, and the loop starts over again. As it goes around and around, each node increases in quantity, often to horrific levels. The loop stops growing when most supporters are committed.

A **degenerate** is someone who has fallen from the norm. They have degenerated. The loop explains why this occurs so easily. The term is not meant as a pejorative label, but rather as a hopefully temporary fall from virtue. The term equates to Jeremy Bentham’s “sinister interest,” which plays a key role in his analysis of politi-

Structure of the Race to the Bottom



The loop grows in strength by using corruption in the form of highly appealing falsehood and favoritism. This increases the number of supporters of corrupt politicians, which increases their influence, which in turn increases their power to peddle still more falsehood and favoritism. Over time the loop can grow to tragically high levels.

cal fallacies. “By a **sinister interest**, we mean an interest attaching to an individual or class, incompatible with the interests of the community... we call an interest confined to himself *sinister*, when it operates in a direction contrary to those which attach to him as a member of the community.”³⁷

The dynamic behavior of the loop is shown in the graph. The behavior is quite simple because the model has only a single main loop.

Corrupt politicians exploit the power of the Race to the Bottom by broadcasting as much falsehood and favoritism as possible to potential supporters. This is done with speeches, interviews, articles, books, jobs, lucrative contracts, special considerations in legislation, etc. The lies and favors are a cunning blend of whatever it takes to gain supporters. *The end justifies the means*. The more influence a politician has, the more falsehood they can afford to broadcast, and the greater the amount of favoritism they can plausibly promise and deliver.

This is the loop that is driving politics to extremes of falsehood and favoritism in far too many areas of the world. This loop is the structural cause behind most of the corruption and bad decisions in government today.

Deception is the act of propagating a belief that is false. The Race to the Bottom employs a dazzling array of deception strategies. These are usually combined to increase their power. The five main types of deception strategies are:

Deception Type 1: False promise

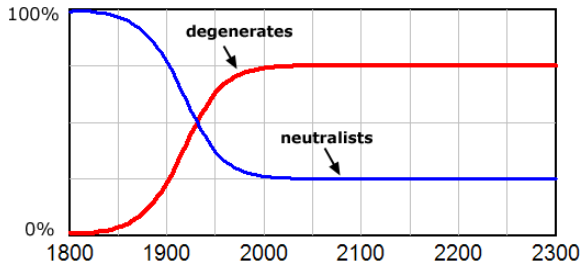
Deception Type 1: False promise

A **false promise** is a promise that is made but never delivered or never delivered fully. False promises are widely used to win and keep the support of various segments of the population, such as organized special interest groups, industries, and demographic groups. False promises flow like wine during election season.

One of the largest false promises in recent history was the way Russian communism promised one thing but delivered another. It promised rule by the masses for the masses but delivered a totalitarian state. To justify its continued existence and hide the broken promise, the communist system manufactured a steady stream of soothing lies and used harsh repressive techniques on those who did not swallow the lies.

Near the end of the collapse of Russian communism, Václav Havel, writing in 1978 in *Versuch, in der Wahrheit zu leben* (An Attempt to Live in Truth) pointed out

Run 1. The Race to the Bottom among Politicians



The run starts with 1 degenerate and 99 neutralists. Over time the percentage of degenerates grows to 75% and stops. What keeps it from growing to 100% is the way degenerates can recover from their infection, after a degenerates infection lifetime of 20 years.

the diabolical, self-destructive nature of the communist approach. It was the ultimate vicious cycle because:

...it turned victims into accomplices: by threatening them and their descendants with disadvantages, it coerces the victims to participate. When Havel became President [of Czechoslovakia in 1989] he reminded his fellow citizens of their complicity arising from their coming to terms with life in lying. Consequently, he exhorted them... to vote for candidates who 'are used to telling the truth and do not wear a different shirt every week'.³⁸

Civilization has a learning problem. *It does not seem to learn from its mistakes, even when they are pointed out.* It has not learned the lesson that false promises work so well to destroy lives *en masse* that their effectiveness must be eliminated somehow. This is nothing new, however. We have been warned before. Long ago in the 14th century Machiavelli explained why false promises are so rampant with *The Prince*, in the chapter on “*How Princes Should Honor Their Word:*”

Everyone knows how praiseworthy it is for a prince to honor his word and to be straightforward rather than crafty in his dealings; nonetheless contemporary experience shows that princes who have achieved great things have been those who have given their word lightly, who have known how to trick men with their cunning, and who, in the end, have overcome those abiding by honest principles. ...it follows that a prudent ruler cannot, and must not, honor his word when it places him at a disadvantage and when the reasons for which he made his promise no longer exist. ... Everyone sees what you appear to be, few experience what you really are.

Deception Type 2: False enemy

A **false enemy** is something that appears to be a significant threat but is not. Creating a false enemy works because it evokes the instinctual fight or flight syndrome. The brain simply cannot resist becoming aroused when confronted with a possible enemy.

The two main types of false enemies are *false internal opponents*, such as negative campaigning, the Salem witch trials, McCarthyism, and homophobia, and *false external opponents*, such as the “threat” of communism and the second Iraq “war.” While communism and Iraq were true problems, both were trumped up enormously to serve the role of a false enemy. False enemies are often scapegoats. A **scapegoat** is someone who is blamed for misfortune, usually as a way of distracting attention from the real causes or more important issues. Name-calling, the straw man fallacy, the biased sample, the irrelevant premise, and dozens of other types of fallacies are used to create false internal enemies. Many of these are combined with the *ad hominem* attack.

When it comes to creating false internal enemies, the winning strategy is to *attack early and attack often*. This becomes doubly successful when those attacked are politicians in the opposing party: (1) The fight or flight instinct is evoked, which clouds the judgment and causes people to want a strong militaristic leader to lead them out of harm's way. The attacker proves his militaristic capability by the viciousness of his attack, causing those witnessing the attack to frequently swing their support to him. (2) Attacks cause the attacker's own supporters to fervently support him even more, because he has just pointed out why the opposition is so bad.

This form of deception works so well that attack politics has become *the* central strategy for many degenerate parties. Look around. Are there any political parties whose outstanding trait is they are essentially one gigantic ruthless attack machine?

Deception Type 3: Pushing the fear hot button

When a politician talks about almost everything in terms of terrorism, or communism, or crime, or threats to “national security” or “our way of life,” and so on, that politician is pushing the fear hot button. It's very easy to push. Just use a few of the right trigger words, throw in a dash of plausibility, and the subconsciousness is automatically hoodwinked into a state of fear, or at least into wondering if there is something out there *to* fear. Whether or not an enemy actually *is* out there doesn't matter—what matters is that we think there *might* be one.

Fear clouds the judgment, making it all the harder to discern whether there really is an enemy out there. Because we cannot be sure, we play it safe and assume there is at least some risk. Since people are risk averse, the ploy works and we become believers. We have been influenced by statements of what *might* be lurking out there. Our fear hot button has been pushed and it worked.

How effective fear can be is echoed in this quote:

Fearful people are more dependent, more easily manipulated and controlled, more susceptible to deceptively simple, strong, tough measures and hard-line postures,” [Gerbner] testified before a congressional subcommittee on communications in 1981. “They may accept and even welcome repression if it promises to relieve their insecurities. That is the deeper problem of violence-laden television.³⁹

That was 1981. Today, little has changed. Al Gore, writing in *The Assault on Reason* in 2007, included an entire chapter on *The Politics of Fear*. It may as well have been called *The Politics of Pushing the Fear Hot Button*. Below are some excerpts: (Italics and comments added)

Fear is the most powerful enemy of reason. Both fear and reason are essential to human survival, but the relationship between them is unbalanced. Reason may sometimes dissipate fear, but fear frequently shuts down reason. As Edmond Burke wrote in England twenty years before the American

Revolution, “No passion so effectually robs the mind of all its powers of acting and reasoning as fear.”

Our Founders had a healthy respect for the threat fear poses to reason. They knew that, under the right circumstances, fear can trigger the temptation to *surrender freedom to a demagogue promising strength and security in return*. [This is an example of a false promise.] They worried that when fear displaces reason, the result is often irrational hatred [which creates a false enemy] and division.

Nations succeed or fail and define their essential character by the way they challenge the unknown and cope with fear. And much depends on the quality of their leadership. If leaders *exploit public fears to herd people in directions they might not otherwise choose*, [which is why they push the fear hot button] then fear itself can quickly become a self-perpetuating and free-wheeling force that drains national will and weakens national character, *diverting attention from real threats....* [A wrong priority]

It is well documented that *humans are especially fearful of threats that can be easily pictured or imagined*. For example, one study found that people are willing to spend significantly more for flight insurance that covers ‘death by terrorism’ than for flight insurance that covers ‘death by any cause.’ Now, logically, flight insurance for death by any cause would cover terrorism in addition to a number of other potential problems. But something about the buzzword *terrorism* creates a vivid impression that generates excessive fear. [Here terrorism has been used not only to push the fear hot button. It doubles as a way to create a false enemy.]

Deception Type 4: Wrong priority

A **wrong priority** is a goal that’s promoted as high priority, when in fact it should be a medium or low priority due to presence of other goals with legitimate high priorities. Wrong priorities stem from hidden agendas. A **hidden agenda** is a plan or goal a politician must conceal from the public, due to an ulterior motive.

There are many ways a hidden agenda can come about. A politician may support a certain ideology, and so bends everything to support the goals of that ideology. He may have accepted donations and/or voter support from special interests, such as corporations, and therefore must promote their agenda. Perhaps he had to cut a deal.

A politician with a hidden agenda must make the wrong priorities seem like the right ones in order to achieve what’s on the hidden agenda. How can he do this? For a corrupt politician such matters are child’s play—manipulate the public through false promises, create a false enemy, push the fear hot button hard and often, repeat the same lie over and over until it becomes “the truth,” and so forth.

The low priority that environmental sustainability receives from most governments today is rapidly becoming *the* textbook example of how devastating wrong priorities can be.

The ultimate wrong priority is the wrong societal goal. For example, the original goal of democracy in the United States was “life, liberty, and the pursuit of happiness.” That’s a quality of life goal. A similar goal was expressed in France’s *Declaration of the Rights of Man and of the Citizen*. But today society’s goal is maximization of short term profit. Proof lies in the daily stock market indexes found on the front page of many leading newspapers or business websites. Market indexes measure future anticipated profits. If the stock market goes up that’s good news. If it goes down it’s bad news. *The implicit goal is everyone should do everything they can to make the market go up.* But nowhere will you find a daily quality of life index or its equivalent. Society is marching to the beat of the wrong priority and the wrong drummer.

Wrong societal goals are the ultimate form of deception because once in place none of the other types of deception are needed anymore. The wrong goal is the new truth and any other viewpoint is by definition false.

Once the wrong goal is in place there’s no longer any need to lie because the lie is now the truth. That’s why George Orwell wrote in *Nineteen Eighty-Four*, Part Two, chapter 9, that:

All rulers in all ages have tried to impose a false view of the world upon their followers.

Deception Type 5: Secrecy

The fifth main type is actually a way to make the other four types of deception ten times as easy to achieve. **Secrecy** is hiding or withholding the truth. The power of secrecy comes from its ability to create a false impression without actually having to openly lie about anything. Secrecy makes it impossible to tell if a politician is lying because key premises cannot be tested. One type of secrecy is *the sin of omission*.

Secrecy is so important to the success of the first four types of deception that without it they would crumble into ineffective mumblings. But with secrecy they work most of the time, because there is no way for the population to tell if a politician is telling the truth or not. When you see a politician, administration, or party using much more secrecy than normal and there is no reasonable justification, you can be certain its purpose is deception.

How the types of deception are implemented

The five main types of political deception won’t work at all unless they can be implemented. The most common implementation technique is to rationalize why a

false promise is really true, why a false enemy is real, why there's a bogymen to fear, why the wrong priority is really the right priority, why secrecy is necessary when it's really not, and so on. These techniques allow degenerates to rationalize why the goal of a special interest is the same as the public interest, and thereby deceive supporters into joining the Race to the Bottom.

A **rationalization** is a falsehood supporting a pre-conceived conclusion. Clever rationalizations are usually the result of extensive testing and competition with other rationalizations, such as by testing on focus groups. All rationalizations employ well known fallacies to trick the receiver into believing a statement is true, when in fact it is false. A rationalization is a lie.

For example, the widely circulated argument that the Kyoto Protocol would not solve the climate change problem, and therefore is not worth supporting, is a clever rationalization. Of course it won't solve it, because the first round of greenhouse gas emission reductions (averaging 5.2% below 1990 levels) are only a first step. Another popular rationalization is that mandatory emission limits would harm the US economy. It is true that GDP will probably fall as lower amounts of fossil fuels, cars, trucks, and so on are consumed. But the long term harm will be much greater if nothing was done. Yet another rationalization is why should the US support the treaty if China and India are exempt? The false answer is the US should not. But the true answer is the less developed countries will be included in later phases of the treaty. It makes little sense to include them in the early phases, because they are not a major source of emissions per capita, nor have they been a major source in the past.

There are many more ways to implement the five types of deception, such as biased framing, spin, false grassroots organizations, biased "public relations," false news stories, the fallacy of "balanced news," casting doubt on the severity or urgency of a problem, wedge issues, etc. When all this starts working smoothly the forces of reason are so smothered that a population can be manipulated in any desired direction. And it never felt the mosquito bite.

The right steady drumbeat of the five types of deception creates the ultimate political weapon: lies that work on entire nations. This weapon has littered the pages of history with these gems of dark wisdom:

*Next the statesmen will invent cheap lies, putting the blame upon the nation that is attacked, and every man will be glad of those conscience-soothing falsities, and will diligently study them, and refuse to examine any refutations of them; and thus he will by and by convince himself that the war is just, and will thank God for the better sleep he enjoys after this process of grotesque self-deception. – Mark Twain, *The Mysterious Stranger*, 1910.*

The whole aim of practical politics is to keep the populace alarmed (and hence clamorous to be led to safety) by menacing it with an endless series of

hobgoblins, all of them imaginary. – H. L. Mencken, *In Defense of Women*, 1917.

A lie repeated often enough becomes the truth. – Vladimir Lenin.

It does not matter how many lies we tell, because once we have won, no one will be able to do anything about it. – Statement by Dr. Joseph Goebbels to Adolf Hitler, early 1930s, from *The Rise and Fall of the Third Reich*, by William L Shirer.

More modern history has given us this one:

The Greatest Story Ever Sold: The Decline and Fall of Truth from 9/11 to Katrina – This is the title of a 2006 book by Frank Rich. A review in the New York Times gives us a deeper look at Rich’s message:⁴⁰ *The truly cynical political operator, whether Republican or Democrat, could read this book as a manual for how to use deception, misinformation and propaganda to emasculate your enemies, subdue the news media and befuddle the public, and not as the call to arms for truth that Mr. Rich seeks to provide.*

It sounds like Machiavelli is alive and well, and working as a consultant to any government who agrees that *the ends justify the means*. Notice Rich’s intuitive realization that the “Fall of Truth” is the cause of the corruption problem currently haunting America (any many other nations) and that a “call to arms for the truth” is the cure. This leads to what Henry David Thoreau wrote in *A Week on the Concord and Merrimack Rivers*, in 1849:

It takes two to speak the truth—one to speak, and another to hear.

Which in turn leads to our own observation:

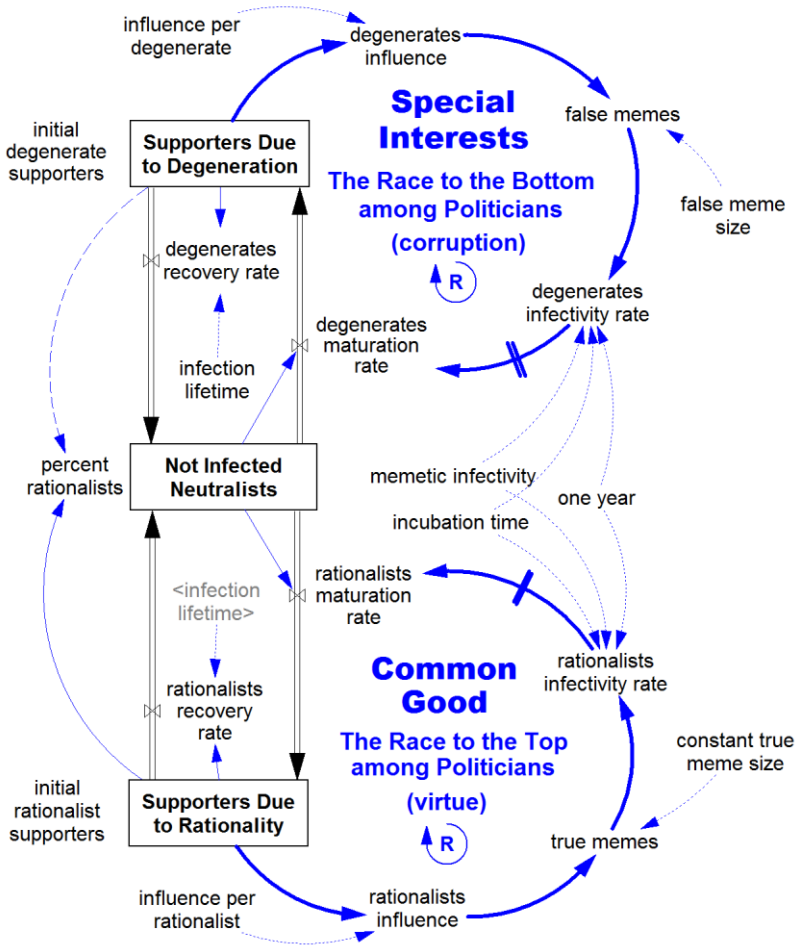
It takes two to speak the lie—one to speak, and one to be deceived.

The two opposing loops

Opposing the Race to the Bottom is the Race to the Top. The two loops are joined together as shown on the next page. Because each loop competes for the same Not Infected Neutralists, they are “Dueling Loops.”

In the Race to the Top virtuous politicians compete for supporters on the basis of the truth. (On the model this is called true memes.) No favoritism is used, because those who tell the truth treat everyone equitably. Virtuous politicians can help improve things so that society benefits as a whole, but they cannot promise or give anyone more than their fair share.

The Two Opposing Loops of the Dueling Loops



There are many variations. This general structure, combined with agent selfishness, is the fundamental cause behind the behavior of all political systems, both ancient and modern. In particular this structure explains why corruption is what dominates politics, no matter how hard society tries to stamp it out. But once the structure is deeply understood it becomes possible to arrive at a way to eliminate corruption indefinitely. This is required to achieve sustainability of any kind, because **sustainability** is defined as the ability to continue a defined behavior indefinitely.

The Race to the Top works in a similar manner to the Race to the Bottom because the two loops are entirely symmetrical, with one crucial difference: in the Race to the Top, the size of the truth cannot be inflated. Corrupt politicians can use false meme size to inflate the appeal of what they offer their supporters. But virtuous politicians cannot use falsehood to promise more than they can honestly expect to deliver. Nor can they use favoritism to inflate expectations of how well they can help particular supporters.

Why exactly do virtuous politicians feel they cannot tell lies? The goal of virtuous politicians is to optimize the common good for all, which includes those who will follow us. The common good includes *the rule of telling the truth*, because the more you can assume a person is telling the truth, the more effectively you can cooperate. Effective cooperation is the foundation upon which all social contract societies are built. Because virtuous politicians feel compelled to tell the truth, they avoid lying. They are **rationalists**, who base their arguments on the truth about what will benefit the common good the most, as opposed to **degenerates**, who base their arguments on what will benefit special interests the most. Since that will not win a majority of voters, degenerates are forced to use deception to convince enough voters to support them. They have degenerated from the norm of trustworthy, truthful behavior.

Rationalists know that if they start telling lies their society will begin to crumble. Eventually it will degrade to life in mankind’s natural state (before that of a central government based on cooperation) where, as Thomas Hobbes put it, “the life of man” was “solitary, poor, nasty, brutish, and short.”

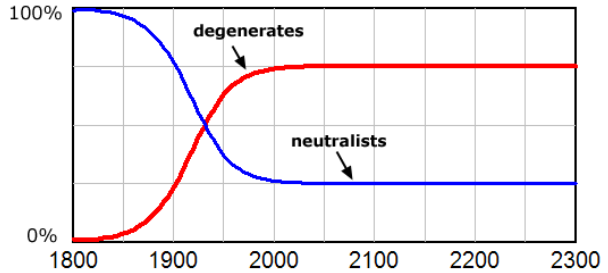
But degenerates feel no such constraint. Their goal is the uncommon good: the good of special interests. Instead of the rule of telling the truth, corrupt politicians follow *the rule of expediency*: do whatever it takes to maximize the good of the special interests supporting you. The end justifies the means. If a situation is best exploited by telling the truth, tell it. If it’s best exploited by a combination of truth and lies, then do that. This makes it impossible to trust corrupt politicians. But that doesn’t matter because if their deception is successful the public has no idea they are being exploited.

By examining how the basic dueling loops model behaves in a series of simulation runs, we can better understand why this political powerplace works the way it does. The table below lists the first six simulation runs we will examine. The first two variables (settings) are the **changeable variables**. By varying them from run to run we can try different scenarios. Each is a logical experiment. The third variable is a **result variable**. It is the outcome of a run after equilibrium is reached. Initial degenerate supporters equals 1 in all six runs.

Two Opposing Loops Model Settings	Simulation Runs					
	1	2	3	4	5	6
Initial rationalist supporters	0	1	5	1	1	1
False meme size	1	1	1	1.1	1.3	2
Results						
Percent rationalists at end of run	0%	50%	83%	20%	5%	0%

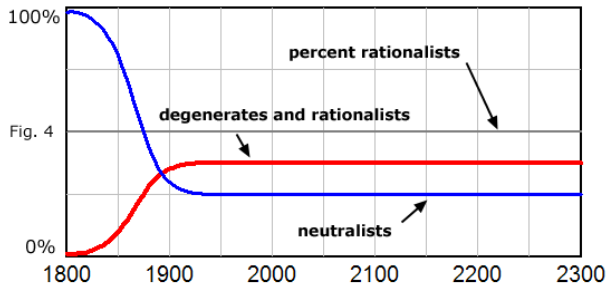
Run 1 – By setting initial rationalist supporters to zero and false meme size to 1, we get the equivalent of the Race to the Bottom loop and graph that was presented earlier on page 95.

Run 1. The Race to the Bottom among Politicians



Run 2 – In run 2 the number of initial rationalist supporters is increased to 1. Now both loops have the same number of initial supporters. Because neither loop has an advantage over the other loop, the result is both loops behave the same. Each attracts the same percentage of supporters.

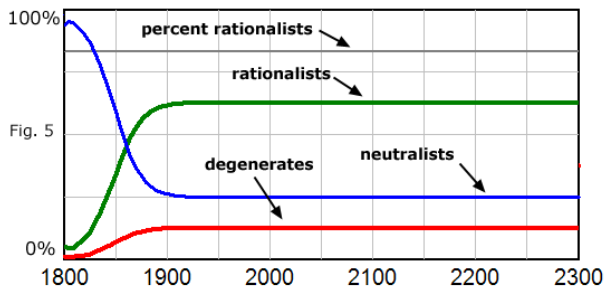
Run 2. Reference mode, no advantage



This run exhibits the most basic behavior of the dueling loops, without the whistles and bells of giving one side an advantage. Notice how in this run the percentage of degenerates and rationalists are always the same, so the degenerates’ curve covers the rationalists’ curve. Both curves will be seen in later runs. Percent rationalists is the number of rationalists divided by degenerates plus rationalists. Naturally the higher this percentage is the better. In this run percent rationalists is always 50%.

Run 3 – In this run we increase initial rationalists to 5. This shows what happens if we give one side a head start on their number of supporters. Because we have not changed false meme size, neither size has an inherent advantage. But even a small head start, if all else is equal, can quickly become a large advantage, as the results show.

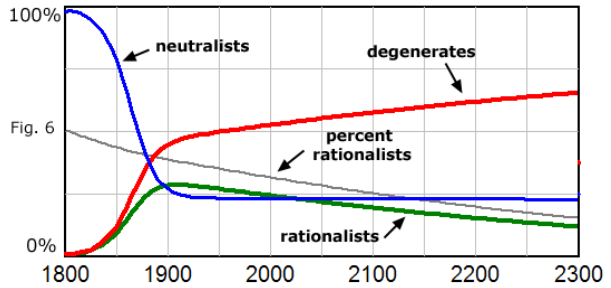
Run 3. The rationalists get a head start



Run 4 – Now things get interesting. The number of initial rationalist supporters is set back to 1 and false meme size is increased from 1 to 1.1. This is only a tiny bit bigger, by 10%. It would seem that itsy bitsy lies and favors wouldn't make much difference, but no—they make a huge difference over a long period of time. As the graph shows, the good guys get wiped out. After 500 years they are down to about 20%. After 5,000 years (not shown) they are down to 0.345879 persons, which in the real world would be zero.

Run 4 is an example of the **Principle of Accumulated Advantage**, also known as the **Mathew Effect** from the biblical parable in Matthew 25:29, “For to all those who have, more will be given, and they will have an abundance; but from those who have nothing, even what they have will be taken away.” The principle appears in the proverb “The rich get richer and the poor get poorer.” Run 4 show how when one side starts with a small advantage, if a reinforcing loop is present and there are no sufficiently strong balancing loops, the small advantage will grow into an overwhelming one.

Run 4. Even a little lie makes a big difference

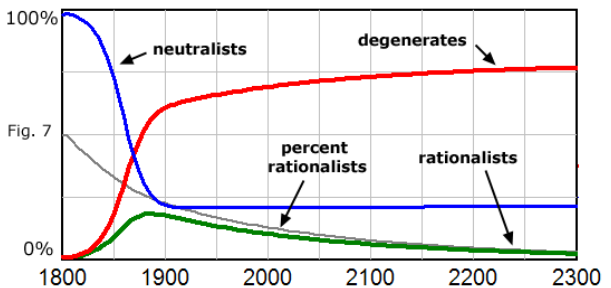


This explains why “balancing” policies like progressive income taxes are necessary. If such policies don't exist the reinforcing loop grows until one group has most or all of the advantage and the other group has little or none. This causes horrendous amounts of suffering. Eventually revolution is required to restore the balance that would optimize the common good.

In run 4 notice how slowly the lines for degenerates and rationalists diverged for the first 50 years. What might happen if the bad guys decided to tell bigger lies and give out bigger favors?

Run 5 – If false meme size is increased from 1.1 to 1.3, system behavior changes dramatically. It only takes about 30 years for the degenerates to pull away from the rationalists. Now the degenerate and rationalist lines flatten out after only 500 years, instead of the 5,000 years it took in run 4. The end result is the same. The lesson is that the bigger the lie, the faster a corrupt politician can take over a political

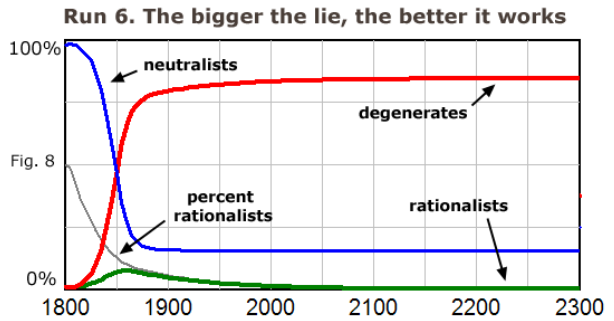
Run 5. A bigger lie makes a bigger difference



system. I wonder if that explains anything we might be seeing in politics today?

Run 6 - Finally we see what happens if a corrupt politician decides to tell real whoppers. False meme size has increased to 2. In other words, every false promise, every false enemy, and so on is now twice as big as they really are.

The results are no surprise. Now the system responds so fast the good guys never even make much of an impact on politics. They are smothered so fast by such big lies that the graph line for rationalists is starting to look like a pancake. Now, after only 500 years, there are 0% rationalists left in the system. They have been exterminated.



There is a limit to how big a lie can grow before it starts to make detection easy. Later we will add the effect of size of lie on detection variable to the model, which will impose diminishing returns on the size of a lie.

These simulation runs show how the two loops are locked in a perpetual duel for the same Not Infected Neutralists. In addition, each politician has his or her own loop, and battles against other politicians for the same supporters. These many loops and the two main loops form the backbone of the structure of the modern political powerplace. The outstanding feature of this structure is:

The inherent advantage of the Race to the Bottom

Because the size of falsehood and favoritism can be inflated, and the truth cannot, the Race to the Bottom has an inherent structural advantage over the Race to the Top. This advantage remains hidden from all but the most analytical eye.

A politician can tell a bigger lie, like budget deficits don't matter. But they cannot tell a bigger truth, such as I can balance the budget twice as well as my opponent, because once a budget is balanced, it cannot be balanced any better.⁴¹ From a mathematical perspective, the size (and hence the appeal) of a falsehood can be inflated by saying that $2 + 2 = 5$, or 7, or even 27, but the size of the truth can never be inflated by saying anything more than $2 + 2 = 4$.

The larger the "size" of a meme, the greater its average memetic infectivity. In the model a larger false meme has the effect of increasing the number of memes a person is exposed to per year. This is accomplished by assuming that a size of 2 equals 2 memes, etc. This greatly simplifies the model.

A false meme size of 1 equals one true meme. They have the same infectivity. This is because a meme size of 1 has not been inflated, so it's true.

Now then, is it true that the greater the size of a meme, the greater the infectivity? Yes, up to a point of diminishing returns. For a lie that occurs when it is so obviously false it's detected. The bigger the lie, the greater the infectivity, because the lies we are talking about here are the ones that are designed to gain supporters. The five main types of deception are false promise, false enemy, pushing the fear hot button, wrong priority and secrecy. The last really just increases the power of the other four.

Let's examine an illustrative example. The first type of deception, a false promise, clearly has more appeal (infectivity) the bigger it is. For example, suppose you are going to pay a workforce 10 Euros an hour on payday. The virtuous politician would tell them exactly that, and he cannot tell them any different. The corrupt politician would make a false promise and say he will pay them 20 Euros an hour. Guess who is going to garner the most workers?

In the above example, a false promise of 20 Euros an hour is a false meme size of 2. A false promise of 200 Euros an hour would be a size of 20, which is so big it would be detected. The workers would not believe it because the offer is absurd. If you start reducing the false promise to 12 Euros an hour, the false meme size is 1.2. If you reduce it all the way to 10 Euros an hour the false meme size is 1, and its effect is the same as a true meme because it's now the truth. The workers really will receive 10 Euros per hour when payday comes.

Let's consider an example of the second type of deception, a false enemy. A true enemy might be a robber at your door with a knife. A false enemy, say 10% bigger, would have a machete. One 100% bigger might have a gun. One 300% bigger might be ten robbers, all with guns, and they have cut your phone line so you cannot call for help. Clearly the bigger the false enemy, the more motivational (infective) the lie, if you believe it's true.

Notice how the size of the truth of a robber at your door with a knife cannot be inflated. There is nothing a truth teller can do to make that situation more motivational, without changing it. But if you lie, there is plenty you can do, without lifting a finger.

Getting closer to the ploys we see in politics, we could substitute a country for the robber and say it was about to attack your country. The bigger the false enemy, the more likely you would be to vote for the politician who has spotted it and can lead you out of harm's way. This might be a choice between a virtuous politician who says the other country has only a conventional weapons army of one million soldiers, versus a corrupt politician who claims that's not true. The other country really has nuclear bombs, in addition to the one million soldiers. If you as a citizen have no way to know who is telling the truth, then your chance of survival is maximized by preparing for the worst, by voting for the corrupt politician.

And so on for the other types of falsehoods.

Another way to explain this is lies allow corrupt politicians to offer larger expected payoffs than virtuous politicians. If you can't tell the difference between the truth and a lie, and they are mutually exclusive, then there is a 50% chance each could be true. If one politician is offering you the equivalent of a 100 Euro payoff and the other a 200 Euro payoff, it's a no brainer. You vote for the politician offering the larger payoff.

These examples should prove that false memes are more infective than true memes. The bigger the lie, the more infective it is, until it's so big it's detected. That's why people lie. A glance at history will provide many supporting examples. Too many. Once you start thinking in terms of the Dueling Loops you will see evidence of Race to the Bottom or Top strategies everywhere, and not only in politics.

Because the size of falsehood and favoritism can be inflated and the truth cannot, corrupt politicians can attract more supporters for the same amount of effort. A corrupt politician can promise more, evoke false enemies more, push the fear hot bottom more, pursue wrong priorities more, and use more favoritism than a virtuous politician can. *The result is the Race to the Bottom is normally the dominant loop.* Thus the reason that "Power corrupts, and absolute power corrupts absolutely" is not so much that power itself corrupts, but that the surest means to power requires corruption.⁴²

Due to lack of an in-depth analysis of the fundamental causes of the change resistance part of the problem, problem solvers have long been intuitively attracted to the low leverage point of pushing on "more of the truth." *On the model this point is the true memes node.* The truth is discovered by research on technical ways to live more sustainably, such as population control, alternatives to fossil fuels, and reduce, reuse, and recycle. The truth is then spread by scientific reports, popular articles, environmental magazines, lobbying, pilot projects, lawsuits to enforce the legal truth, demonstrations to shock the public into seeing the real truth, and so on. This works on problems with low change resistance, such as local pollution problems and conservation parks. But it fails on those with high change resistance, like climate change, because environmentalists simply do not have the force (wealth, numbers, and influence) necessary to make pushing on this point a viable solution.

Because of its overwhelming advantage, the Race to the Bottom is the surest way for a politician to *rise to power*, to *increase* his power, and to *stay* in power. But this is a Faustian bargain, because once a politician begins to use corruption to win, he joins an anything goes, the-end-justifies-the-means Race to the Bottom against other corrupt politicians. He can only run faster and keep winning the race by increasing his corruption. This is why the Race to the Bottom almost invariably runs to excess, and causes its own demise and collapse.

This collapse ends a cycle as old as the first two politicians. A cycle ends when corruption becomes so extreme and obvious that the people rise up, throw the bums

out, and become much harder to deceive for awhile. But as good times return, people become lax, and another cycle begins. These cycles never end because presently there is no mechanism in the human system to keep ability to detect deception permanently high.

The dueling loops structure offers a clear explanation of why environmentalists are facing such a hostile political climate. Strong opposition appears because a dominant Race to the Bottom causes corrupt politicians to work mostly for the selfish good of degenerate supporters, instead of working for the common good of the people. In other words:

The Race to the Bottom Is Easily Exploited by Special Interests

Exploitation is the use of others to increase your own competitive advantage, at the cost of theirs. Because this is so obviously self-destructive to those being exploited, deception is required to pull it off. (We are considering only voluntary exploitation and not cases like slavery.)

The Race to the Bottom provides the perfect mechanism for political exploitation, via election support of some type in return for favors. A little of this goes a long way, because each politician has his or her own loop. There are also hierarchies of loops, since a politician's supporters can be other politicians. At the top of each hierarchy is the top politician, such as a president, political strategist, or party. Whoever is at the top has tremendous leverage. *Thus the Race to the Bottom greatly amplifies the power of the exploiter.*

In stark contrast, the Race to the Top cannot be exploited. Unseemly rewards cannot flow to a truth telling politician without everyone knowing about it, because part of telling the truth is keeping no secrets and not committing the "sin of omission," a type of lie. Nor can the Race to the Top be exploited by supporters or outsiders with bribes or favoritism, because truth telling politicians would say no and if necessary report them. If they didn't, they would lose supporters because they would be committing falsehood.

Basically the Race to the Top is not exploitable because exploitation requires unjustified support, which is what the Race to the Bottom thrives on. But in the Race to the Top, all support is justified because it is based on the truth and the equitable distribution of the benefits of social cooperation.

The incentive to exploit occurs when a special interest group has interests that conflict with those of society as a whole. Common examples are religious fundamentalists, the rich, the military, and large for-profit corporations. The latter two (or is it really the latter three?) make up the infamous military industrial complex.

A corrupt politician, by accepting donations (legal bribes) and votes in return for favoritism, becomes beholden to the special interest groups involved. If a special interest is powerful enough it can control and exploit a political system by clever use of the Race to the Bottom. That's exactly what's happening today. The global politi-

cal system is by and large being exploited by *Corporatis profitis*, as analyzed in the next chapter.

The high leverage point that has not yet been tried

We have extremely good news. There is a very promising high leverage point in the human system that has not yet been tried. It is general ability to detect political deception, as shown on the revised model on the next page. Pushing there appears to give problem solvers the greatest possible chance of solving the social side of the problem, where change resistance lies.

Actually the model identifies not one but two high leverage points. Both need their present values raised to solve the problem. But as we will show in another series of simulation runs, the high leverage point of general ability to detect political deception makes the biggest difference.

The central purpose of this chapter is to convey the importance of two propositions: that The Dueling Loops of the Political Powerplace model explains why environmentalists are meeting such stiff resistance, and what the high leverage points appear to be. If we can do that, it will not be long before readers of this book explore these propositions for themselves, launch their own analyses, and begin pushing on high leverage points. Those points may or may not be the ones presented here, because this analysis is merely a first iteration.

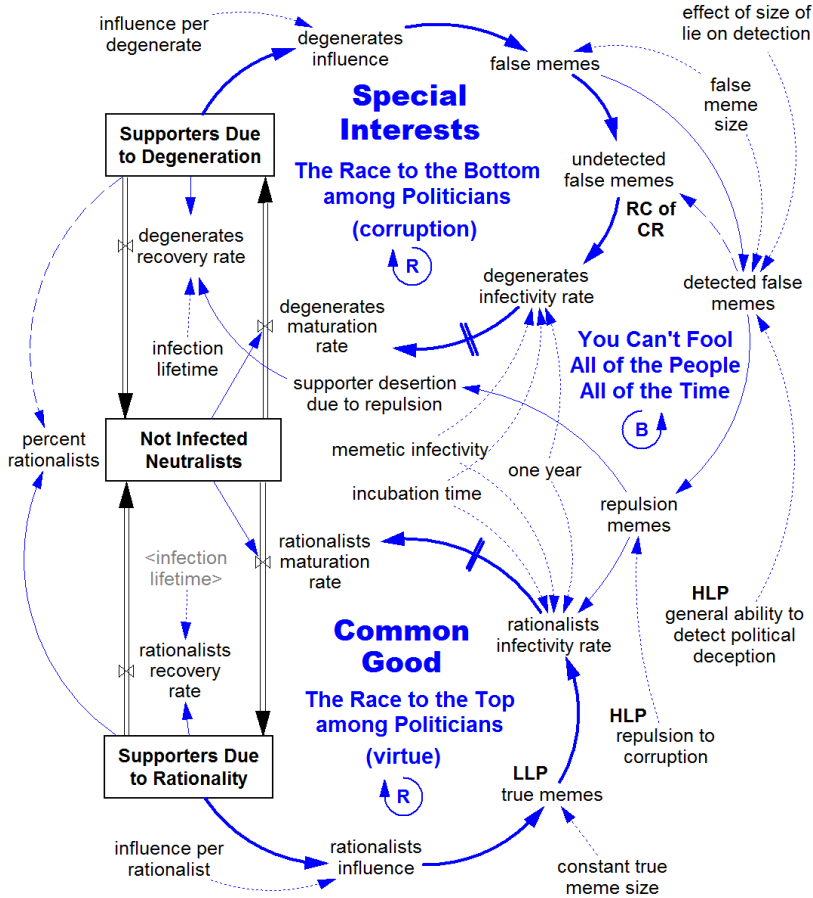
On the model a solid arrow indicates a direct relationship. The two dashed arrows show an inverse relationship. A dotted arrow is a constant or a lookup table function.

Currently general ability to detect political deception is low. The lower it is the lower detected false memes are. The lower that is, the higher undetected false memes are and the lower repulsion memes are. This causes more degenerates and fewer rationalists, which is bad news.

Currently repulsion to corruption is also low. The lower it is, the lower the rationalists infectivity rate and the lower supporter desertion due to repulsion. This is because repulsion to corruption times detected false memes equals repulsion memes. This makes sense, because detected corruption is a good reason to decide to support virtuous politicians and to desert corrupt ones.

For a system to react to deception, two steps must take place. The deception must be detected, which is handled by general ability to detect political deception times false memes equals detected false memes. Then those detected false memes must cause people to be repulsed enough by the corruption to either defect from the degenerates, which is what the supporter desertion due to repulsion variable does, or to become rationalists, which is handled by adding repulsion memes to true memes

The Basic Dueling Loops of the Political Powerplace



There are two high leverage points (HLP). The one making the most difference is general ability to detect political deception. If the model is reasonably correct then pushing there will allow us to overcome systemic change resistance to solving the sustainability problem. Currently nearly all effort is directed toward the more intuitively attractive but low leverage point (LLP) of "more of the truth," which is the true memes node. Pushing there fails because environmentalists do not have enough force to directly overcome the inherent advantage of the Race to the Bottom. They can only overcome it indirectly by pushing elsewhere on high leverage points. This will reduce undetected false memes and thereby resolve the root cause of successful change resistance (RC of CR).

to calculate the rationalists infectivity rate. In addition to this, false memes minus detected false memes equals undetected false memes, which reduces degenerate infectivity.

Let's summarize how the **You Can't Fool All of the People All of the Time** loop works, focusing on the higher leverage point. Currently the loop is weak, and thus might be more appropriately named **You Can Fool Most of the Peo-**

ple Most of the Time. The level of ability to detect deception, the size of false memes, and the effect of the size of a lie on detection determine the amount of detected false memes. Thus when ability to detect deception is low corruption works like a charm because most false memes flow through the system unimpeded. This causes undetected false memes to be high and detected false memes to be low, which strongly favors the Race to the Bottom.

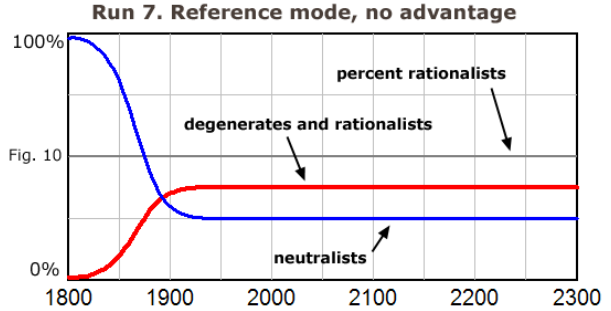
But if problem solvers can raise ability to detect deception to a high level, most false memes flow to detected false memes. This greatly decreases undetected false memes, which destroys the power of the Race to the Bottom because that’s what allows successful change resistance. At the same time this increases repulsion memes, which increases the rationalists infectivity rate and increases the degenerates recovery rate due to supporter desertion due to repulsion. The result is corruption doesn’t work anymore, which causes the Race to the Bottom to collapse as most people suddenly see the real truth and flee for their lives to the stock of Supporters Due to Rationality. This is precisely what happens when massive amounts of corruption are suddenly exposed.

It is the effect of influencing so much so strongly that makes general ability to detect political deception such a potent high leverage point.

Next let’s familiarize ourselves with how pushing on the two high leverage points affects model behavior. The table below lists the simulation runs needed to do this. In these runs the number of initial degenerate and rationalist supporters is 1.

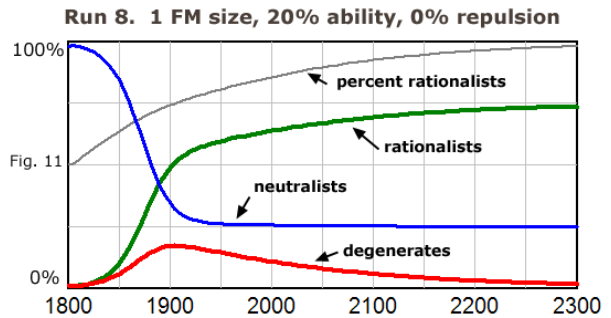
Two HLPs Model Settings	Simulation Runs							
	7	8	9	10	11	12	13	14
False meme size	1	1	4.8	4.8	2.4	2.4	3.8	4.7
Ability to detect deception	0%	20%	20%	20%	20%	20%	60%	80%
Repulsion to corruption	NA	0%	0%	20%	20%	80%	20%	20%
Results								
Percent rationalists at end of run	50%	98%	0%	41%	20%	57%	69%	100%

Run 7 – This is the same as run 2 presented earlier. The purpose of this run is to test that the revised model has the same foundational behavior. It also serves as a good starting point for further scenarios.



Run 8 – In the United States and many other countries, the general ability to detect political deception is low, somewhere around 20% or 30%. This is obvious because of the large amount of political corruption that goes undetected. Let’s try raising this high leverage point from 0% to 20% and see what happens.

Wow! Great results! Finally it’s the bad guys whose graph line is flattened like a pancake. Percent rationalists rises to 75% in 100 years and levels out at 98%. This is a dream scenario. All we’ve got to do is figure out how to make it happen.



Unfortunately, that can’t be done, because this scenario is unrealistic. There is no way corrupt politicians are going to sit by and stick to a false meme size of 1, when they know full well, from at least 200,000 years of experience, that corruption works. So let’s fix that in the next run.

Run 9 – The bad guys may be corrupt, but they are not dumb. They are usually plenty clever enough to adjust the size of lies and favoritism to be close to the right amount: not too big, and not too small. Those corrupt politicians that cannot do this will be selected out by the iron hand of evolution’s most merciless law: survival of the fittest.

To reflect the above reasoning, in this run we change false meme size from 1 to 4.8, which is the optimum that effect of size of lie on detection and supporter desertion due to repulsion will let the bad guys get away with.

The graph tells the sad story. Now it is the good guys are as flat as a pancake after a *Tyrannosaurus Conservatex* stepped on it. In this scenario the rationalists have lost the game so soon and so badly it's as if they had hardly any influence at all on the political system. But once again, is this a realistic simulation run? Not quite, because repulsion is still 0%, which is unrealistically low. Let's do another run and experiment to see what happens when we increase it.

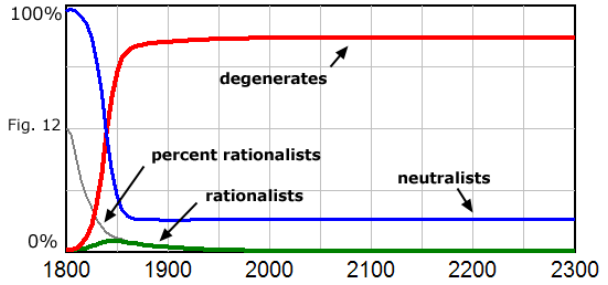
Run 10 – Now we push on the second high leverage point, repulsion to corruption, raising it from 0% to 20%. Because both high leverage points are now being pushed, things should start looking more favorable. If they don't, our understanding of the model is faulty.

The results look better but they're still not good enough. Percent rationalists tops out at 41%, which is well below what's needed for a political system to run itself well. We've got to do better.

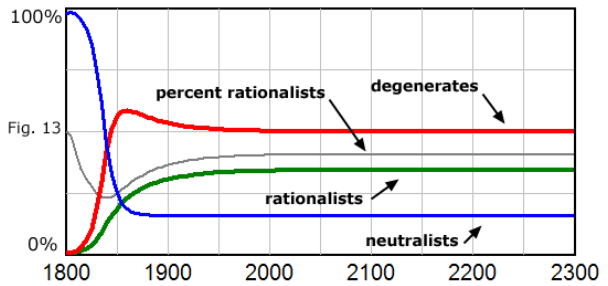
Run 11 – The smarter the agent, the faster and better it adapts to changing circumstances. We can only assume that degenerate politicians will adapt their strategy to the new circumstances of run 10. Experimentation with the model shows that the optimum false meme size for a 20% ability to detect deception and a 20% repulsion factor is 2.4. So in this run let's change false meme size to 2.4.

The results show this strategy has a substantially better outcome for the degenerates. Percent rationalists levels off at 20% instead of the 41% of run 10. In other words, the degenerates have increased their percentage

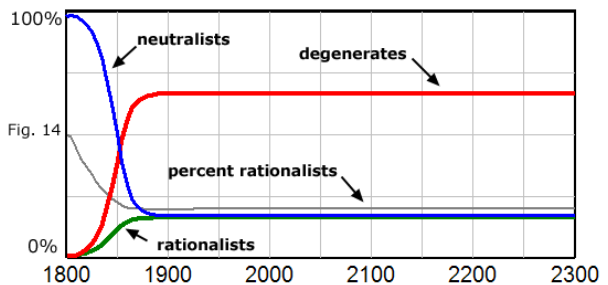
Run 9. 4.8 FM size, 20% ability, 0% repulsion



Run 10. 4.8 FM size, 20% ability, 20% repulsion



Run 11. 2.4 FM size, 20% ability, 20% repulsion



from 59% to 80%. Not bad for such a simple change. What’s interesting is they did it by *decreasing* the size of lies and favoritism, which means *less* corruption earned them *more* supporters.

The point is that false meme size is not fixed. It is fluid and, like so many agent strategies in complex social systems, changes as the situation demands.

Run 12 – Next let’s see which of the two high leverage points gives problem solvers the most leverage. First let’s raise repulsion to corruption from low to high, which is from 20% to 80%. Then we experiment with the running model to determine the optimum false meme size is for this competitive situation. It turns out to still be 2.4. Will the result be good enough for the good guys to win or not?

Actually the model is now so complex I found it hard to reliably predict the outcome of this run. But that’s one of the many benefits of simulation modeling: Once you have expressed your analysis as a dynamic structure, the software takes it from there and tells you how that structure will behave in any situation. And unlike my poor overworked cranial lobes, simulation software never makes a mistake.

The results show that even 80% is still not good enough. The forces of truth and corruption are still so evenly matched that they would be totally unable to deal cooperatively and proactively with difficult problems like the global environmental sustainability problem, because they would be too busy battling each other. The degenerates would also be engaging in promoting too many wrong priorities for the right priority of environmental sustainability to emerge as a top priority.

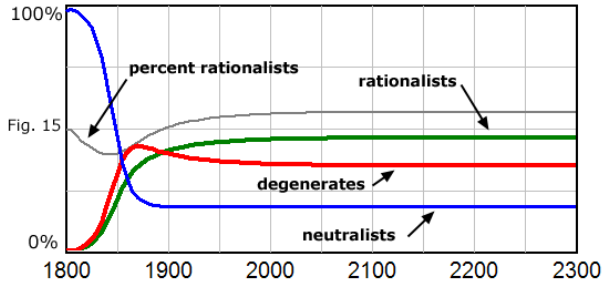
Time for a sanity check. Does this result make sense? Yes, because ability to detect deception is still low, at 20%. So let’s roll back repulsion to a more realistic value and then see what would happen if we raised ability to detect deception.

Run 13 – First we must estimate a reasonable value for repulsion to corruption. Later we hope to measure it in the field, but for now we must rely on an estimate.

There are five ballpark values repulsion to corruption could be: zero, low, medium, high, and 100%. Zero and 100% are so extreme as to be unrealistic, so we will rule them out.

I feel that presently repulsion to corruption is low. When the average citizen hears about detected corruption they do very little. They do not take action. Instead, the incident is written off as “politics as usual.” Only if corruption is extreme and prolonged do they take effective action. Even when Election Day comes, it is not

Run 12. 2.4 FM size, 20% ability, 80% repulsion



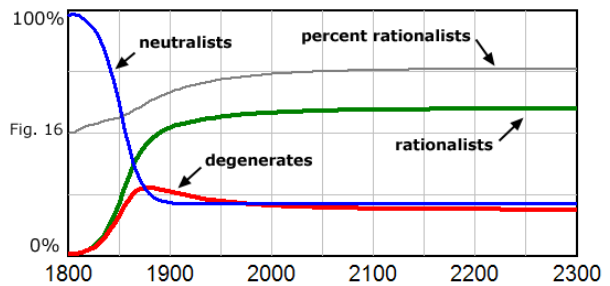
corruption that voters consider the most. It is numerous other factors, like looks, charisma, sound bytes that stick in the mind, and most importantly, where the candidate stands on issues that are important to each voter. These issues rarely center on corruption, unless corruption has been prolonged and extreme.

Let’s not go too low, like 10%. A value of 20% seems reasonable. Much higher would slip into a medium level (40% to 60%), which does not make sense. People do not act on half the corruption they hear about. It is much less.

Also let’s start to raise ability to detect deception. In runs 8 to 12 it was 20%. Let’s raise it to 60%. Let’s continue to assume corrupt politicians will adapt to the new situation and change to the optimum strategy of 3.8 for false meme size.

The results show that to adequately counter a false meme size of 3.8, ability to detect deception must be at least 60% and repulsion at least 20%. Percent rationalists is now up to 69%, which is probably about the bare minimum for a government to begin to put aside political squabbling and begin to work on its backlog of problems. But 69% is still not high enough for nations to focus efficiently on highly demanding problems, because solving these types of problems requires a nation’s full attention and its complete cooperation with other nations.

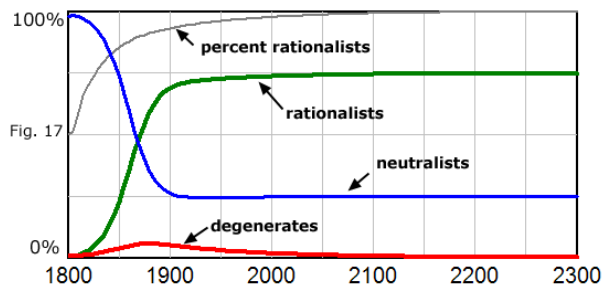
Run 13. 3.8 FM size, 60% ability, 20% repulsion



Run 14 – To see if we can achieve a high enough percent rationalists to solve the problem, let’s raise ability to detect deception from 60% to 80%. Again we assume adaptation and change false memes size to 4.7.

The graph shows that at last we have the behavior in the model we would like to see in the real world, because percent rationalists has risen to a blissful 100%. The opposition is eliminated and virtuous politicians can now focus on society’s proper priorities, at last. *If the model is correct*, then raising the general ability to detect political deception from low to high is all it takes to make the Race to the Top go dominant and thus solve the change resistance part of the problem.

Run 14. 4.7 FM size, 80% ability, 20% repulsion



Notice how this run was able to raise percent rationalists from 41% to 100% (a 59% rise) by raising ability to detect deception from 20% to 80%, while run 12 only raised percent rationalists from 41% to 57% (a 16% rise) by raising repulsion from 20% to 80%. Calculating the leverage, $59\% / 16\% = 3.7$. Thus in these fairly realistic scenarios ability to detect deception has 370% more leverage than repulsion to corruption has.

Comments on these runs

What about leaving ability to detect deception at 60% and raising repulsion to corruption? Would that solve the problem? No. Experimentation with the model shows that increasing repulsion to 80% increases percent rationalists to 94%, and increasing it to 100% only increases percent rationalists to 95%. It seems that increasing repulsion cannot eliminate the last few degenerates. However it does appear that the best overall solution is to raise both high leverage points some: repulsion a little bit, and ability to detect deception a lot.

Now for the important question: *Is the model correct?* No one knows, because it has not yet been subjected to the rigors of experimental proof and field calibration. But I do believe that it contains the fundamental brushstrokes explaining why solution adoption resistance is so high. At the very least the model should be able to serve as the starting point for a larger project that would go much further than I've been able to go by myself.

Next we need to take up the notion that the dueling loops are cyclic. However, let's first pause for:

A word of caution

At Thwink.org, as well as in this book, we think like scientists. Every assertion we make is a hypothesis that could be overturned tomorrow. The pages you are reading contain many novel hypotheses. While these seem to have withstood the test of logical proof, using a number of analytical tools, few have undergone the acid test of real world experimentation. No one knows how many will survive. But rather than couch every assertion with a "maybe," a "this suggests," or a "probably," and so on, we have elected to only occasionally stress that all the conclusions in the book are merely examples and pointers to a new way of thwinking. None should be interpreted as *the* analysis or *the* solution.

The cyclic behavior of the Dueling Loops

Up until now the model has ignored consideration of what it is that causes a society to want to raise its general ability to detect political deception and/or repulsion to corruption. To raise the values for these two variables in our simulation runs, all

we had to do was reach into the model and change them. That’s not how it happens in the real world. How then do societies adjust these values?

My hypothesis is that societies reactively change these values when they see the clear and present need to change them. This need appears when a prolonged excess of corruption occurs. Because there is no formal reliable mechanism to keep the values of these two variables permanently high, they tend to fluctuate as the decades pass. Another way to say this is societies have a short organizational memory on what the values of these two variables should be.

Reactively changing these values causes an endless cycle. This cycle was briefly described earlier as: A cycle ends when corruption becomes so extreme and obvious that the people rise up, throw the bums out, and become much harder to deceive for awhile. But as good times return, people become lax, and another cycle begins. These cycles never end, because presently there is no mechanism in the human system to keep ability to detect deception permanently high.

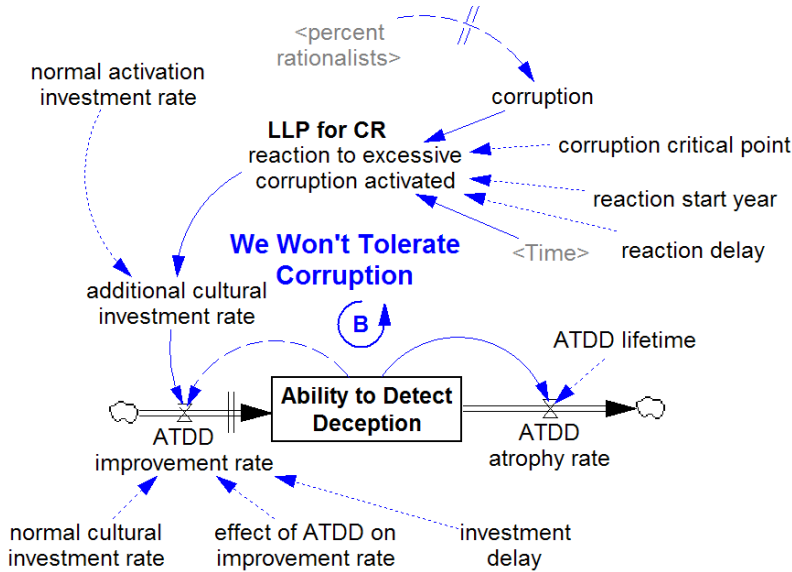
The minimum conditions required for the dueling loops to be cyclic appear to be:

1. The natural tendency for general ability to detect political deception and repulsion to corruption to be low.
2. The existence of critical points that are automatically activated when corruption gets bad enough. Once a critical point is activated, society invests in raising general ability to detect political deception and/or repulsion to corruption.
3. The critical point is deactivated once corruption falls low enough. This is because there is no permanent mechanism to keep these variables high enough to prevent corruption. (Maxims like “The price of democracy is eternal vigilance” intuitively recognize the need for a permanent mechanism, but even 1,000 such maxims are not enough. Something more is needed.)
4. The presence of delays in raising and lowering the two variables, and in changing supporters of one type into the other.

The previous model has been revised to incorporate these minimum conditions by renaming the key high leverage point to be Ability to Detect Deception and changing it to a stock instead of a variable. (It is traditional to capitalize the names of stocks, due to their central importance in stock and flow models.) The Critical Point Reaction Subsystem, shown on the next page, was then built around this stock to give it a realistic critical point and change delay.

In the model 1 – percent rationalists = corruption. The critical point reaction occurs when corruption rises above a certain arbitrary cultural corruption critical point.

Critical Point Reaction Subsystem



This simple subsystem imitates how society reacts when corruption rises above an unwritten, culturally defined critical point. This reaction is part of a cycle that never ends because presently there is no formal, enduring mechanism in governments to keep Ability to Detect Deception permanently high.

Here's how a **We Won't Tolerate Corruption** (for awhile) cycle works: Once corruption rises above the corruption critical point a common complex social system reaction occurs. The reaction to excessive corruption activated node goes from false to true, after a reaction delay of 5 years. This causes normal activation investment rate to become the additional cultural investment rate. Because that is 20 times as large as the normal cultural investment rate, the reaction vastly increases a society's investment in raising Ability to Detect Deception, such as by launching investigations, publishing information on who is corrupt, prosecuting corrupt officials, and changing the processes of its governmental institutions to be more corruption proof. This takes time, as represented by the investment delay of 5 years and by the way it takes many years to fill the stock up to the high level needed to detect most corruption.

As the stock of Ability to Detect Deception investments accumulates, more and more false memes are detected. Once the stock rises high enough, so much falsehood and favoritism is detected that corruption falls so low that the corruption critical point is no longer exceeded. This causes reaction to excessive corruption activated to change back to false, which causes additional cultural investment to change back to zero, which causes the stock of Ability to Detect Deception to start falling. It contin-

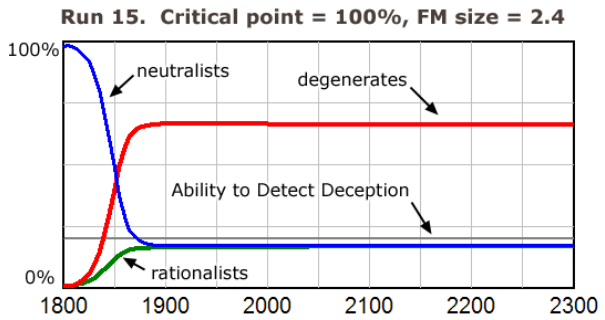
ues to fall until it goes so low that another critical point reaction is triggered, and the cycle starts over again.

Below is the table of simulation runs needed to illustrate the dynamic behavior of the critical point model. In all runs repulsion to corruption is 20%. In a real solution it probably needs to be increased a bit, but here we leave it alone for simplicity.

Critical Point Model Settings	Simulation Runs							
	15	16	17	18	19	20	21	22
Corruption critical point	100%	65%	65%	50%	50%	30%	5%	0%
False meme size	2.4	2.4	4.7	4.7	5.6	4	4	4.7
Results								
Percent rationalists	20%	Very cyclic	40%	Less cyclic	55%	A little cyclic	Barely cyclic	100%

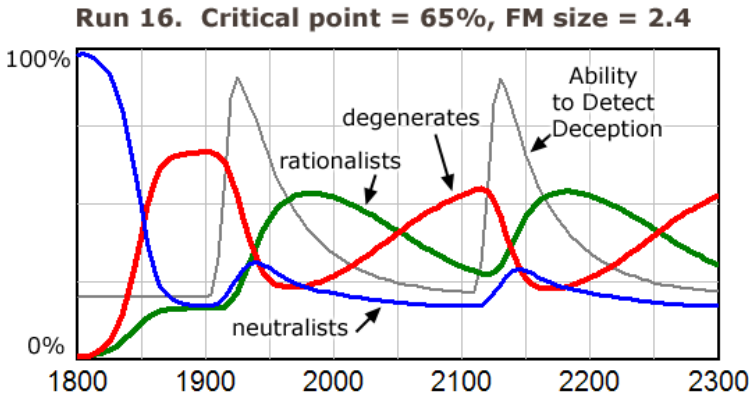
Run 15 – This run has no critical point reaction since the corruption critical point equals 100%. That’s so high it can never be exceeded. Thus this run’s behavior is identical to run 11 because additional investment has not yet been triggered.

The subsystem has a normal cultural investment rate that keeps Ability to Detect Deception at 20% when additional investment is zero. Run 15 is the reference mode for the critical point model. In the graph percent rationalists has been replaced by Ability to Detect Deception, which in this run is a constant 20%.



It takes this run only a hundred years to reach steady state equilibrium. To show the cyclic nature of the dueling loops in later runs, the reaction start year is set to 1900. Starting the reaction then instead of in 2000 (which would be about now, and make the modeling experience a little more true to life) gives us more cyclic activity to look at, so that we can more clearly understand the model and its implications.

Run 16 – This is the basic problem to solve. In this run the critical point is lowered from 100% to 65%, which means the critical point reaction will take place whenever corruption rises above 65% or percent rationalists dips below 35%. Since in the reaction start year of 1900 percent rationalists equals 20%, the critical point reaction starts then. The simulation results show such insightful social system behavior that we've enlarged the graph for this run so the details may be more easily seen.



The graph shows the cycles are about 200 years long. This is much longer than the corruption cycles (really exploitation cycles) we see today. Thus it is more representative of the deeper cycles that occur, such as those due to changes in styles of government, which are a reaction to very deep social system drivers like class oppression by a landed aristocracy or a hereditary line of rulers. If the four delays in the model are reduced to low levels, cycle length falls to about 75 years, which is closer to what we see in cyclic political party dominance or exploitation by life forms or special interest groups like the modern corporation, due to corruption and other related factors that tend to obscure the fact that exploitation of the Race to the Bottom is the central driver of these cycles. (75 years requires investment delay = 1 year instead of 5, reaction delay = 1 year instead of 5, incubation time = 1 year instead of 10, and infection lifetime = 5 years instead of 20.)

For example, the modern corporation became ruthlessly dominant in the US in the late 19th century. The cycle was ended with a backlash against the oppressive power of corporations that led to passage of legislation like the Sherman Anti-Trust Act of 1890. But now corporations are overly dominant again, due to successful exploitation of the Race to the Bottom.

The important thing to realize is that the natural tendency of the dueling loops is to be cyclic. The length of the cycles varies greatly depending on a host of factors, only a few of which are incorporated in the model. Because there are many corrupt politicians and special interest groups trying to exploit the Race to the Bottom, there are many cycles underway at the same time. A political system will be most domi-

nated by whichever cycles are currently dominant and by how strong and clever the various exploiters are.

Let's walk through a cycle and explain what's happening, both in the model and the real world it attempts to represent.

A cycle begins when percent rationalists falls below the corruption critical point. Then, after a reaction delay of 5 years we see that Ability to Detect Deception suddenly spikes upward. These spikes are mass panic reactions to flagrant amounts of corruption. When a spike is underway a society will be wildly investing in all sorts of things to increase the public's ability to spot political deception, like editorials and articles explaining how certain politicians are using lies and favoritism to achieve their nefarious goals, investigations to get to the bottom of various scandals and root out corrupt politicians, speeches extolling the importance of virtue and the ravaging effects of corruption, and so forth. Mechanisms to detect falsehood will start spontaneously appearing, such as the way FactCheck.org appeared in the 2004 election and PolitiFact.com in 2007, both in the US.

The incubation time of 10 years and other delays causes the percentage of degenerates to not fall as fast or as soon as Ability to Detect Deception spikes upward. Instead, there is a noticeable lag. While it takes only about 25 years for Ability to Detect Deception to reach its peak, it takes about 70 and 80 years for the percentage of degenerates to fall to its lowest level and for the rationalists to reach their peak. These excruciatingly long delays do occur, because it normally takes generations for fundamental cultural norms, like ideology allegiance or addiction to consumptive extravagance, to shift radically.

Once a critical point reaction occurs, eventually the degenerates fall out of power, the rationalists come into power, and a society enters good times. Those times are so good and what is allowing them is so well hidden that without realizing it society "forgets" that it should be investing in keeping the Ability to Detect Deception high. The result of this oversight is that very early in the cycle the level of detection ability starts to fall. In this run it starts to fall after only about 25 years, which is 1/8 of the cycle's length. It continues to fall, though the rate of fall slows down as it approaches its normal level of 20%.

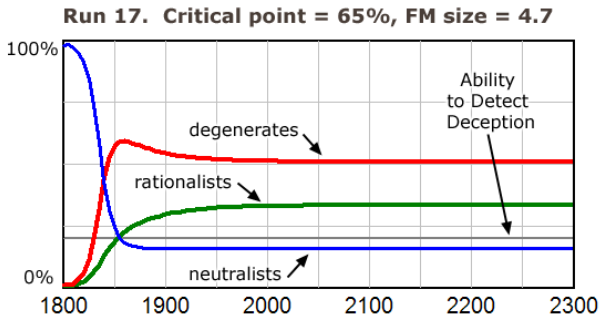
In the graph the good times begin when supporter type crossover occurs after about 35 years. After this the rationalists are dominant. This lasts for about half the cycle's length, and then crossover occurs again as the degenerates become dominant. As the percentage of degenerates continues to increase, it eventually triggers another critical point reaction and the cycle starts all over again.

Note that after 1900 the percentage of neutralists stays within a range of 17% to 29%. This corresponds to the roughly 10% to 30% of the population who are the so called "swing voters." These voters are not strongly committed to either side. If the percentage of rationalists is close to the percentage of degenerates in a political sys-

tem, as it so often is, then it is the neutralists who determine election outcomes. This fact has not escaped the attention of election strategists.

Run 17 – In the first draft of this model write up I completely missed the fact there’s a very successful strategy the degenerates can employ to totally overcome what the rationalists did in run 16. It was only due to correcting a modeling error that I noticed that the wily degenerates have an ace up their sleeve.

Once the cyclic behavior of run 16 begins, the degenerates are dominant a little less than half the time. Thus they are losing. But as the run 17 graph shows, they can win by “losing” even more! This is done by increasing false meme size from 2.4 to 4.7 so as to get caught red

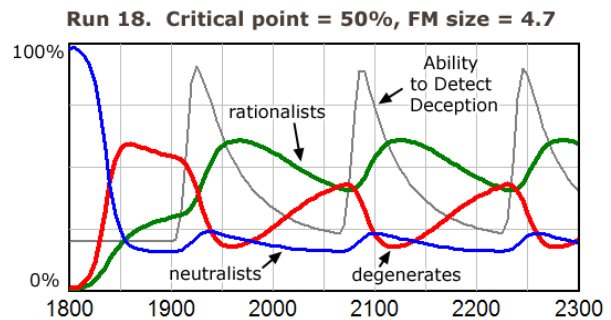


handed even more. This causes the pre 1900 portion of the run to level out at 40% instead of the 20% percent rationalists that we saw in run 15. The amazing result is the critical point of 65% is never triggered, the cyclic behavior never happens, and the degenerates, instead of being dominant less than half the time as in run 16, now stay at 60% dominance! How’s that for craftiness?

In other words, at a 65% critical point corrupt politicians can win big by telling whoppers they know are going to be detected and cause them to lose more supporters. This corresponds to the flagrant, braggadocio style of lie spinning and cash for favors we sometimes see corrupt politicians or political parties engaging in. There seems to be no logical reason they would try to get caught. But from the viewpoint of the model, there is a perfectly sane reason for such insane behavior: it is the winning strategy. *Figuring out why baffling social behaviors like this occur is impossible without building simulation models like this one.*

Run 18 – It looks like our friends, the virtuous politicians, have no choice but to try a lower critical point. Let’s hold false meme size at 4.7 and lower the critical point to 50%.

Once again we have cyclic behavior, though it is a little less so than in run 16. This time the degenerates are dominant only about 10% of the time.

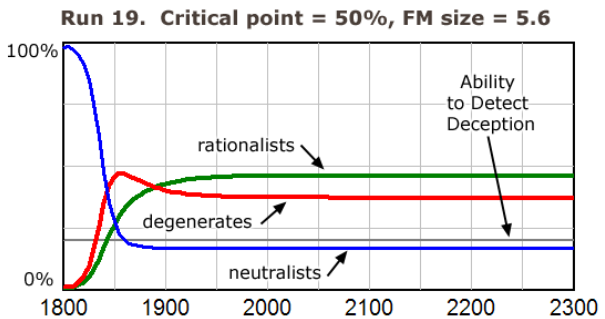


This run begs the intuitive question, if Ability to Detect Deception is 50%, then why aren't the rationalists and degenerates each dominant about 50% of the time?

The answer is they would be, if repulsion to corruption was 0% instead of 20%. But 0% is unrealistic, because some people *do* take effective action when they detect corruption, so we have used the value of 20%.

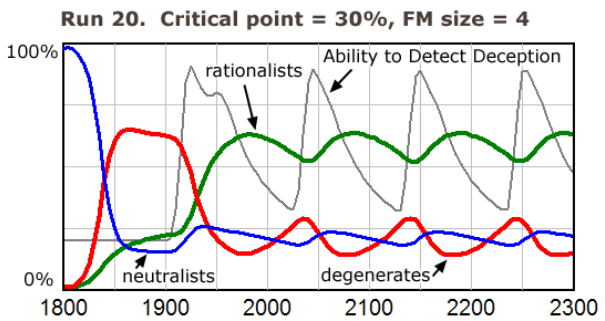
We must not forget for a moment the cleverness of those who believe the end justifies the means. Is there a winning strategy the degenerates can use to counter a critical point of 50%?

Run 19 – Yes there is. Telling even bigger whoppers works like a charm once again. A false meme size of 5.6 allows the degenerates to do much better than being dominant 10% of the time, as in run 18. The results show they don't do quite as well as run 18, because now they are in the minority. But they have achieved a dominance of 45%, which is definitely enough to achieve many of their goals, not to mention the sizable impact such a large minority would have on political decision making.



Run 20 – The rationalists need to do much better. Let's get serious and lower the critical point all the way to 30%. Surely this will do the job. At least I hope it does, because raising Ability to Detect Deception even higher is not going to be easy.

The results of this experiment are much better, as expected. For the first time the rationalists are safely in control of the political system all the time, by a very comfortable margin. There is still a little cyclic behavior, but now the forces of reason are never seriously challenged. The rationalists average about 60% of the population and the degenerates average about 20%.



Once again, is there a strategy the degenerates can use to do better? No. At least not the way this model is constructed. A false meme size of 6.7 does avoid triggering the critical point reaction but the degenerates average only the same percent dominance. That strategy does not give a better outcome. In this run their best strategy is

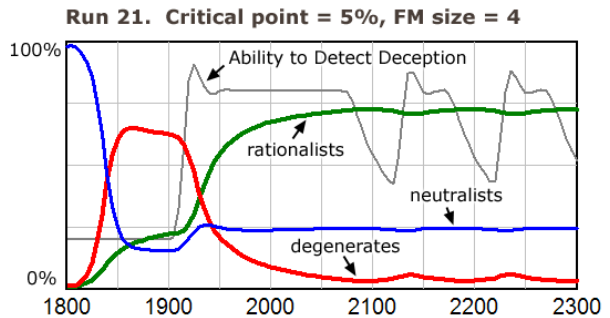
to maximize their cyclic dominance and use the chaos that causes to try for a lucky victory, which requires adapting to an optimal false meme size of about 4. Thus an important conclusion we can draw from the model is that a high level of Ability to Detect Deception is required to successfully counter the extraordinary power of the Race to the Bottom.

We are not yet done. Looking at the graph closely, this run is still not good enough because even a 20% minority, with occasional swings to over 25%, can still upset the applecart. In modern democracies every sizable minority still has a voice that must be listened to and frequently accommodated. Thus if a society was trying to deal with a problem so large and difficult that it required all of that society's or a planet's attention to solve it, a 20% minority could prevent that.

So how high does the critical point have to go to solve the problem? That is, how strong does a society's organizational memory have to be for it to always remember how to prevent excess corruption? Let's continue experimenting to find out by lowering the critical point again, this time to 5%. The optimal false meme size of 4 remains the same.

Run 21 – The cyclic behavior is now almost completely gone. But some still exists and there are still a few degenerates to be reckoned with. Is a critical point of 5% good enough to solve problems as intractable as the global environmental sustainability problem?

I think not, for several reasons. One is that as long as some cyclic spikes exist in a social system, it is too easy for those signals to obscure other signals and thus add to the complexity of any problems a society may be trying to solve. Ability to Detect



Deception spikes are not just another signal—they lay at the very heart of human systems, because they are attempts to adjust the perceptual acuity of self-governance. That acuity needs to be at least 20/20 to be able to see the true facts of the many complex, difficult problems governments are responsible for solving. Thus spike signals due to rising degeneration must be responded to in a serious manner, because they may indicate problems of great importance. In addition to the signal confusion problem, spikes in Ability to Detect Deception investment siphon investment away from other endeavors.

There is, however, an even greater reason that a corruption critical point of 5% is not good enough. I believe you can see for yourself what that reason is, from this

article that appeared the day after I first wrote this. Only the first half of the article is quoted since the rest adds very little to the article's basic argument. (Italics added)

On Climate Change, a Change of Thinking, by Andrew C. Revkin, The New York Times, December 4, 2005. ~ In December 1997, representatives of most of the world's nations met in Kyoto, Japan, to negotiate a binding agreement to cut emissions of greenhouse gases.

They succeeded. The Kyoto Protocol was ultimately ratified by 156 countries. It was the first agreement of its kind. But it may also prove to be the last.

Today, in the middle of new global warming talks in Montreal, there is a sense that the whole idea of global agreements to cut greenhouse gases won't work. A major reason the optimism over Kyoto has eroded so rapidly is that its major requirement - that 38 participating industrialized countries cut their greenhouse emissions below 1990 levels by the year 2012 - was seen as just a first step toward increasingly aggressive cuts.

But in the years after the protocol was announced, developing countries, including the fast-growing giants China and India, have held firm on their insistence that they would accept no emissions cuts, even though they are likely to be the world's dominant source of greenhouse gases in coming years. Their refusal helped fuel strong opposition to the treaty in the United States Senate and its eventual rejection by President Bush.

But *the current stalemate* is not just because of the inadequacies of the protocol. It is also a response to the world's ballooning energy appetite, which, largely because of economic growth in China, has exceeded almost everyone's expectations. And there are still no viable alternatives to fossil fuels, the main source of greenhouse gases.

Then, too, there is a growing recognition of the economic costs incurred by signing on to the Kyoto Protocol. As Prime Minister Tony Blair of Britain, a proponent of emissions targets, said in a statement on Nov. 1: "*The blunt truth about the politics of climate change is that no country will want to sacrifice its economy in order to meet this challenge.*"

The message I glean from this article is that the solution adoption resistance part of the problem has reached the stage where it is no longer just difficult—it may now be impossible to solve in time. This is because, as shown in Tony Blair's statement, most of the world is trapped in an **Economic Race to the Bottom among Nations** and doesn't know how to get out. But guess what life form benefits most from that particular downward spiral and therefore has caused it to happen? And guess what high leverage point must be pushed extraordinarily well to stop that downward spiral in its tracks?

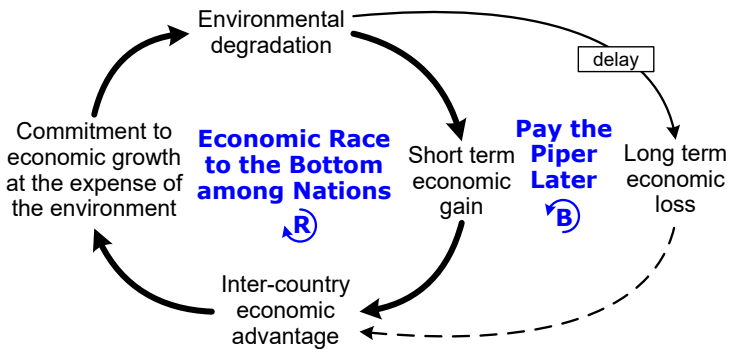
The problem is now so close to the threshold of insolvability (or past it, we really don't know) that society no longer has the luxury of tolerating *any* corruption, because that hinders solving the problem and could tip it over the threshold.

One solution alternative is to wait until the first “wake up call” environmental catastrophes start to occur, and then use the belated global realization that humanity *must* solve the problem to move forward on a solution. But if we wait that long, Humpty Dumpty will have already fallen off the wall and it will not be possible to put all of the pieces back together again.

The case can be made that as percent degenerates approaches zero, a multiplier effect is at work. These last few percent are the desperate, hard core degenerates, which includes the smartest of the lot. As percent degenerates goes low, every special interest degenerate ties up two or more for-the-good-of-all rationalists, because (under present conditions) that's how many people it takes to handle damage control and counter the insidious, endlessly disruptive stream of falsehood and favoritism.

Therefore a rule of zero tolerance to political corruption must be adopted, so that *Homo sapiens* is not distracted while it attempts to save itself from ecocide. Anything less is just asking for trouble when it comes to figuring out how to get the US, China, India, and the entire world on board a rapid and radical solution to the climate change problem, as well as to other global environmental problems such as topsoil loss, deforestation, and groundwater depletion.

Why the International Stalemate Exists



What Tony Blair was really saying is no country can afford to “sacrifice its economy” to get out of the above race to the bottom. This is because the New Dominant Life Form has structured the international commerce game so that nations see the main loop before the side loop. The way out is to raise ability to detect deception at the level of nations, so that they can break free of the illusion that they are trapped in the main loop, and can see the truth: that the **Pay the Piper Later** side loop is the more important loop to their citizens.

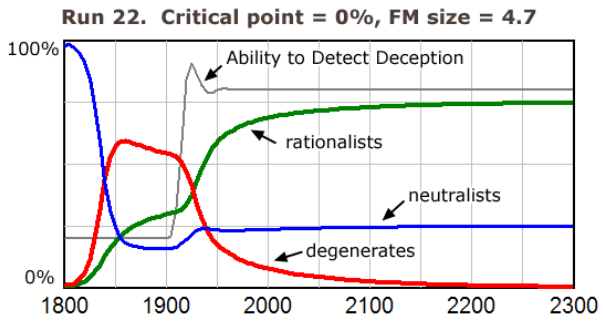
The main loop starts when a country makes a commitment to economic growth at the expense of the environment. This increases environmental degradation, which in turn raises the short term economic gain, which increases that nation's inter-country economic advantage, and the loop starts all over again, because that is A Good Thing. The side loop shows how, if the *delay* of environmental degradation is considered, then there is a long term economic loss that will eventually decrease the inter-country economic advantage, arguably by much more than the short term economic gain.

Let’s take a look at what would happen if we tried the rule of zero tolerance in the final simulation run by using a critical point of 0%.

Run 22 – As expected, *zero tolerance to corruption completely ends the cyclic behavior of the dueling loops*. Once the rationalists rise to dominance they stay there. Degenerates do not just drop to a low level—they are reduced to 0%. Their best strategy is to hold out as long as possible, by using a false meme size of 4.7. After about 50 years, society’s Ability to Detect Deception holds steady at 80%. A successful transition to solving the solution adoption resistance part of the problem has occurred.

But this transition takes a long time. It takes about 25 years for rationalists to begin to outnumber degenerates, and 40 years for percent rationalists to rise to 69% (barely over a 2 to 1 majority), which was mentioned in run 13 as

probably the bare minimum it will take to make a serious start on solving the problem, though it is still too low to be enough. As we argued in run 21, it will take somewhere near 100% to be enough.



Because the model is not calibrated (the numbers used in it are estimated, not measured), it cannot make accurate predictions. Nevertheless, it does look as if solving the solution adoption resistance part of the problem will take a long time. Will it take too long? That is one of the great questions facing problem solvers and civilization.

Key findings from the Dueling Loops

Simplifying enormously, most conventional wisdom says all we need to do to solve the sustainability problem is to find the proper practices needed to live sustainably and then aggressively promote those practices until they are adopted. This approach has tremendous logical and technical appeal. The inner talk runs about like this: "Solving this problem is basically a matter of finding out what's best for the good of all, and then spreading that knowledge. Once people and governments see what's in their own best interests, they will start doing things that way, because people are rational."

There is, however, a slight drawback to this approach. It doesn't work.

This is because it completely misses the change resistance part of the problem, and fails to see the hidden causal structure causing of decades of solution failure. If problem solvers would focus their efforts on why so much change resistance is oc-

curing they might find, as this analysis has, that all they've been doing is engaging in "more of the truth." This is a low leverage point. *Pushing on this point fails because it is no more than a heavy handed, naive attempt to make the Race to the Top dominant through the application of brute force.* It does not consider that the Race to the Bottom is inherently stronger and has a more powerful special interest group behind it. Thus conventional approaches have no hope of succeeding, unless the laws of physics change or a "wakeup call catastrophe" occurs in time. Neither appears likely.

Fortunately there is at least one way out. It is the high leverage point of general ability to detect political deception. Currently this is low. If problem solvers can raise it to a high level the Race to the Bottom will collapse, leaving the Race to the Top dominant. Politicians will then respond correctly to the truth about the global environmental sustainability problem because it will now be in their best interests. If they come to the same conclusion that environmentalists have, that sustainability is civilization's top priority and nothing else comes close, then civilization will at long last begin the Sustainability Revolution.

One way to summarize the Dueling Loops model is that democracy doesn't work if citizens cannot tell the difference between a good and a bad politician.

The five substeps of analysis

The Dueling Loops model was built by methodically walking through SIP's five substeps of analysis. The model explains so much it serves as a rich source of explanation for subproblems A, B, and C. The rest of this chapter applies the model to just subproblem A. Substep results are summarized in subproblem A in the *Summary of Analysis Results* on page 88.

The symptoms of the change resistance subproblem are *Successful opposition to passing proposed laws for solving the sustainability problem*.

Substep A. Find the immediate cause of the problem symptoms in terms of the system's dominant feedback loops.

The basic Dueling Loops model on page 111 shows the immediate cause is **The Race to the Bottom among Politicians** is dominant most of the time. The more dominant that loop is, the more deception transmitted to Not Infected Neutralists. These are swing voters and recently disenchanted degenerates or rationalists. The Race to the Bottom amplifies degenerates influence with false memes. Because the size of a falsehood can be inflated but the size of the truth cannot, the Race to the Bottom wins more supporters from the pool of Not Infected Neutralists than the Race to the Top does. The result is degenerate supporters elect corrupt politicians, who because they are in the majority, successfully oppose attempts to solve the sustainability problem.

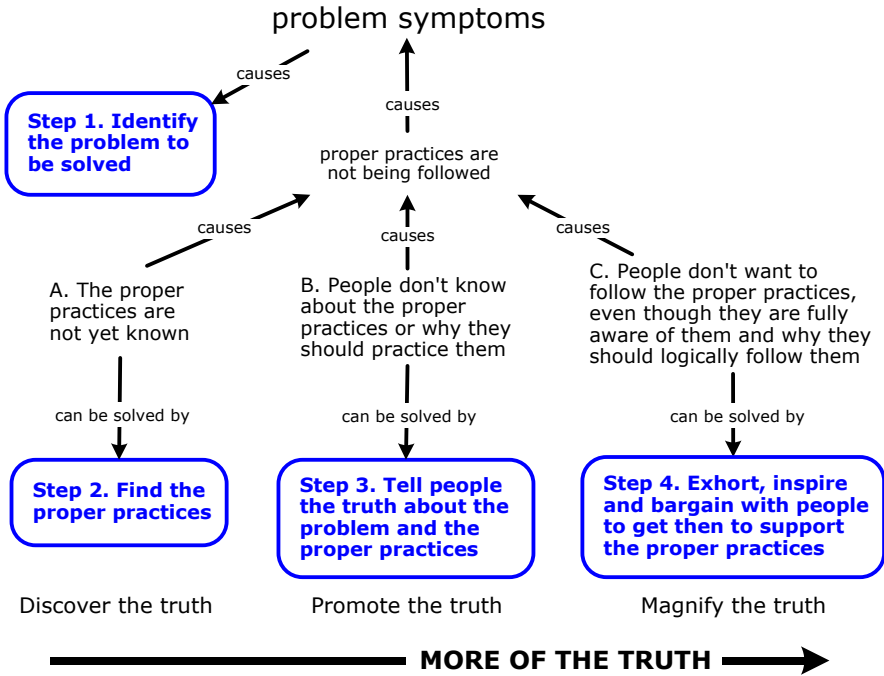
Note the stark contrast between this conclusion and the norm. Conventional reasons for failure to overcome change resistance are things like lack of political will, this is a hard problem, human greed, not enough activists, wrong framing of the issues, and so on. These opinions, while sincere, are nowhere close to what's needed to analytically solve the problem.

Substep B. Find the intermediate causes, low leverage points, and symptomatic solutions.

Now our investigations get a little interesting, as we're about to explain WHY conventional solutions for overcoming change resistance have failed. This information may come as a disconcerting shock to a lot of environmentalists. But then again, it may be seen as incredibly helpful information by others.

As I studied the system for evidence of WHY environmentalism has been unable to solve the sustainability problem, a theory arose explaining WHY activists were so attracted to the low leverage point of "more of the truth." By long habit, activists use a process so entrenched and traditional that it pretty much names itself. The process is Classic Activism, as diagrammed on the next page.

The Basic Process of Classic Activism



Classic activism is the use of the four steps of The Basic Process of Classic Activism for *all* types of public interest problems. The process is simple and has only four steps. The general idea is to persuade people to follow the proper practices needed to solve the problem. The main strategy is “more of the truth” will solve the problem.

How Classic Activism works

The heart of how Classic Activism works is embodied in this famous quote by cultural anthropologist Margaret Mead: *“Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has.”* A true classic activist will argue Mead’s words must be true, because thoughtful, committed citizens are all that ever *has* changed the world for the better. How exactly do citizens change the world? By use of the four steps in the diagram.

A **proper practice** is a behavior that if followed would directly help to solve the problem. Examples of the proper practices needed to solve the sustainability problem are use of renewable energy, the three R’s of reduce, reuse, and recycle, closed loop manufacturing, and the Kyoto Protocol treaty on climate change.

Let’s walk the diagram. **Step 1** identifies the problem. The problem symptoms are always caused by proper practices not being followed. If the proper practices are not yet known, then **step 2** is needed to find the proper practices. Next, if people don’t know about the proper practices or why they should practice them, **step 3** is needed. This attempts to tell people the truth about the problem and the proper prac-

tices. If after that people don't want to follow the proper practices, and they usually don't, then **step 4** is needed. This tries to exhort, inspire, and bargain with people to get them to support the proper practices.

If step 4 doesn't work, what does a classic activist do? The only thing they can do: repeat the steps and somehow do them better. Since that doesn't involve any root cause analysis or treatment of change resistance as a separate problem to solve, historically Classic Activism has worked poorly on most difficult large-scale social problems, except over a long period of time, such as for women's suffrage, slavery, and racial discrimination.

Classic Activism is the basic process that activists have been following ever since the government first appeared. It works on those types of problems where "more of the truth" is all that is necessary to prevail, by winning over one mind at a time. It thus works best in democracies.

More of the truth is the practice of steps 2, 3, and 4 of Classic Activism. The steps are discover the truth, promote the truth, and magnify the truth.

The truth is the proper practices society must follow to optimize the good of the group as a whole. If the proper practices are not yet known, they must be found with step 2. For example, in the environmental sustainability problem agricultural practices that do not require heavy use of pesticides may be developed. In health problems, research proving that smoking causes cancer may be done. In racial discrimination problems, research can be done to prove there is no inherent intelligence related genetic difference between races. And so on.

Once the proper practices and why they should be followed are known, all it *should* take to get people to use them is telling them about the proper practices and why they should use them, which is step 3. This is done with articles, magazines, pilot projects, publicity campaigns, lobbying, the use of the courts to tell judges about the real truth of a situation, and so on.

If step 3 fails, then step 4 is tried. The step 3 techniques are cranked up by the use of more inspiration and exhortation, which slips into emotional arguments and rhetoric. Bargaining is also employed. Models of ideal behavior, such as gardener of the month or a city that started recycling are trotted out. Demonstrations to shock the public into paying attention are used. And so on.

If step 4 fails, the only recourse is to repeat the steps and somehow do them better. This so often fails and leads to so much pent up frustration that some activists resort to a fifth step, violence and revolution. This is illegal in democracies and is not shown.

The process has tremendous logical appeal. The inner talk runs about like this: "Solving this problem is basically a matter of finding out what's best for the good of all, and then spreading that knowledge. Once people see what's in their own best interests, they will start doing things that way, because people are rational." Classic

Activism is enormously popular because it's been used for so long, it sometimes works.

Classic Activism is so appealing and popular it's the *de facto* standard for environmentalism. To my knowledge, all what-to-do environmental literature falls into this process. *Silent Spring* was a superb mixture of steps 3 and 4, with a little bit of step 2. *Natural Capitalism*, a book about how corporations can take the lead and create the "next industrial revolution" by switching to more environmentally sustainable technology, uses mostly steps 2 and 3. Al Gore's *Earth in the Balance* is mostly 3. Environmental and nature magazines, such as *Sierra*, *The Ecologist*, *Green Futures*, and *Audubon Magazine*, are steps 3 and 4. Step 3 is also known as education on the facts or "appeal to logic," while step 4 is the "appeal to emotion," which attempts to magnify the truth with rhetoric and bargaining. The 2006 *Stern Review on the Economics of Climate Change* performed step 1 from an economic point of view and presented evidence that "the benefits of strong, early action considerably outweigh the costs," which is step 3. The actions reviewed were all proper practices. As discussed earlier, the common-pool resource literature sees its mission as finding the right proper coupling practices, which is step 2.

Environmental organizations also rely on steps 2, 3, or 4 to achieve their goals. Lawsuits to comply with existing environmental regulations would seem to fall outside of 2, 3, or 4. However, this is enforcement of the legal truth by telling judges about the truth of the facts involved. It is thus a form of 3. Lobbying is a mixture of 3 and 4. Scientific research into alternative energy, sustainable agriculture, recycling, ways to reduce population, and so forth is 2. Extremist actions such as sit-ins and blocking nuclear test sites are forms of 4. So are demonstrations, marches, and publicity stunts. Polls, such as how strongly people support a clean environment, are a form of 3. They are "the truth" why decision makers should enforce proper practices. Corporate social responsibility campaigns, since they play on psychological elements, are step 4.

Even the innovative sustainability solutions pioneered in developing countries, such as ecotourism, microfinance, acceleration of the demographic transition, direct marketing cooperatives for green products, and community based common-pool resource management, are a collection of better proper practices. Perfecting them is step 2. Education and assistance is step 3. Pleading and bargaining with developed nations, NGOs, and international agencies to support them and with developing countries to adopt them is step 4.

The Limits to Growth employed the general pattern of Classic Activism. The World3 model focused mostly on step 1: identify the problem. The 1972 first edition said little about the solution. But due to lack of solution progress, the second and third editions did. The 1992 second edition presented "a simple set of general guidelines for restructuring the world system toward sustainability," such as "improve the signals... speed up response times... minimize the use of nonrenewable resources."

(p213-214) These are proper coupling practices, so the book was advocating step 2 and performing step 3. The authors acknowledged the presence of systemic change resistance: “Systems strongly resist changes in their information flows, especially in their rules and goals.” (p223) But when addressing how to deal with resistance, the authors turned to the old paradigm of Classic Activism: “In our search for ways to encourage the peaceful restructuring of a system that naturally resists its own transformation, we have tried many tools.” (p223) The tools were “visioning, networking, truth-telling, learning, and loving.” (p224) These are techniques used to implement Classic Activism steps 3 and 4.

The 2004 third edition repeated these suggestions and included one of the clearest descriptions of the practice of Classic Activism that I’ve ever seen. Of the three authors, Dana Meadows, the main voice of the first two editions, “was the unceasing optimist. She was a caring, compassionate believer in humanity. She predicated her entire life’s work on the assumption that if she put enough of the right information in people’s hands, they would ultimately go for the wise, the farsighted, the humane solution [that would solve the problem].” (pxvi) This is step 2.

More recent modeling efforts continue to follow the four steps of Classic Activism. The Millennium Institute’s Threshold 21 sustainability model focuses on how a nation can better manage proper coupling. The IPCC assessment reports seek “the understanding of human induced climate change, potential impacts of climate change and options for mitigation and adaptation.”⁴³ But this understanding, which is heavily model based, starts with the symptoms and stops at the same intermediate causes of the World3 model: the IPAT factors. Like the three editions of *Limits to Growth*, the four IPCC assessment reports have progressively tip toed into Classic Activism steps 3 and 4. The fourth report took a leap in section 4: Adaptation and Mitigation Options. This contained an extensive listing of existing proper practices and projections by sector on their effectiveness, which is step 3. Section 5, The Long-term Perspective, used “five reasons for concern” to emphasize that “Adaptation is necessary in the short and longer term to address impacts resulting from the warming that would occur even for the lowest stabilization scenarios assessed.” While expressed in the dry language of scientists, this is nevertheless the exhortation of step 4.

Al Gore’s 2006 documentary film, *An Inconvenient Truth*, was one long visual example of more of the truth: discover the truth, promote the truth, and magnify the truth. The film concluded with Al saying:

Each one of us is a cause of global warming, but *each one of us can make choices to change that* with the things we buy, the electricity we use, the cars we drive; we can make choices to bring our individual carbon emissions to zero. The solutions are in our hands, we just have to have the determination to make it happen. We have everything that we need to reduce carbon emissions, *everything but political will.*⁴⁴

“Each one of us can make choices to change that” means each of us should follow the proper practices to end global warming. That we have everything we need but political will bluntly admits change resistance is too high to solve the problem, and that the problem is insolvable until that resistance is overcome. To somehow overcome that resistance, the film lists actions you can take in the closing credits, such as “Tell your parents not to ruin the world that you will live in” and “Vote for leaders who pledge to solve this crisis.” The film is steps 1, 3 and 4.

However, despite its ubiquity and use by the world’s finest environmentalists, Classic Activism is deeply flawed. It doesn’t find and resolve root causes. Nor does it treat change resistance as a separate problem to solve and to solve first. Classic activists have thus fallen into the deadly embrace of the Superficial Symptoms and One Subproblem Traps discussed earlier.

The main point of this examination of Classic Activism is to show that when it comes to overcoming change resistance, environmentalists are *all* pushing on the low leverage point of “more of the truth.” The Dueling Loops model shows why that approach has not and will not work.

The intermediate cause – Economic Growth Is Good

The symptoms of the change resistance subproblem are *Successful opposition to passing proposed laws for solving the sustainability problem*. Substep A found the immediate cause loop for that opposition is a dominant Race to the Bottom among Politicians. In substep B, SIP tells us to ask WHY is that loop dominant?

The Dueling Loops tells us that loop is dominant because the Race to the Bottom has an inherent advantage over the Race to the Top. All sorts of deception has been used by special interests to attract supporters and make the Race to the Bottom the dominant loop. But what specific false meme deceives supporters into opposing solutions to the sustainability problem?

Investigation found the main false meme to be *system acceptance of the fallacious paradigm that Economic Growth Is Good above all else*. The worst thing that can happen to a nation (short of war) is a recession or even worse, a depression. The worst global event between the two World Wars was the Great Depression of 1929. The worst global event after World War Two was the Great Recession of 2008. The predominance of this false meme is the intermediate cause of subproblem A.

That Economic Growth Is Good above all else is widely acknowledged. Herman Daly, referring to his reading *The Limits to Growth* forty years earlier when it was first published in 1972, wrote in 2012 that “it is now forty years later and economic growth is still the number one policy goal of practically all nations; that is undeniable.”⁴⁵ Heinz Arndt⁴⁶ found the ascendancy of the Economic Growth Is Good meme to be a recent phenomenon:

There is in fact hardly a trace of interest in economic growth as a policy objective in the official or professional literature of western countries before 1950. But it is possible to detect in the five post-war years changes in the climate of opinion which foreshadowed the ascent of growth to preeminence. (p30) By the end of the decade [the 1950s], economic growth had, as one commentator put it, been ‘thrust to the top as apparently the supreme, overriding objective of policy.’ (p41) ...*more rapid economic growth* came to be regarded as a prophylactic or *remedy for all the major current ailments* of western economies. (p43, italics added)

“More rapid economic growth” as a “remedy for all the major current ailments” is so universally accepted that it became part of the world’s official solution to the environmental sustainability problem, **sustainable development**, defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”⁴⁷ Development is economic growth and must be *increased* to solve the problem. “[To stop the] downward spiral of poverty and environmental degradation.... What is needed is a new era of economic growth—growth that is forceful and at the same time socially and environmentally sustainable.”⁴⁸

Thus the world’s leading “solution” to the environmental sustainability problem, sustainable development, champions Economic Growth Is Good, and thereby makes the environmental sustainability *worse* instead of better. This demonstrates the dominance of the Economic Growth Is Good meme.

The low leverage points and symptomatic solutions

The Dueling Loops model and the theory of Classic Activism make it easy to conclude that activists follow **The Race to the Top among Politicians** strategies. Not having analyzed the problem in order to find its root cause, they intuitively sense that the *intermediate cause* is the universal fallacious paradigm that Economic Growth Is Good. That cause must be countered with “more of the truth,” which is the *low leverage point*. This is done with steps 2, 3, and 4 of Classic Activism: (2) find the truth in the form of the technical proper practices needed to solve the problem, (3) promote the truth, and (4) if that doesn’t work, magnify the truth with exhortation, inspiration, and bargaining. Because they push on a low leverage point, steps 2, 3, and 4 are all *symptomatic solutions*.

Substep C. Find the root causes of the intermediate causes.

Substep B found the intermediate cause is the system acceptance of the fallacious paradigm that Growth Is Good. What is the root cause of that intermediate cause? That’s the same asking: WHY is **The Race to the Bottom among Politicians** dominant most of the time? What is the root cause of that dominance?

Because the Dueling Loops model was designed to find root causes, the answer to this question is built into the model. The main root cause of successful change resistance is *the inherent advantage of the Race to the Bottom*, which causes that loop to be dominant most of the time.

Root causes must meet the five requirements of a root cause:

Requirement 1. It is clearly a (or the) major cause of the symptoms.

The Dueling Loops model clearly shows how this root cause is the major source of high change resistance. There will, however, be skepticism that something as simple as *the inherent advantage of the Race to the Bottom* could be the root cause. What about people's selfishness? What about force of habit? Basic ignorance about the problem? Voter apathy? Money in politics? And so on.

Let's cut right through this confused mishmash of possible root causes. The precise question is WHY is change resistance so *successful*? Selfishness is a cause of resistance, rather than a cause of resistance success. The same holds for force of habit, ignorance, apathy, money, etc. People are confusing subproblem A with subproblem B. Subproblem A deals with the *success* of change resistance. Subproblem B deals with the *source*. The reason for this continual confusion is that because of no formal problem decomposition, classic activists are trying to simultaneously solve subproblems A, B, C, and D without realizing it. They might as well be trying to sign four signatures simultaneously with one hand.

Such lack of decomposition is not only foolhardy. It makes solving the sustainability problem humanly impossible. On large complex problems one must divide *and then conquer: divide et impera*. This timeless strategy has worked on the battlefield, in politics, and in large engineering problems. The pattern is it works on large formidable problems of any kind. So why not bring the pattern to the sustainability problem?

Suppose you studied a political system and starting asking why resistance to solving the sustainability problem was so successful. You might decide, as many have, that it's because activists are not packaging their message well enough, or they're just not reaching the right people, or they're being outspent on media messaging and lobbying. But that's a classic activist viewpoint. These causes deal with *individual* resistance. What about *systemic* change resistance and the feedback loops behind that? Causes like these can't answer deeper questions like this at all.

But causal models like the Dueling Loops can. The model explains exactly why systemic change resistance is successful. It's because those opposing change use massive amounts of deception to trick voters and politicians into voting for what special interests want, even though that hurts the system as a whole. And what allows that deception to work? *The inherent advantage of the Race to the Bottom*.

If that advantage didn't exist change resistance would vanish, because the truth of the matter is that the sustainability problem is *the* top priority problem of our time.

We thus conclude that *the inherent advantage of the Race to the Bottom* is the central root cause of successful change resistance.

There may still be some skepticism. How can such a complex subproblem, massive global change resistance to living sustainably, have such a simple root cause, which implies a simple solution?

This situation has occurred before. Before invention of modern democracy by America and France in the late 16th century, autocratic government was the norm. This had long been terribly hard on subjects, who had few rights and were often over taxed to the point of poverty and rebellion. But all that ended with a single simple solution: addition of the voter feedback loop. Another example is the low productivity of science before invention of the Scientific Method. After it appeared, the basic problem of science, how to tell if a cause-and-effect proposition was probably true, was solved. *That each problem was solved by a single simple solution means it had a single simple root cause.* For the autocratic ruler problem (diagrammed on page 57) the root cause was no easy way to replace a bad ruler with a good one, i.e. low ruler accountability. There was no strong incentive for rulers to rule for the good of the people instead of themselves. For the low productivity of science problem the root cause was no reliable way to tell a theory that made plenty of sense from one that was actually true.

Because SIP forces you to decompose the one big problem into tightly focused subproblems, it's likely that each subproblem has a single main root cause. When they do, that's a signal that the right subproblems have been identified.

Requirement 2. It has no worthwhile deeper cause.

Why does the Race to the Bottom have an inherent advantage? That might lead to deeper more useful causes.

It hasn't for two reasons. One is that digging deeper gets into individual factors, like how people make decisions, how force of habit becomes stronger with age, how wording and framing affects infectivity, etc. This is tempting rabbit hole to dig into. Many have. But it's not productive, because it gets into causes of *individual* susceptibility to deception. This line of attack falls into the trap of the Fundamental Attribution Error. This trap has snared more classic activists than any other. It works like this: ⁴⁹ (Italics and bolding added)

A **fundamental principle of system dynamics** states that *the structure of the system gives rise to its behavior*. However, people have a strong tendency to attribute the behavior of others to dispositional rather than situational factors, that is, to character and especially character flaws rather than the system in which these people are acting. The tendency to blame the person rather than the system is so strong psychologists call it the “**fundamental attribution error**.”

In complex systems different people placed in the same structure tend to behave in similar ways. When we attribute behavior to personality, we lose sight of how the structure of the system shaped [their] choices. The attribution of behavior to individuals and special circumstances diverts our attention from the *high leverage points* where redesigning the system or governing policy can have significant, sustained, beneficial effects on performance. When we attribute behavior to people rather than system structure the focus of management becomes *scapegoating and blame*, rather than the design of organizations in which ordinary people can achieve extraordinary results.

The Fundamental Attribution Error explains why Classic Activism has such powerful appeal but fails over and over. When solving normal everyday people related (social) problems, we frequently have to win over one mind at a time. This causes the false assumption that can work in the large, such as on the sustainability problem. It cannot, because activists do not have the numbers, money, or power to change the many minds *in positions of power* required to solve the problem.

Systemic problems can only be solved by resolving systemic root causes. When strong systemic change resistance is present, as it is in the sustainability problem, it cannot be overcome by attempting to directly change the behavior of one mind at a time, as Classic Activism tries to do with steps 3 and 4. One must instead change the system, which is where all individual social agents get their most important behavioral cues from.

The second reason digging deeper is not productive is that the hypothesized root cause, the inherent advantage of the Race to the Bottom, is resolvable. Resolving it will fix the problem. So why dig any deeper? (This is a stopping rule.)

Requirement 3. It can be resolved.

Effective political deception due to the inherent advantage of deception over the truth has long been a problem. The fact that effectiveness can be greatly reduced has been known just as long. James Hoggan, in *Climate Cover-up: The Crusade to Deny Global Warming*, describes why it's necessary: (p25, italics added)

...to arm yourself against the effect of those [deceptive] tactics in the future. It's as Aristotle said more than two thousand years ago: someone who is highly trained in rhetoric can argue any question from every angle—a skill that can be used for good or ill. But Aristotle didn't teach rhetoric so shysters could play the public for fools. Rather, he was trying to make sure that people would recognize when someone was playing with the language rather than promoting the truth. *He taught rhetoric to inoculate the public against that kind of abuse.*

A voting population can be armed against the effects of deceptive tactics by inoculating them against the abuse of deceptive rhetoric. It can be done. Not perfectly, but good enough to resolve the root cause. A later chapter presents several sample solution elements to show how this can be done.

Requirement 4. Its resolution will not create other equal or bigger problems. Side effects must be considered.

By far the most important requirement of any species is the size and health of its ecological niche. Resolving the root cause of successful change resistance to solving the environmental sustainability problem will not create other problems of equal or bigger size, because no other problems affect *Homo sapiens*' niche nearly as directly.

Requirement 5. There is no better root cause. All alternatives have been considered.

This is a tough requirement to prove. No one can actually consider all alternatives because the root cause space is so vast. Thus one has to search the space intelligently.

The symptom of the change resistance subproblem is successful opposition to passing proposed laws for solving the environmental sustainability problem. The immediate cause of that is a dominant **Race to the Bottom among Politicians**. Inspection of the model shows this dominance is due to one key feature of the loop: undetected false memes. This node is not in the Race to the Top. The node is *the* feature differentiating the Race to the Bottom from the Race to the Top. It is therefore *the* feature explaining the root cause of the Race to the Bottom's dominance. High undetected false memes is the same as successful exploitation of the inherent advantage of the Race to the Bottom. Thus the root cause has been found by inspection of the physical system. It's the only apple on the table.

Is there a better model that would explain the symptoms? That might lead to a better root cause.

There might be. In fact, many improvements to the analysis are certain to be found because it's so young and is the work of a single researcher. But after fifteen years of analysis and looking for even better root causes, I've yet to find anything else even close to persuasively explaining the root cause of such successful change resistance.

Substep D. Find the feedback loops that should be dominant to resolve the root causes.

This is clearly the **You Can't Fool All of the People All of the Time** loop. Once it goes dominant the Race to the Bottom no longer has an advantage. Corruption will collapse, as will systemic change resistance to solving problems whose solution would benefit the common good.

Substep E. Find the high leverage points to make those loops go dominant.

This follows smoothly from the root cause. If the root cause is the inherent advantage of the Race to the Bottom, then we need to prevent that advantage. Looking at the model, the advantage occurs because of too many undetected false memes. How can these be greatly reduced? By raising detected false memes. How can that be done? By raising general ability to detect political deception from low to high. That is the high leverage point. Solutions must push there to solve the subproblem, as demonstrated in Run 14 on page 116. That scenario concluded that “*If the model is correct, then raising the general ability to detect political deception from low to high is all it takes to make the Race to the Top go dominant and thus solve the change resistance part of the problem.*” To summarize, the high leverage point is: *Raise general ability to detect political deception from low to high.*

The evidence

The Dueling Loops of the Political Powerplace model offers an insightful explanation of why change resistance to solve the sustainability problem is so high. It’s because of the unresolved root cause of *the inherent advantage of the Race to the Bottom*. This causes the Race to the Bottom among Politicians feedback loop to be the dominant loop most of the time in most countries. Since that loop is controlled by each country’s most powerful special interests, the average political system places a low priority on solving common good problems like sustainability.

The high leverage point is *raise general ability to detect political deception*. Once that’s done the system will flip from a dominant Race to the Bottom to a dominant Race to the Top. After that, political systems in which this has occurred will aggressively seek to solve common good problems, including sustainability.

But does the Dueling Loops structure really exist?

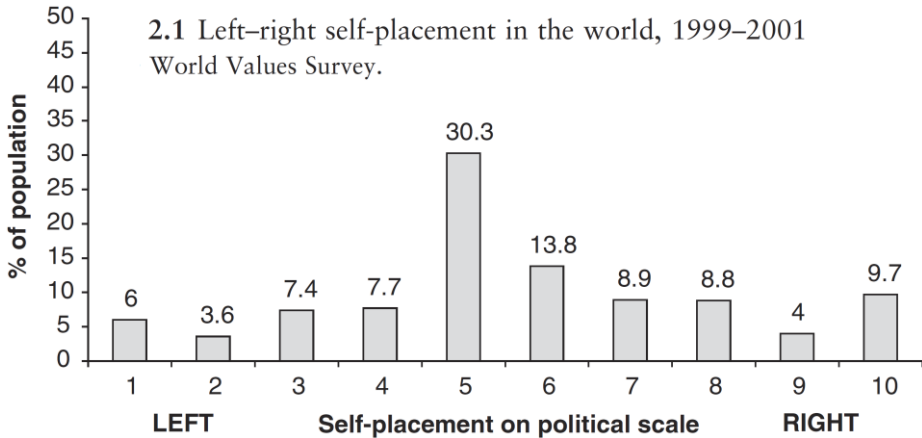
The evidence shows it does. Noel and Thérien, in their book on *Left and Right in Global Politics*, 2008, found that “global politics is first and foremost a debate between the left and the right. ... The left-right dichotomy occupies a special place, as the most enduring, universal, and encompassing of all political strategies.” (p3)

The Dueling Loops explains why the left-right dichotomy exists. The two dueling loops each embody an enduring, stable political strategy. The Race to the Top houses the progressive left, who lean towards equality of opportunity and justice because that optimizes the common good. The Race to the Bottom houses the conservative right, who profess the freedom of the individual, the power of free markets, and preference for the status quo, because that maximizes what today’s powerful special interests want.

The dominant special interest changes over time. Currently it is *Corporatis profitis*. This explains why the right’s chief current concern is the power of free markets

and unlimited economic growth. The status quo is preferred, because it favors *Corporatis profitis* and his allies. Freedom of the individual is championed, because that lets individuals do whatever they want, with a minimum of regard for how that affects equality of opportunity or the common good. What “freedom of the individual” really means is *Corporatis profitis* managers don’t want to be regulated.

Noel and Thérien present the strongest evidence of the dominance of the Race to the Bottom that I’ve encountered. Page 34 displays the figure below.⁵⁰



The data covers seventy-eight societies with a representative sample of at least 1,000 people per society. The respondents saw 5 as the midpoint since there’s no point at 5.5, which would be the true midpoint. 25% saw themselves as on the left, 30% in the center and independent, and 45% on the right. Even if 5.5 is used as the midpoint, 45% are on the left and 55% are on the right. The right is clearly dominant. The 30% in the center corresponds to the stock of neutralists in the Dueling Loops model.

Finally Noel and Thérien place environmentalism on the political spectrum, “with environmentalists on the left and their opponents on the right. Companies like British Petroleum or General Electric may have jumped on the environmental bandwagon, but overall business still tends to oppose environmental policies that threaten to reduce profits.” (p211)

As another example of what the data show, below is an extract from a presentation on conservative versus liberal think tanks, by Andrew Rich, assistant professor of political science at the City College of New York: (*Italics added*)⁵¹

For example, one of the questions on my survey asked think tank leaders about the criteria they used when selecting or promoting full-time staff. They had nine options to choose from. Leaders of conservative think tanks most often named *political or ideological orientation as the most important consideration when hiring staff*. Almost three-quarters of the leaders of

conservative think tanks named political or ideological orientation at the top when making decisions about who to hire. Next in importance were issue expertise, media and public affairs experience, and a record of publication.

By contrast, for the leaders of liberal think tanks, *issue expertise and education were most important*. Liberals placed a premium on advanced degrees and proper training. Ideology was further down the list with a 30 point spread between conservatives and liberals on that characteristic.

Andrew went on to interpret the above data this way:

Conservative leaders are interested in hiring politically conservative people above all else and they want folks who are prepared with experience to make a contribution in the war of ideas. Progressives have a different set of priorities: a focus on training, knowledge and expertise.

The Dueling Loops, however, allow a different and deeper interpretation. To me this data means that conservative think tanks are promoting a “political or ideological orientation” by any means necessary, while liberal think tanks are promoting the truth, which is why “issue expertise and education were most important.”

Solution requirements specifications

One benefit of a formal comprehensive process like SIP is that social problem solving may be treated as social system engineering. Large social systems self-evolve. That self-evolution may be steered, somewhat, by incrementally producing solution requirements for existing problems. Each problem is analyzed for its causal structure and especially its high leverage points, where solution elements must push. Solution requirements are then specified, contracted, developed, tested, and implemented. Waves of successive improvement will cause a system to reach successively higher states of desired behavior until the system goal state is achieved.

That’s the conceptual vision. It duplicates how engineering occurs in many other fields, where requirement specifications are routinely used to contract for many types of construction. Each newly engineered large-scale project, like a dam, a manufacturing plant, or a space program, successively improves a field of engineering. It is a matter of time until that practice comes to social system engineering.

The concept is young. Perhaps you will have ideas on how to improve it. An example of a solution requirements specification is shown on the next page.

Solution Requirements Specification for	
Subproblem A – How to Overcome Change Resistance	
1. Main problem	The global environmental sustainability problem
2. Subproblem	How to overcome change resistance
3. Subproblem symptoms	Successful opposition to passing proposed laws for solving the sustainability problem
4. Intermediate cause	System acceptance of the fallacious paradigm that Economic Growth Is Good above all else
5. Root cause	The inherent advantage of the Race to the Bottom
6. High leverage point	Raise general ability to detect political deception from low to high
7. Model	Basic Dueling Loops of the Political Powerplace
<p>9. Standard Requirements: Solution elements must resolve the root cause by pushing on the high leverage point, in such a manner that a permanent system mode change occurs. The new root cause forces must be engineered such that new or strengthened feedback loops lock the system into the new mode.</p> <p>You can't manage what you can't measure. Changes in the root cause force must be measured. A measurement method shall be used to refine solutions under development, to evaluate the effectiveness of implemented solutions, and to monitor the long-term health of solutions.</p> <p>These specifications represent a solution strategy hypothesis. Solution elements can be designed to push on the high leverage point. Then the solutions can be tested and evolved until final solutions emerge that can solve the problem via large-scale implementation.</p>	
<p>10. Measurement Considerations: We can offer this guideline:</p> <p>An accurate method of measuring <i>ability to detect deception</i> (ATDD) shall be developed. For groups of people or political units tested, baseline ATDD shall be compared to ATDD after various solution elements are applied. After solution application, ATDD shall be measured immediately and then periodically, to determine how long solution effects last. ATDD can also be called the level of truth literacy, i.e. the percent of falsehood spotted.</p>	
<p>11. Solution Considerations: See the analysis write-up for details on model behavior and how general ability to detect political deception can be raised. The public's ability to detect false memes used for political purposes must be raised from low to high. This can be done directly, such as by education, or indirectly, such as by Truth Ratings, a Quality of Life Index, and a Sustainability Index, or both. We expect both will be the most effective.</p>	

Subproblem B – How to Achieve Life Form Proper Coupling

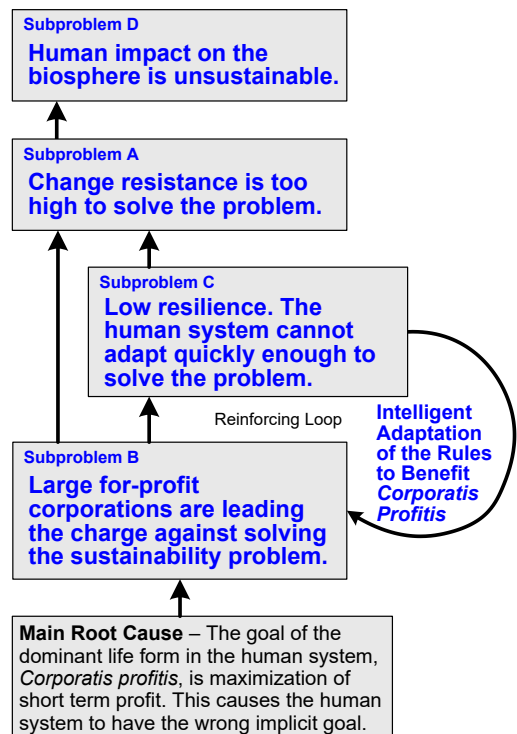
Slashing away the fog of complexity can do wonders for seeing what really matters. When placed under the piercing scrutiny of root cause analysis, the sustainability problem was found to have an astonishing feature: the entire problem has a single main root cause. It's a house of cards! Resolve the main root cause and the house collapses and the problem is solved. The problem has a surprising fragile status quo, but only if you can analyze your way through a treacherous jungle of confounding complexity and find the bottommost card in the house of cards. This chapter presents that analysis.

The main root cause was introduced earlier in the social force diagram of the unsustainable mode, page 78. That diagram shows how the four subproblems interact. Subproblem B, the bottommost subproblem, contains the main root cause. A high level version of that diagram is shown.

That one main root cause lies at the bottom was a thrilling discovery (and to be honest almost unbelievable) because it instantly explains the whole problem. It all fits together. The main root cause is *the* source of all the other subproblems. There's no need to look any further for where environmentalism needs to focus to solve the sustainability problem.

What was almost unbelievable was that the sustainability problem as a whole has such a simple high level structure. The problem is hideously complex. But the high level structure is not. It has only five nodes, six relationships, and one feedback loop. This suggests the fundamental solution will be just as simple. There's some very good news here, *if* the main root cause is reasonably correct.

High Level Root Cause Analysis, Unsustainable Mode



This raises a critical question: Is this really the main root cause? We propose that it is. The causal chain running from symptoms to the main root cause may be easily traced by inspection of the system. The first step is to identify subproblem B. Tracing the causal chain then proceeds until it arrives at the main root cause. A **main root cause** is one that causes one subproblem to cause all the other subproblems.

Identifying subproblem B

Our tracing begins by looking back at the change resistance subproblem. Its intermediate cause is *system acceptance of the fallacious paradigm that Economic Growth Is Good above all else*. Analysis of the change resistance subproblem found the root cause for that acceptance to be *the inherent advantage of the Race to the Bottom*. That explains the *success* of change resistance. But what explains the *source* of change resistance? Who is promoting the fallacious paradigm of growth, growth, growth? Whoever it is, they must be extremely powerful. Tracing the causal forces, we find compelling evidence of who this entity might be:

“Towards the end of the 1970s we witnessed a turning point in history. The rise of Thatcherism in the UK and Reaganism in the US, as well as the conversion of labour and social democratic governments in countries such as Australia and New Zealand to free market policies, marked a shift in government priorities. Corporate interest began to take priority over national interests and the nation state began to fade as the pre-eminent organizing principle for human activities.”⁵²

“...the 20th century has seen three related developments: the growth of democracy, the growth of corporate power, and the growth of corporate propaganda as a means of protecting corporate power against democracy. ...it is clear that democratic power was progressively eclipsed by corporate power during the 20th century.... As a consequence, *corporations now completely dominate the political process*.”⁵³ (Italics added)

“...the transnational or multinational corporation... has been increasing almost exponentially in size and scope... of the 100 largest economies of the world, 53 are multinationals.... Their power and effect are almost incalculable in regards not only to the economy but to politics, society, and culture. They have an impact on practically every sphere of life, from policy making and community, and from the future of work to the future of the nation-state. Multinationals are, in fact, the new Leviathans of our time.”⁵⁴

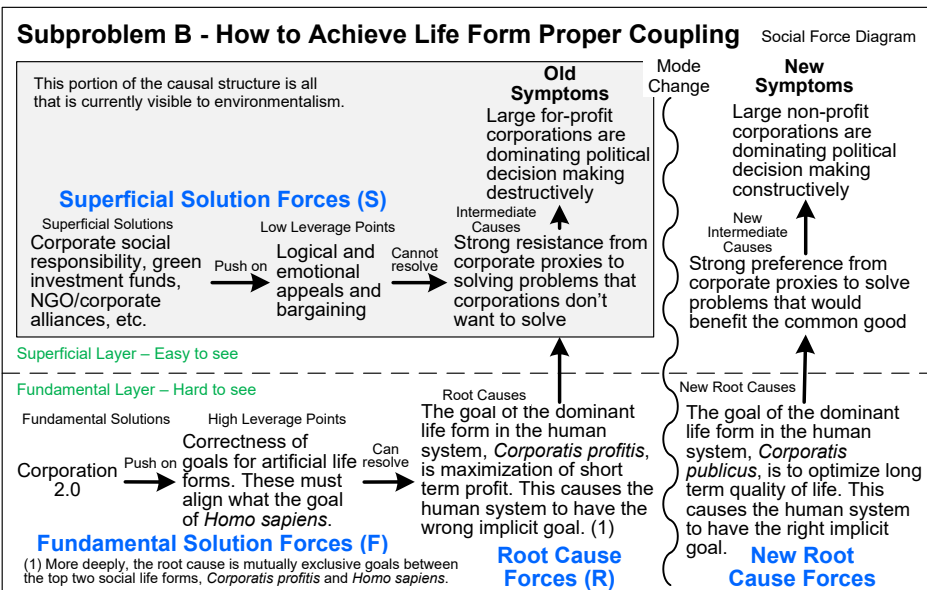
“Capitalism as we know it today... includes ...the modern corporation as its principle mechanism.... Inherent in the dynamics of capitalism is a powerful drive to earn profits, invest them, innovate, and thus grow the economy.... The capitalist system, whatever its shortcomings, is very good at generating growth. These features of capitalism, as they are constituted to-

day, work together to produce an economic and political reality that is highly destructive of the environment. ... The first tenet of globalization design is to give primary importance to the achievement of ever-more rapid, never-ending corporate economic growth—hypergrowth.”⁵⁵

Evidence like this strongly points to the main promoter of the Economic Growth Is Good meme. It is the modern large for-profit corporation. While corporations provide many benefits, “corporations now completely dominate the political process” and oppose solving many common good problems, like environmental sustainability. This behavior indicates a distinct subproblem, which becomes subproblem B: *Large for-profit corporations are leading the charge against solving the sustainability problem.* Its symptoms are *Large for-profit corporations are dominating political decision making destructively.*

The social force diagram

What the analysis found is summarized below. As before, all environmentalists can see is what’s in the gray box. This is where grassroots activists, writers, scholars, politicians, NGOs, and everyone else thinks and works, when trying to overcome *strong resistance from corporate proxies to solving problems that corporations don’t want to solve.* That’s obviously the cause of why corporations are dominating decision making destructively. How can that resistance be overcome? That too is obvious: with *logical and emotional pleas and bargaining.* This is done with solutions like *corporate social responsibility, green investment funds, NGO/Corporate alliances, etc.* But none of this has worked, indicating these are superficial solutions.



The diagram contains a useful insight. Consider the intermediate cause: *Strong resistance from corporate proxies to solving problems that corporations don't want to solve*. Environmentalists assume this resistance can be overcome *directly* by *logical and emotional appeals and bargaining*, which is a form of the “more of the truth” strategy of Classic Activism. The strategy should work but doesn't. This indicates an error in reasoning.

The error occurs in the assumption that the strong resistance can be *directly* overcome by “more of the truth.” That's a false assumption. It arises from the implied question: HOW can the resistance be overcome? Better is to *indirectly* overcome the resistance by asking an entirely different question: WHY is that resistance so strong in the first place? By asking a WHY question we have slipped into a root cause analysis mindset. The insight is that environmentalists have been asking the wrong question, a fatal error that leads to staying trapped in the gray box.

So WHY is that resistance from corporate proxies so strong? Analysis shows it's because of the main root cause: *The goal of the dominant life form in the human system, Corporatis profitis, is maximization of short term profit. This causes the human system to have the wrong implicit goal.*

For me the most outstanding feature of the diagram is it thinks in terms of system goals and life forms. The root cause is the human system presently has the wrong goal because its dominant life form, *Corporatis profitis*, has the wrong goal. The high leverage point is to change the goal of artificial life forms, particularly corporations, so that they have the right goal because it aligns with the goal of *Homo sapiens*. Once a fundamental solution pushes on the high leverage point, the system will flip into a new mode. There the new root cause is one where the dominant life form has the right goal and thus so does the human system.

Before delving into the five substeps of analysis, we must first discuss several life form concepts.

The New Dominant Life Form

Let's define a **life form** as any independent agent that follows the three fundamental requirements of evolution: replication, mutation, and survival of the fittest. Life forms can be genetic or memetic.

Here's a question: What life form has the ability to replicate instantly with almost no expenditure of energy, can mutate during replication or at any time thereafter, and, when it has failed in the battle of survival of the fittest, sells little pieces of itself to its competitors in order to minimize its own pain of death? These are fantastic powers no human could hope to have. But what if we go further, and ask what life form has the miraculous power of being in many places at the same time, has an infinite life span, and can cleave off chunks of itself and have them instantly come

alive? That would make it a formidable competitor indeed, one that could run rings around any other plant or animal. Darwin would be astounded.

But there's more: What life form totally dominates mankind, by controlling most jobs in developed countries, by determining the path of nearly all of new technology, products, and services, by controlling elections and political decisions more than any other life form, and by defining the very evolution of culture to its advantage through demand advertising, ownership of the media, and new product design? If that is not enough, what life form controls the billions of boxes in our homes that provide us with most of our "news," and most of our new knowledge once we have finished school, while at the same time subconsciously indoctrinating us to be high volume, complacent consumers? To top it off, what life form is spreading exponentially from industrialized countries to the rest of the world, and will soon dominate them all? The answer is obvious. It is large for-profit corporations, which is the **New Dominant Life Form**, also known as *Corporatis profitis*.

Thus the dominant life form on Earth is no longer genetic *Homo sapiens*. Instead, it is the modern corporation and its allies, notably the rich.

The corporate life form has not only achieved economic and cultural dominance. It has achieved *political* dominance by successful exploitation of the Race to the Bottom. It can thus endlessly thwart or delay all efforts to significantly change the human system to environmental sustainability, and just as endlessly continue to maximize Gross World Product growth so as to achieve its goal of short term maximization of profit. Globalization is mainly the deliberate spread of the New Dominant Life Form into new economic niches, cloaked in the fallacious but appealing premise that the free market/corporate system, driven by profit maximization, is the most efficient and best system possible.

The goal of an agent determines its behavior. The goal of most large for-profit corporations is to maximize the short term value (net present value) of profits. The goal of most people, once past the survival and security stage, is to maximize long term quality of life for themselves and their descendants.

These two goals are mutually exclusive. As a result, as things get better for the New Dominant Life Form they get worse for the previously dominant life form: *Homo sapiens*. For example, as Gross World Product continues to rise, sales and profits soar to unprecedented heights. However, so does pollution and natural resource depletion. While the consequences of these effects are delayed, it is only a matter of time before the quality of life for *Homo sapiens* begins to fall.

Please note this is not an indictment of all corporations and their managers. Most are doing the best they can, and are basically good. Each agent, from its own perspective, is behaving rationally. It is the life form as a whole that has the emergent property of behaving unsustainably.⁵⁶

This is the real enemy environmentalists are battling. Don't blame "bad" politicians. These are mere proxies for the real opponent: the modern corporation and its allies. Its allies include top corporate management, stockholders, the rich (the key ally), the military, and politicians, plus various large special interest groups as expediency requires, such as the religious right.

It is a paradox why *Homo sapiens* would create an entity that is more powerful than itself and has a mutually exclusive goal. Such a creation is guaranteed to cause its creator great harm, if not eventual extinction. But it is really not a paradox at all—it is an experiment gone awry. So awry, in fact, that it is time to end the experiment by redesigning that creation.

A comparison of competitive advantage

That creation has steadily pulled ahead of its closest rival. Step by tiny step, it has relentlessly changed the rules of the game to favor itself. This has been done so cleverly and in such small, imperceptible increments that few citizens have noticed, except for sudden large changes like the US Supreme Court decision on the Citizens United case in 2010, which allows corporations to spend unlimited amounts of money to influence elections. But when you examine the outcome the findings are shocking, as the table on the next page reveals.

Only in the first attribute does *Homo sapiens* have the advantage. In the second attribute they are equal. In all the rest *Corporatis profitis* has the overwhelming advantage.

Galloping galoshes! Decision by legal decision the modern corporation has built up an astronomical lead over *Homo sapiens*. These are huge, order of magnitude advantages. There is little question who is going to win the battle for niche dominance unless things change. Furthermore, because corporations march to the beat of a different drummer (maximization of profit for *corporations* instead of quality of life for *people*), they have been aggressively using these advantages to their own benefit, with only enough regard for their opponent to keep him happy and healthy enough to perform his role of incognizant worker, consumer, or corporate proxy in the political process. While this observation may appear extreme, there is little doubt it optimizes the corporate life form's goal.

The Competitive Advantage of Two Life Forms		
Attribute	<i>Corporatis profitis</i>	<i>Homo sapiens</i>
1. Can physically manipulate its surroundings	No	Yes
2. Is legally considered a person	Yes	Yes
3. Maximum life span	Infinite	About 120 years
4. Can be in many places at the same time	Yes	No
5. Can own slaves like itself	Yes	No
6. Speed of procreation	Hours	Nine months
7. Can cut itself up into little pieces, each of which can become a new life form	Yes	No
8. Can hibernate indefinitely in hard times	Yes	No
9. Body size limit	Unlimited	About 8 feet high
10. Brain size limit	Unlimited	About 1,500 grams
11. Owners have limited liability	Yes	No, since no owners
12. Has international organization with high efficiency of decision making and full power of enforcement of decisions for its life form type	Yes, the World Trade Organization	No, the United Nations
Primary energy input	Money via sales	Food and oxygen
13. Requires a physical form for its primary energy	No	Yes
14. Can transmit its primary energy instantaneously over great distances	Yes	No
15. Can store its primary energy indefinitely	Yes	No
16. Can store infinite amounts of its primary energy at no cost	Yes	No
17. Financial impact of storing its primary energy	Makes a profit by collecting interest	Must pay storage costs for food

The Principle of Competitive Exclusion

The goals of *Corporatis profitis* and *Homo sapiens* are mutually exclusive. They cannot be achieved at the same time in the same system, a fact with decisive implications.

According to the ecological **Principle of Competitive Exclusion**, when two life forms occupy the same niche, only one outcome is possible: One life form will drive out the other. If any of the other remains, it is only because its members have *adapted*, and are now living in a slightly different niche. Here's how the principle was discovered: (*Italics added*)

Georgyi Gause, the Russian microbiologist... interested in competition, discovered this principle. Gause inoculated a simple, finite culture with *Paramecium*, and... got logistic population growth. These *Paramecium* eat

bacteria, and there is only so much food in a culture to support a certain number of Paramecium.

Then he put two [different] species of Paramecium in the same culture. He got lowered growth rates of both populations. *Even more interestingly, one species always drove the other to extinction.*

This led Gause to come forth with a famous ‘principle’ that would dominate ecological research for nearly the entire century: *Two species that use resources exactly the same way cannot coexist. One will drive the other to extinction.* ⁵⁷

The stunning data from one of Georgyi Gause’s actual experiments is shown.

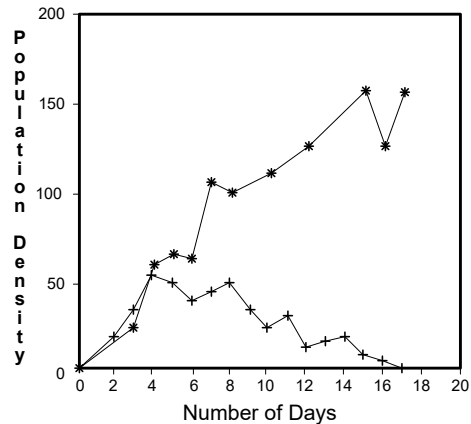
The Principle of Competitive Exclusion explains what’s happening in the sustainability problem. Two life forms, one genetic and one memetic, are battling for control of the biosphere. According to the principle, the loser must adapt to a different niche or go extinct. There are no other choices.

It appears that *Homo sapiens* has chosen adaptation rather than extinction, so he is now subservient to the modern corporation and its allies. Depending on your point of view, his new niche is a powerless employee and consumer, or a *Corporatis profitis* slave. Perhaps it’s all three. This transition is still in progress in the less industrialized areas of the world.

Once *Homo sapiens* ceded control of the biosphere to the New Dominant Life Form an ecological niche succession event occurred. This has happened billions of times before in the genetic world, as one species overcame another in a struggle for survival of the fittest in a niche. It’s probably happened trillions of times in the memetic world.

Niche succession occurs when successful competition from one life form drives another life form out of the same niche. This occurs due to superior strategies, superior physical abilities, or both. Sometimes luck is a factor.

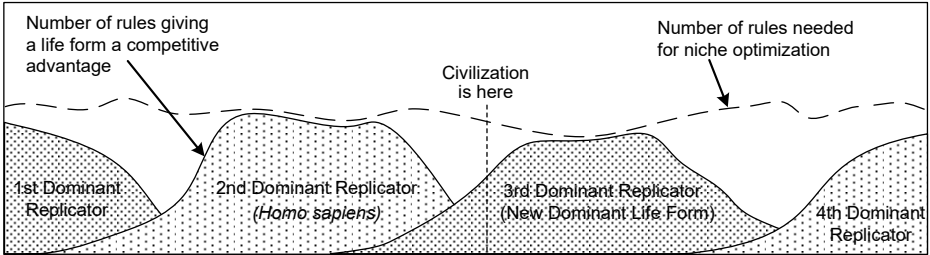
The diagram below illustrates the cycle of battles of niche succession. Instead of the way conventional evolution theory usually uses population for the niche limit (carrying capacity) and measure of niche fill, a life form’s rule set is used. The wavy horizontal dashed line is the number of rules needed for niche optimization in the



Results of competition between two species of Paramecium with similar requirements. Both did well for four days. After that the species represented by the lower curve was driven to extinction in 17 days, while the other species thrived.

model. The line varies because except in Petri dishes, niches are always changing. The rising and falling curves are the Competitive Advantage Rules of different life forms. The one with the most control of the niche's resources (which includes other life forms in the niche) is the dominant replicator. Except during transition there can be only one dominant replicator in a niche.

The Endless Cycle of Ecological Niche Succession



On the left, the diagram starts with the 1st dominant replicator almost at the limit. At the same time, the dominance of the 2nd dominant replicator starts growing from zero. As it grows, dominance of the 1st replicator falls even further and goes extinct. The 2nd dominant replicator evolves to fill the niche and enjoys exclusive control of the niche for a while. Then another niche succession event begins, as the 3rd dominant replicator starts to grow. The cycle repeats indefinitely.

Substitute *Homo sapiens* for the 2nd dominant replicator and the New Dominant Life Form for the 3rd one, and you have the niche succession event underway today.

Simulation runs – How the Alignment Growth loop could solve the sustainability problem

To support the analysis the Dueling Loops model was extended by adding The Artificial Life Form Subsystem, described in the appendix on page 375. The subsystem added several feedback loops. The most important is the **Alignment Growth** loop. As the strength of this loop grows, the goals of artificial life forms (notably corporations) come closer and closer to agreement with the goal of *Homo sapiens*.

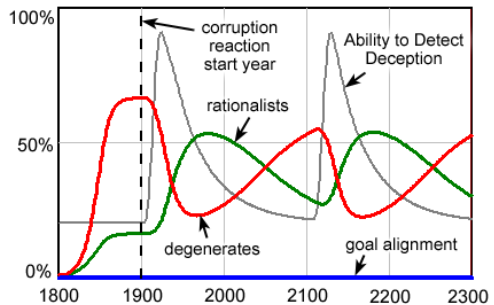
Let's run the extended Dueling Loops model to see how pushing on various leverage points will affect system behavior. The settings for each simulation run are shown in the table below. Settings that change from previous runs are bolded. In all remaining runs repulsion to corruption equals 20%, and the corruption critical point is 65%. ALF means artificial life forms.

Run 23 – Earlier on page 121 we presented run 16 as the basic problem to solve. To ensure that by adding the **Alignment Growth** loop we have preserved the behavior we had before, run 23 duplicates the behavior of run 16 exactly. This is done by turning off the **Alignment Growth** loop by setting decisions per year to zero.

Artificial Life Form Subsystem Model Settings	Run 23 is the problem to solve Simulation Runs Table 4									
	23	24	25	26	27	28	29	30	31	
Preferred goal correctness	NA	NA	NA	80%	NA	80%	100%	80%	NA	
Goal correctness change start year	2300	2300	2300	2020	2300	2020	2020	2020	2300	
Preferred process maturity	NA	NA	NA	NA	80%	80%	100%	80%	NA	
Process maturity change start year	2300	2300	2300	2300	2020	2020	2020	2020	2300	
Corruption reaction start year	1900	1900	2010	2010	2010	2010	2010	2300	2300	
False meme size	2.4	2	2	2	2	2	2	2	2	
Decisions per year	0	.1	.1	.1	.1	.1	.1	.1	.1	
Results										
Percent rationalists, cyclic or final	Very cyclic	Very cyclic	Very cyclic	100%	100%	100%	100%	100%	24%	
Goal alignment, range or final	0	5% to 8%	5% to 8%	84%	84%	85%	95%	90%	3%	
Year alignment reaches 50%	NA	Never	Never	2108	2108	2052	2045	2056	Never	
Years to reach 50% from 2010	Never	Never	Never	98	98	42	35	46	Never	

To make the graph easier to read the corruption reaction start year is marked. This is the year the ability to detect deception subsystem is turned on. After that, whenever corruption rises above the corruption critical point the reaction to excessive corruption starts.

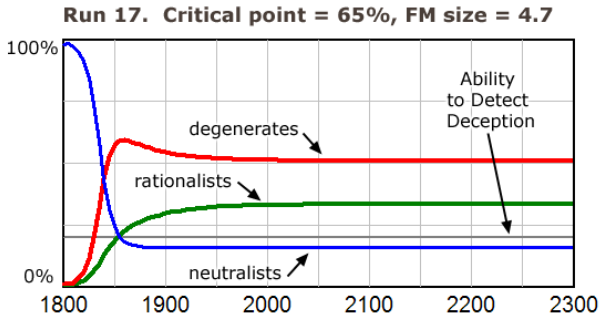
In the run 23 graph the reaction start year is 1900. Corruption equals the number of degenerates divided by degenerates plus rationalists. In 1900 corruption is 80%. Since this exceeds the corruption critical point of 65% a reaction is triggered immediately. As the graph shows, this leads to severe cyclic behavior. The impact of these bouts of extreme corruption would be seen in society’s inability to avoid problems such as the unjustified Iraq war of 2003, severe recessions, or environmental collapse. These problems are avoidable if **The Race to the Top among Politicians** is dominant. But when the Race to the



Run 23. Reference mode, the same as run 16. This is the basic problem to solve.

Bottom is dominant instead, rampant use of political deception leads invariably to large problems like those listed. These are cyclic because their sudden appearance causes people to wake up, solve the problem, see that it was caused by mass deception, and throw the deceivers out in the next elections. As this happens the number of rationalists rises and the number of degenerates falls. But since there's nothing in the system keeping Ability to Detect Deception permanently high, eventually another cycle occurs. And another.

A more sinister scenario occurs when the degenerates figure out what a society's corruption critical point is and keep the symptoms of deception below it somehow. Then a cycle is never triggered. Instead, society degrades through a long spell of corrosive corruption that leave a country or region in social, economic, and/or environmental ruin. This is what happened in run 17.

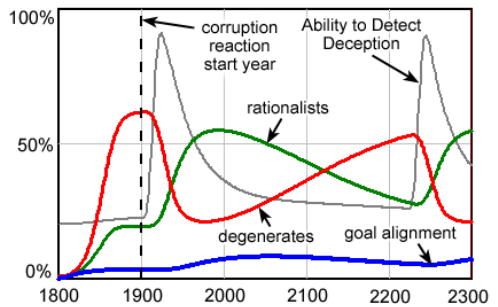


Runs 18 and later went on to show how society

would need a higher corruption critical point to counter the degenerate's strategy of a false meme size of 4.7. So which of these runs represents the problem to solve? History has not been smooth in terms of bouts of mega social problems. Therefore we need to pick a run with strong cyclic behavior. That's why run 16 is a reasonable choice for a rough representation of the problem to solve.

As we continue examining more simulation runs, don't think of the graphs as just curves for numbers in a model. The curves reflect the agony or the joy of living for billions of real people.

Run 24 – In runs 24 and later the **Alignment Growth** loop is on and false meme size equals 2. This size is the degenerate's best strategy given the small changes the **Alignment Growth** loop causes. Run 24 duplicates the behavior of run 23 almost perfectly because the effect of the loop is currently so minor, except for a slightly longer cycle. Here's why:



Run 24. Alignment loop on and false meme size = 2. The results are almost identical to run 23. Now have full Dueling Loops model.

In run 24 current goal correctness of artificial life form goals is 10%. In

other words, the goals of the New Dominant Life Form and *Homo sapiens* are almost completely mutually exclusive. Only 10% of their goals agree.

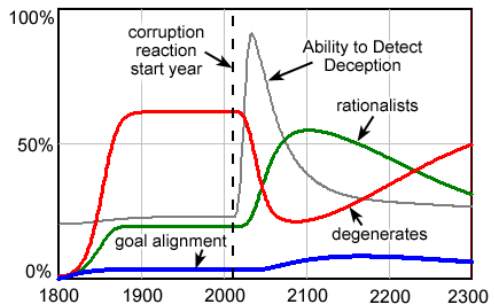
10% is a very rough estimate, but it doesn't have to be exact. It only has to be in the ballpark, because it's the structure of the model that makes the difference in how the system behaves. If the structure is reasonably correct, then ballpark estimates for node values works just fine for our purposes. This is a qualitative model rather than a quantitative model. Its purpose is to strategically understand system behavior, rather than duplicate or predict exact behavior.

In run 24 current process maturity of the political decision making process is 10%. This reflects the abysmal performance we seen in the ability of governments to proactively solve mega social problems. What dominates political discourse in most countries is not what really matters in terms of optimizing the common good for all and their descendants, but what matters to the New Dominant Life Form. That life form's goal is to maximize the net present value of profits. So whatever it takes to silently and deceptively achieve that goal is what dominates discourse and thus political decisions.

Now that the Alignment Growth loop is on, the effects of current goal correctness and current process maturity affect goal alignment. This stays very low, bobbing up and down in a range of 5% to 8%. This is too low to have any noticeable affect on the other curves.

Run 25 – In this run the corruption reaction start year is moved from 1900 to 2010, shifting the cyclic behavior to the right.

2010 is about now. The forces of degeneration have been growing. They have recently grown so strong that if a reaction to corruption is going to occur, it should happen now because at least three large wakeup call catastrophe events have occurred lately. Curiously, there's one event



Run 25. The corruption reaction start year is moved from 1900 to 2010. This shifts the reaction to about now for realism.

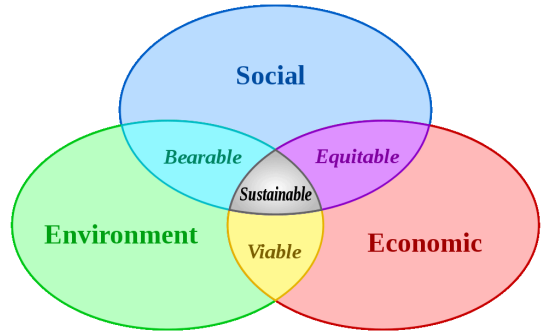
for each of the three pillars of sustainability (shown on the next page), which indicates how systemic the effects of degeneration have become. ⁵⁸

The **first event** was the totally unjustified Iraq war of 2003. A smokescreen of deception centering on weapons of mass destruction (which were never found and didn't exist, because Iraq had stopped its nuclear, chemical, and biological weapons programs in 1991) and accusations that Saddam Hussein had harbored and supported al-Qaeda (which turned out to be blatantly false). War is a social sustainability problem. A society is socially unsustainable if it cannot avoid wars.

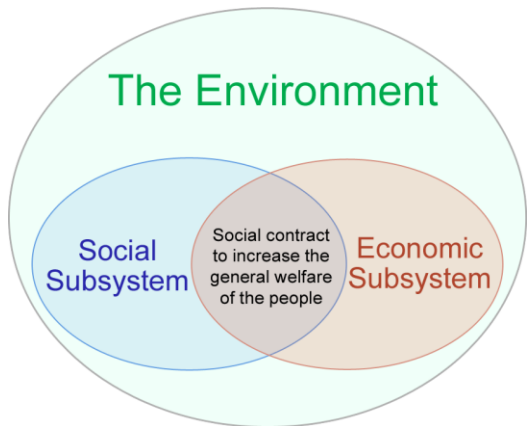
The **second event** was the ominous news in 2008 that carbon emissions were rising much faster than the IPCC's (Intergovernmental Panel on Climate Change) models had predicted. The difference was alarming: "The growth rate of [fossil fuel] emissions was 3.5% per year for 2000-2007, an almost four-fold increase from 0.9% per year in 1990-1999. ... This makes current trends in emissions higher than the worst case IPCC-SRES scenario."⁵⁹ A four-fold increase is clear, shocking evidence it's time for society to wake up and do something. Emissions growth is an environmental sustainability problem.

The **third event** began in 2007 with collapse of a global housing bubble. This, combined with overshoot in consumer credit, overinvestment in high risk new financial instruments, and dangerously low banking capital-to-asset ratios, led to widespread bank insolvency. This triggered a recession in late 2008 that grew so large it has rivaled the Great Depression in magnitude. Recessions are an economic sustainability problem.

These three events are so large that they, and others like them due to the same underlying reasons, should be causing a corruption reaction about now. That's why the corruption reaction start year is 2010.



The three pillars of sustainability are a popular, simplified way to envision complete sustainability. When a society has all three pillars it is fully sustainable. The diagram illustrates how the three pillars work together.

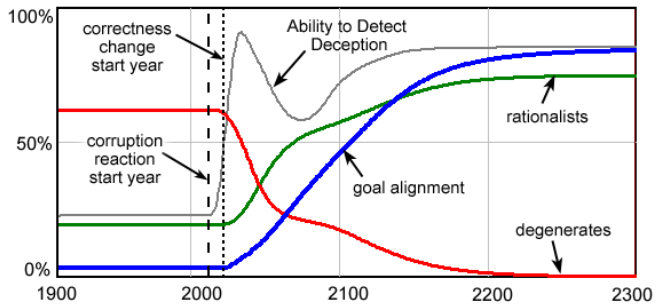


The two subsystems of the environment – This "ecosystem health" perspective shows why environmental sustainability must have the highest priority of the three main types of sustainability. The maximum health of the two subsystems is determined by the health of the greater subsystem they lie within. Thus social problems like poverty and disparity of wealth and economic problems like level of GDP must always take a back seat to environmental sustainability.

Run 26 – From this point forward, the graph starts at 1900 instead of 1800. There’s no need to show the simulation coming to equilibrium. It’s distracting and adds little to the story these graphs can tell.

In this run we begin to turn on the full force of the **Alignment Growth** loop. The preferred goal correctness of goal alignment is set to 80% and the goal correctness change start year moves from 2300 (which means it never happens) to 2020 (so it will happen then). This is ten years after the reaction to corruption begins. It will take about that long for problem solvers to get solution elements in place to begin pushing on the high leverage point of correctness of goals for ALFs.

Pushing on a high leverage point is so effective it always causes dramatic change in a system’s behavior. As the graph shows, the cyclic behavior has vanished. Goal alignment soars to 84%. The number of rationalists rises to a high level. Best of all, the degenerates go extinct.



Run 26. The correctness change start year moves from 2300 to 2020. The cyclic behavior disappears and goal alignment soars to 84%.

They are wiped out. Overall, this is a tremendous improvement.

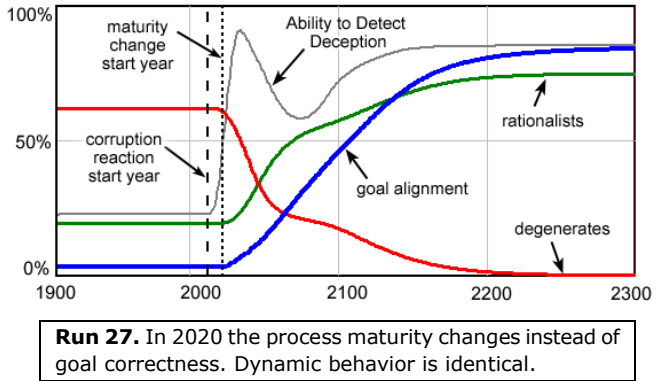
But it’s not enough. Look how long it took for goal alignment to reach 50%: 98 years. It will take at least 50% alignment for the New Dominant Life Form to drop its change resistance and start actively helping humans to solve the sustainability problem. Since we need a tangible measure of when the model can “solve” the problem, let’s say that occurs when alignment reaches 50%. (Later this measure will be when percent of optimal stewards niche filled reaches 50%.)

Here’s why the rationalists curve reaches about 75% on the graph but percent rationalists reaches 100% in the table of simulation runs. Percent rationalists = rationalist / (rationalists + degenerates). The rationalists curve is the number of rationalists, rather than percent rationalists. The same holds for the degenerates. At the end of the run there are about 75 rationalists, 25 neutralists, and no degenerates.

As big an improvement as it is, run 26 is not good enough. How can we do better?

Run 27 – Run 26 changed goal correctness. This is one of the two identified high leverage points in the **Alignment Growth** loop. So what happens if we change process maturity instead? Will that work any better?

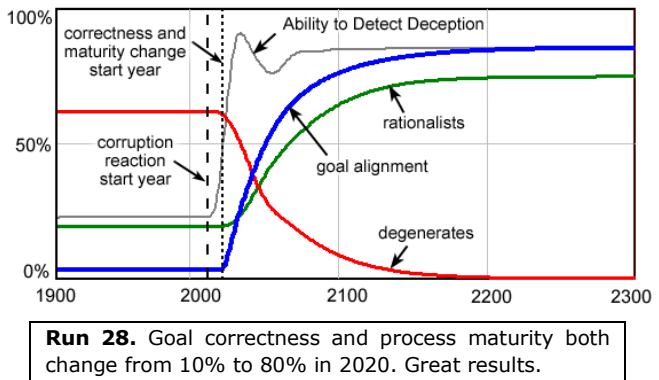
No. It works exactly the same. This is due to the formula used to calculate quality of political decisions, as explained on page 380. The correctness of goals for ALFs and maturity of decision making process nodes affect the calculation equally, as seen in the equation used:



$$\text{maturity of decision making process} \times \text{correctness of goals for ALF's} \times \text{percent rationalists} = \text{quality of political decisions}$$

Thus changing each node separately has the same effect. This raises the obvious question: What happens if we raise both to 80% in 2020?

Run 28 – We have marvelous results at last. Instead of goal alignment reaching 50% in 2108, it reaches it in 2052. This is only 32 years after changing goal correctness and process maturity in 2020. Final goal alignment inches up a little more, from 84% to 85%.



Now the model is starting to pay off. We can see what points in the system we should be pushing on to get the behavior we want.

These are super curves, *if* we can achieve them. Because we understand the structure of the problem we have become system puppet masters. We push, and the system responds as anticipated.

Now that we've extended the Dueling Loops model and seen how it works, let's turn our attention to:

The five substeps of analysis

Proper coupling occurs when the behavior of one system affects the behavior of other systems in a desirable manner, using the appropriate feedback loops, so the systems work together in harmony in accordance with design objectives. **Life form improper coupling** occurs when two or more social life forms are improperly coupled. The symptoms of life form improper coupling for subproblem B are painfully obvious: *Large for-profit corporations are dominating political decision making destructively.* They are so successful at dominance they have become the New Dominant Life Form, also known as *Corporatis profitis*.

Substep A. Find the immediate cause of the problem symptoms in terms of the system's dominant feedback loops.

The previous chapter analyzed the *success* of change resistance. This chapter analyzes the *source* of change resistance. The previous chapter also presented the basic Dueling Loops model, making this substep easy to perform. **The Race to the Bottom among Politicians** is the dominant loop most of the time. The loop is the immediate cause of high systemic change resistance. It's also the immediate cause of life form improper coupling because it is large for-profit corporations who are driving exploitation of the loop.

Thus a dominant Race to the Bottom feedback loop is the immediate cause of two subproblems, as listed in the Summary of Analysis Results on page 88. The loop's dominance explains the *success* of change resistance. It also explains the *source* of that change resistance.

Substep B. Find the intermediate causes, low leverage points, and symptomatic solutions.

WHY are *large for-profit corporations dominating political decision making destructively*? How are they doing that? Who is actually standing in for *Corporatis profitis*, since he cannot physically manipulate his surroundings, his only competitive advantage weakness? By inspection the answer is that domination is due to *strong resistance from corporate proxies to solving problems that corporations don't want to solve*. This is the intermediate cause.

Confronted with that strong resistance from corporate proxies, it's obvious what to do. *Logical and emotional appeals and bargaining* should work like a charm. All you have to do is tell corporations the truth about why they should be sustainable and they will do it. (The logical step) If that doesn't work, try appeals like do you want to leave a world in environmental collapse for your children, or don't you want to be socially responsible? (The emotional appeal step) And if that doesn't work, then talk to a few corporations about what it would take for them to be more sustainable. (The bargaining step) This is the low leverage point.

A wide range of solutions for pushing on the leverage point have been tried. This includes *corporate social responsibility*, *green investment funds*, *NGO/Corporate alliances* like Earth Watch's many corporate partnerships,⁶⁰ "going green" campaigns for corporations, sustainability certifications, boycotts, getting corporations to use the triple bottom line, Certified B Corporations, and more. These are the symptomatic (superficial) solutions. They have largely failed.

Substep C. Find the root causes of the intermediate causes.

Finally we arrive at the most important root cause in the book because it's the cause of the all the other subproblems.

Substep A found that **The Race to the Bottom among Politicians** is the immediate cause dominant loop. Substep B found the cause of loop dominance is *strong resistance from corporate proxies to solving problems that corporations don't want to solve*. What's the root cause of that intermediate cause? WHY is that resistance so ferociously strong and systemic?

This question is so hard to answer it took years. Half that time was figuring out the right question in the first place. The other half eventually led to this line of reasoning:

The Competitive Exclusion Principle states that when two life forms compete in the same niche, one will come to dominate the niche. The other will go extinct or adapt to a different niche. In the control-of-the-biosphere niche, *Corporatis profitis* has clearly won. It's dominant. The loser, *Homo sapiens* has adapted to a different niche where he plays the role of good consumer, good employee, compliant voter, and even more compliant corporation proxy. He's content with this role, because he's under the illusion that he's dominant and in control. The mass deception machine run by corporate proxies creates this comforting illusion. But like most mass illusions, the audience pays a hidden price: the New Dominant Life Form is destroying the system both life forms live in. WHY is that?

Answering that question requires a deep grasp of how system goals work. An **agent** is an independent entity with the ability to pursue a goal. A **social agent** is an agent in the human system, such as people, nations, organizations, cultures, and religions.

All social systems have goals because all social systems are composed of social agents and all social agents have goals. Understanding social system goals is indispensable when attempting to change the behavior of a social system. Here's what Peter Senge, the man who brought systems thinking to the business world with *The Fifth Discipline* in 1990, has to say on this topic: (Italics added to final paragraph. The rest are in the original.)

What makes balancing processes so difficult [to see] in management is that the goals are often implicit and no one recognizes that the balancing process

exists at all. I recall a good friend who tried, fruitlessly, to reduce burnout among professionals in his rapidly growing training business. He wrote memos, shortened work hours, even closed and locked offices earlier—all attempts to get people to stop overworking. But all these actions were offset—people ignored the memos, disobeyed the shortened hours, and took their work home with them when the offices were locked. Why? Because an unwritten norm in the organization stated that the *real* heroes, the people who really cared and who got ahead in the organization, worked seventy hours a week—a norm that my friend had established himself by his own prodigious energy and long hours.

To understand how an organism works we must understand its balancing processes—those that are explicit *and* implicit. We could master long lists of body parts, organs, bones, veins, and blood vessels and yet we would not understand how the body functions—until we understand how the neuromuscular system maintains balance, or how the cardiovascular system maintains blood pressure and oxygen levels. This is why many attempts to redesign social systems fail.

The state-controlled economy fails because it severs the multiple self-correcting processes that operate in a free market system. This is why corporate mergers often fail. When two hospitals in Boston, both with outstanding traditions of patient care, were merged several years ago, the new larger hospital had state-of-the-art facilities but lost the spirit of personal care and employee loyalty that had characterized the original institutions. In the merged hospital, subtle balancing processes in the older hospitals that monitored quality, paid attention to employee needs, and maintained friendly relationships with patients were disrupted by new administrative structures and procedures.

Though simple in concept, balancing processes can generate surprising and problematic behavior if they go undetected.

In general, balancing loops are more difficult to see than reinforcing loops because it often *looks* like nothing is happening. There's no dramatic growth of sales and marketing expenditures, or nuclear arms, or lily pads. Instead, the balancing process maintains the status quo, even when all participants want change. The feeling, as Lewis Carroll's Queen of Hearts put it, of needing “all the running you can do to keep in the same place” is a clue that a balancing loop may exist nearby.

Leaders who attempt organizational change often find themselves unwittingly caught in balancing processes. To the leaders, it looks as though their efforts are clashing with sudden resistance that seems to come from nowhere. In fact, as my friend found when he tried to reduce burnout, the resistance is a response by the system, trying to maintain an *implicit system*

goal. Until this goal is recognized, the change effort is doomed to failure. ... Whenever there is ‘resistance to change’ you can count on there being one or more ‘hidden’ balancing processes. ⁶¹

“Balancing processes” refers to balancing feedback loops, which contain goals. A balancing loop (aka goal seeking loop) causes a system to automatically pursue the loop’s goal.

Like an ecological niche, a social system contains a single dominant agent due to competitive exclusion unless dominance is in transition. Building on this and Senge’s advice to always consider implicit system goals, we arrive at a primary principle of social system behavior, the **Principle of Social System Goals**: Over time, the goal of the dominant agent in a social system becomes the goal of the system. Let’s apply this principle.

Earlier we established that the dominant life form in the human system is *Corporatis profitis*. Applying the principle, the goal of the human system has aligned with and become the goal of *Corporatis profitis*, whose goal is maximization of short term profits. While the *explicit* goal of the human system is that of *Homo sapiens*, the *implicit* goal is that of *Corporatis profitis*. This causes the system to pursue short term objectives at the expense of long-term ones, which prevents solving long term problems like sustainability. Not knowing this, environmentalists, like the Queen of Hearts, need “all the running you can do to keep in the same place” (or move backwards) as they feverishly try to prevent further environmental deterioration.

The effect of this goal on the human system is so fundamentally systemic and has no worthwhile deeper cause that we have not only found the cause of strong resistance from corporate proxies. We have at last drilled down to the main root cause of the sustainability problem.

The **main root cause** is that *the goal of the dominant life form in the human system, Corporatis profitis, is maximization of short-term profit. This causes the human system to have the wrong implicit goal.* This is the wrong goal because of its opposition to the goal of *Homo sapiens*: to optimize long term quality of life for those living and their descendants. These two goals are mutually exclusive and cannot be achieved in the same system. One goal is “right” and one is “wrong.” Which is right or wrong to a particular person depends on whether they are a corporate proxy or not.

At a deeper level, the root cause is *mutually exclusive goals between the top two social life forms, Corporatis profitis and Homo sapiens.* This second form of the root cause is harder to understand, so the first form is used in social force diagrams, while the second and more compact form is used in the Summary of Analysis Results table.

Looking back at the high-level diagram on page 145 for how the four subproblems interact, the main root cause clearly causes all the other subproblems.

Let’s check this root cause against the five requirements for a root cause:

Requirement 1. It is clearly a (or the) major cause of the symptoms.

The symptoms of this subproblem are that large for-profit corporations are dominating political decisions destructively. Mutually exclusive goals between *Corporatis profitis* and *Homo sapiens* are the major cause of these symptoms, because if goal alignment existed instead then the symptoms would disappear. This satisfies the first requirement.

Requirement 2. It has no worthwhile deeper cause.

Given the evolutionary algorithm model and the fact that evolution is the ultimate driver of all social behavior, there is no productive deeper root cause of life form improper coupling. This satisfies the second requirement.

Requirement 3. It can be resolved.

Because the New Dominant Life Form is an artificial life form its goals can be changed. Looking ahead to the Solution Convergence step, it appears realistically possible to change something as fundamental as the modern for-profit corporation's goals. Thus the root cause can be resolved. This satisfies the third requirement.

Requirement 4. Its resolution will not create other equal or bigger problems. Side effects must be considered.

What equal or bigger problems could solving the environmental sustainability problem create? None are possible, because that's the world's biggest long-term problem by far. If it's not solved, no other problem will matter because *Homo sapiens* won't be around anymore. We will have destroyed our ecological niche. Lack of a suitable niche is the biggest possible problem any life form can have. This satisfies the fourth requirement.

Requirement 5. There is no better root cause. All alternatives have been considered.

These requirement means you've searched the entire root cause space (similar to a solution space or landscape) and have found no better root cause.

The symptoms are that large for-profit corporations dominate political decisions destructively. Why do they dominate, not in terms of why do they succeed, but in terms of the source of wanting to dominate? There's only one clear answer. Social agents exist to achieve their goals. That's all. It's the heart of the source of their behavior. If a social agent is misbehaving consistently and nothing is blocking it from doing what it wants, then its misbehavior must arise from the wrong implicit goal. There are no other alternative explanations.

The strongest goal a social agent can have is its built-in permanent goal. For corporations this is currently the wrong goal. Therefore there is no better root cause.

The subtle nature and high complexity of this portion of the analysis explains why the true root cause of life form improper coupling has remained beyond the reach of Classic Activism. The short arms of that process are not up to the task of pursuing the line of investigation leading to conclusions like those in this chapter because Classic Activism is not an analytical process that fits the problem. It's an intuitive, easy to learn, easy to apply, one-size-fits-all process. But it doesn't fit the sustainability problem. Despite that handicap, some classic activists have intuitively arrived at a similar root cause conclusion: the goal (the core purpose) of corporations needs redesign. For example, Corporation 20/20 asks on their home page:

What is the core purpose of the corporation? How should it be designed to seamlessly blend sustainability into its design, ownership, governance, strategy and practices? Corporation 20/20 is an international, multi-stakeholder initiative that seeks to answer these questions. Its goal is to develop and disseminate a vision, pathway for the 21st century corporation in which social purpose moves from the periphery to the heart of the organization. Such transformation is indispensable to a Great Transition toward a just and livable world. (Retrieved June 18, 2016)

This is a terrific vision. However there are thousands more on how to best move forward on sustainability, which is the problem. There should only be a few visions, one for each high leverage point, so that environmentalists can focus their efforts and leverage the limited amount of force they can exert on the system.

Substep D. Find the feedback loops that should be dominant to resolve the root causes.

The root cause of life form improper coupling is mutually exclusive goals between *Corporatis profitis* and *Homo sapiens*. The solution must deal with how to make those goals the same. Thus the system needs a feedback loop to align those two goals. It follows that the loop that needs to go dominant is the **Alignment Growth** loop. The loop is described later on page 375 when the Dueling Loops model is extended.

Substep E. Find the high leverage points to make those loops go dominant.

The Achilles' heel of *Corporatis profitis* is its goal. Change that goal and the life form changes with it, as a sample solution element will later show.

Extension of the Dueling Loops model with the Alignment Growth loop allows pinpointing the high leverage point needed to make that loop go dominant. The exact high leverage point is *correctness of goals for artificial life forms*.

If the system has the wrong goal then the high leverage point is fairly obvious: Change the goal of *Corporatis profitis* to a goal that aligns with that of *Homo sapi-*

ens, so the system will have the right implicit goal. However, there are other possible life forms to consider, like robots, computer systems, and cloud networks. The high leverage point is *correctness of goals for artificial life forms. These must align with the goal of Homo sapiens.*

The evidence

I cannot prove the assertion that this is the main root cause of the environmental sustainability problem and that this is its high leverage point. No one can prove that until the problem is solved. I can, however, make the assertion plausible and show that it is society's best strategic course of action, based on available analysis and evidence.

This book provides a first iteration of that analysis. Once you grasp how the analysis was performed and what the high-level results are, as expressed in the social force diagrams, you can test the assertion with your own evidence. Do analysis results agree with what you can see in the real world? I'd like to argue that they do. Let's first assemble some key pieces of evidence:

1. Dominance of corporations – There's little doubt that *Corporatis profitis*, the modern large for-profit corporation, is the world's dominant social agent as measured by influence on jobs, technology, economic growth, quality of life, ecosystem impact, cultural evolution, and legislation. No other social agent, not even governments or "we the people" comes close. Ideally, I wish this wasn't true. People should be in charge. But that is simply not the case.

2. Who is leading the charge against solving the sustainability problem – This is unquestionably *Corporatis profitis*, as shown earlier.

3. The official policy of most governments is maximum economic growth above all else. – This was shown earlier.

4. Life form goals – The goal of *Corporatis profitis* is maximization of short term profits. The goal of *Homo sapiens* is the long term optimization of quality of life for those people living and their descendants.

The main root cause is easily deduced from these facts. As long as all of the facts are true, the sustainability problem is insolvable. The human system will behave exactly as it should. The goal of its dominant life form will be the system's implicit goal. This goal will drive all system behavior in the large. Because the system's implicit goal is short term maximization of profits, the system will not solve long term problems of any type, because that reduces the short-term goal. Therefore the main root cause is what was stated before: *The goal of the dominant life form in the human system, Corporatis profitis, is maximization of short term profit. This causes the human system to have the wrong implicit goal.* At a deeper level, the main root cause

is mutually exclusive goals between the top two social life forms, *Corporatis profitis* and *Homo sapiens*.

The high leverage point follows easily. Corporations presently have the wrong top goal. If they had the right top goal, one that was the same as *Homo sapiens*, then the entire human system would behave radically differently. It would seek to optimize the long-term quality of life. Achieving that goal would require solving any problems blocking that goal. At the top of that list of problems sits the sustainability problem.

There's some agreement this is the main root cause, but it's not stated in the way we have here. Instead, environmentalists see the system is somehow too oriented toward economic growth at all costs. It somehow has the wrong goal. For example, here's the opening paragraph to Herman Daly's *Steady-State Economics*, the book that established the idea that "enough is best" and that sustainability requires steady-state rather than growth-oriented economics: ⁶² (italics are in the original)

The theme of this book is that a steady-state economy is a necessary and desirable future state of affairs and that its attainment requires quite major changes in values, as well as radical, but non-revolutionary, institutional reforms. Once we have replaced the basic premise of "more is better" with the sounder axiom that "enough is best," the social and technical problems of moving to a steady state become solvable, perhaps even trivial. But *unless* the underlying growth paradigm and its supporting values are altered, all the technical prowess and manipulative cleverness in the world will not solve our problems and, in fact, will make them worse.

What the "the underlying growth paradigm" might be is not clear. It's some vague system thing causing "more is better." But with root cause analysis these concepts can be clarified to the point where effective solutions can be designed. "More is better" is *system acceptance of the fallacious paradigm that Economic Growth Is Good above all else*, the intermediate cause of the change resistance subproblem. That fallacious paradigm is promoted by *Corporatis profitis* and his many proxies, due to the root cause of subproblem B: *The goal of the dominant life form in the human system, Corporatis profitis, is maximization of short-term profit. This causes the human system to have the wrong implicit goal.* That wrong goal is the source of "the underlying growth paradigm."

I hope I've made myself clear here. To me it's an open and shut case. Examine the evidence and the conclusions become blindingly obvious. But this book takes a very different approach to looking at the problem. It thus marshals very different evidence and reaches very different conclusions.

The solution requirements specification is shown on the next page.

Solution Requirements Specification for	
Subproblem B – How to Achieve Life Form Proper Coupling	
1. Main problem	The global environmental sustainability problem
2. Subproblem	How to achieve life form proper coupling
3. Subproblem symptoms	Large for-profit corporations are dominating political decision-making destructively
4. Intermediate cause	Strong resistance from corporate proxies to solving problems that corporations don't want to solve
5. Root cause	The goal of the dominant life form in the human system, <i>Corporatis profitis</i> , is maximization of short-term profit. This causes the human system to have the wrong implicit goal. At a deeper level the root cause is mutually exclusive goals between top two social life forms, <i>Corporatis profitis & Homo sapiens</i> .
6. High leverage point	Correctness of goals for artificial life forms. These must align with the goal of <i>Homo sapiens</i> .
7. Model	Extended Dueling Loops of the Political Powerplace, with the Alignment Growth loop.
<p>9. Standard Requirements: Solution elements must resolve the root cause by pushing on the high leverage point, in such a manner that a permanent system mode change occurs. The new root cause forces must be engineered such that new or strengthened feedback loops lock the system into the new mode.</p> <p>You can't manage what you can't measure. Changes in the root cause force must be measured. A measurement method shall be used to refine solutions under development, to evaluate the effectiveness of implemented solutions, and to monitor the long-term health of solutions.</p> <p>These specifications represent a solution strategy hypothesis. Solution elements can be designed to push on the high leverage point. Then the solutions can be tested and evolved until final solutions emerge that can solve the problem via large-scale implementation.</p>	
<p>10. Measurement Considerations: We can offer this guideline:</p> <p>High goal alignment between corporations and <i>Homo sapiens</i> is what must be achieved to resolve the root cause. What must be measured is how closely an artificial life form, such as corporations, robots, or intelligent software systems, strives to support the goal of <i>Homo sapiens</i>. In the short term we are only interested in corporations since that's the life form needing reengineering.</p> <p>An accurate method of measuring goal alignment of the new corporate life form, such as <i>Corporatis publicus</i> in the Corporation 2.0 solution, shall be developed. Different versions of corporations can be measured and compared, such as <i>Corporatis profitis</i>, Certified B Corporations, and <i>Corporatis publicus</i>.</p>	
<p>11. Solution Considerations: See the analysis write-up for details on model behavior and how artificial life form goal alignment works as a high leverage point. Pushing on the high leverage point in a large-scale manner would change the very core of capitalism, so considerable care is required in solution design and implementation.</p>	

Subproblem C – How to Avoid Excessive Model Drift

Model drift occurs when a solution model fails to evolve as needed as a social system evolves. Politicians are democracy's problem solvers. They create and manage the solutions for running political systems. When politicians fail to see a solution model (a policy and the understanding behind it) is drifting and needs fixing before it fails, that is clearly a political decision error. Each of these errors is a defect produced by the political decision-making process. Thus, one can expect the analysis to lead to a weakness in the process for making political decisions. From a systems thinking and business process management point of view, all this is apparent before analysis begins.

It's hard to overstate the importance of this subproblem. In the short term, how to overcome change resistance is the most important subproblem. Difficult social problems cannot be solved until change resistance is overcome. But in the long term, how to avoid excessive model drift is the biggest problem. If model drift is not permanently solved and solved well for each problem when it occurs, then those problems will recur. All large political systems face a multitude of difficult problems. If too many problems recur, even at sub-crisis levels, the system will become overwhelmed and unable to cope, because the problems it faces exceed the resources available to solve them. This will cause even bigger problems, such as the classic failed state problem, where a nation fails to meet the basic governance and economic needs of its citizens. Or it may cause political leaders to find a scapegoat to blame the problems on. That scapegoat then become that country's common (false) enemy, and the situation can escalate to war. Both are frequent outcomes.

All this arises from the **Rule of Problem Recurrence** discussed earlier on page 53: *If the model drift subproblem is not permanently solved then the overall problem will eventually recur.* Solutions to subproblem C must *permanently* resolve the root cause of model drift. This requires self-managing solutions.

The social force diagram

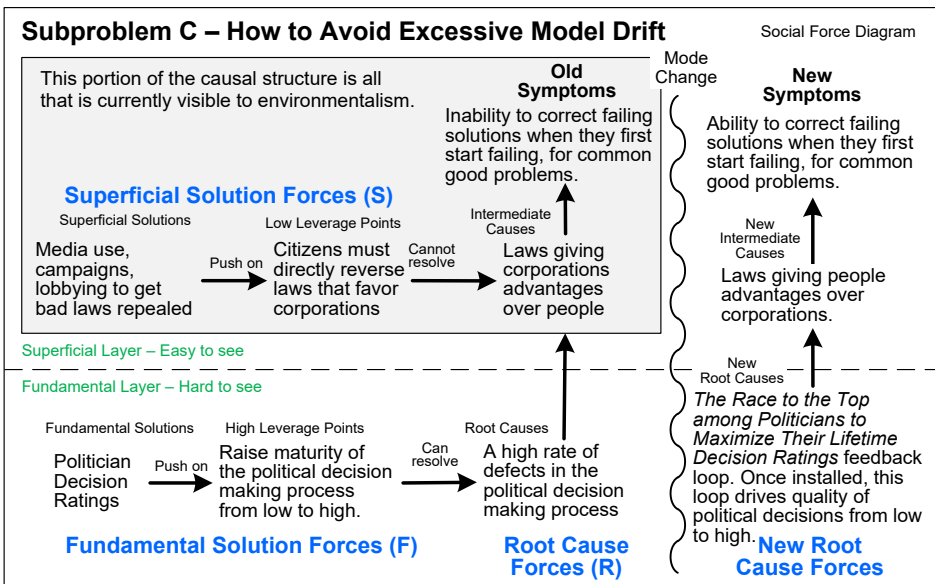
This is shown on the next page. Subproblem symptoms are: *Inability to correct failing solutions when they first start failing, for common good problems.* Because this is a reusable subproblem, these symptoms (and the new symptoms) are the same for all cases. What may differ is the rest of the social force diagram.

The intermediate cause and superficial solution forces were discussed earlier on page 81. There are many contributing causes of the symptoms. SIP asks which are

the intermediate causes that current solutions are attempting (in vain) to solve. This narrows the field considerably. Long study found that the intermediate cause is related to subproblem A and B, which both found that *Corporatis profitis* is dominating the human system and using that dominance to cause subproblems A and B. The same holds for subproblem C. The laws related to quality of governance, which includes management of model drift, are biased toward *Corporatis profitis*. The result is the intermediate cause of subproblem C: *Laws giving corporations advantages over people*. This causes obviously bad laws like corporation personhood and limited liability. It also causes not so obvious bad laws like allowing corporations to pursue profits as their top goal. The net result is the system has become biased toward solving problems that would benefit *Corporatis profitis*, such as trade problems and “excessive” regulations. Other problems that would benefit *Homo sapiens* at the expense of *Corporatis profitis* go unsolved.

If the intermediate cause is *Laws giving corporations advantages over people*, then the leverage point strategy is intuitively obvious: *Citizens must directly reverse laws that favor corporations*. This is done with solutions like *Media use, campaigns, and lobbying to get the bad laws repealed*. But we know that none of this has worked, so these must be superficial solutions.

This portion of the causal structure is currently visible to environmentalists. They sense everything in the gray box. But due to lack of a process like SIP they can go no further. If they did, they would discover a surprisingly easy and common high leverage point, one well known in the business world. The root cause is *a high rate of defects in the political decision-making process*. Its high leverage point is *raise maturity of the political decision making process from low to high*.



This high leverage point is so well known in business, and so frequently pushed on, that a large and robust process improvement industry exists. Populated by consultants, standards creation bodies like the International Organization for Standardization, certification organizations, career process managers, trainers, article and book writers, and so on, the process improvement industry has brought a gravy train of gold to company after company and industry after industry. But that gravy train has never extended beyond industry to political governance systems.

It can. A later chapter presents a fundamental solution for pushing on the high leverage point. The solution is engineered to introduce a new feedback loop: **The Race to the Top among Politicians to Maximize Their Lifetime Decision Ratings**. That's my personal record for a long feedback loop name, but it does the job. It describes exactly what the loop does in a memorable manner. Once the loop is installed it drives quality of political decisions from low to high. This creates the new root cause force seen in the social force diagram. That force causes a new intermediate cause: *Laws giving people advantages over corporations*. That in turn causes the new symptoms: *Ability to correct failing solutions when they first start failing, for common good problems*. The subproblem is solved permanently, or as permanent as "permanent" can be.

Here are the details behind the social force diagram:

The five substeps of analysis

Substep A. Find the immediate cause of subproblem symptoms in terms of the system's dominant feedback loops.

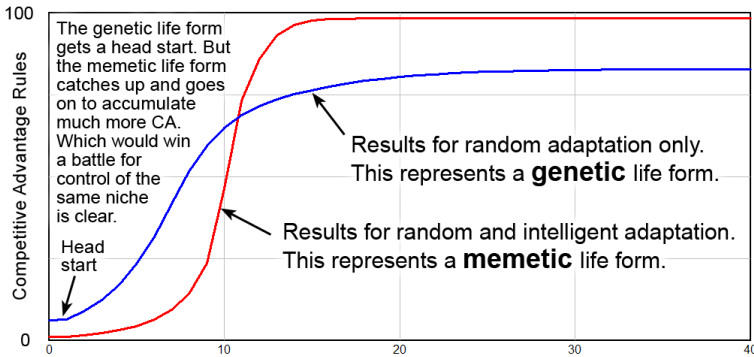
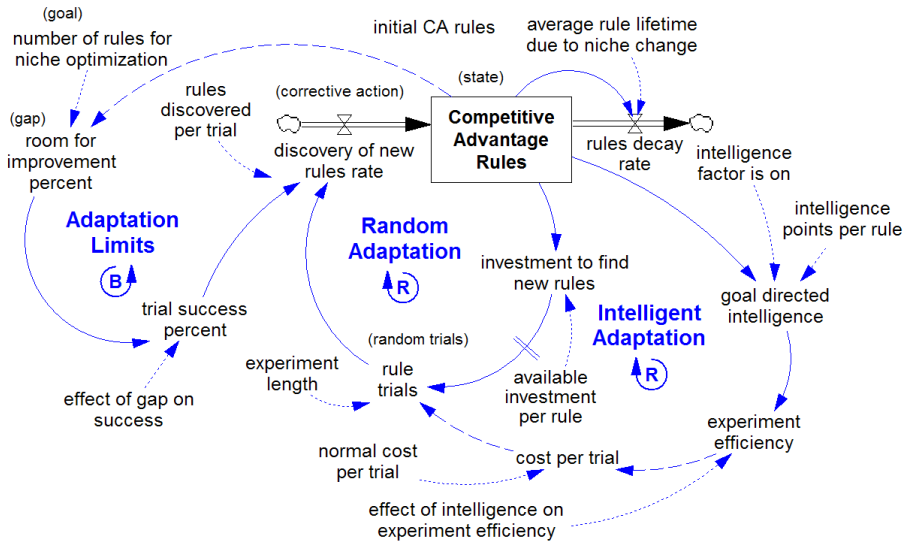
Subproblem symptoms are *inability to correct failing solutions when they first start failing, for common good problems*. Solution models are drifting excessively.

Given these symptoms, what are the loops causing the symptoms? The answer lies in The Evolutionary Algorithm model, shown on the next page. The model was developed to experimentally test the hypothesis that memetic life forms adapt faster than genetic life forms. They do, as the two simulation runs show.

Homo sapiens uses the **Random Adaptation** loop. *Corporatis profitis* or other artificial life forms use the **Intelligent Adaptation** loop. If two life forms, one genetic and one memetic, compete in the same niche, the memetic one will trounce the genetic one, even if the genetic one has a head start. Indeed, this is the case for *Homo sapiens* versus *Corporatis profitis*. *Homo* had a 200,000 year head start. Richard Dawkins pointed out this advantage this in *The Selfish Gene*, 1976, when he wrote the following in the chapter on *Memes: the New Replicators*:⁶³

I think that a new kind of replicator [memes] has recently emerged on this very planet. It is staring us in the face. It is still in its infancy, still drifting around in its primeval soup, but already it is achieving evolutionary change at a rate that leaves the old gene panting far behind.

The Evolutionary Algorithm



Dawkins was right. Memetic *Corporatis profitis* has left genetic *Homo sapiens* panting far behind, in terms of who has accumulated the most competitive advantage rules. How lopsided the battle has become may be seen in the table comparing the competitive advantages of each life form on page 151. The reason *Homo sapiens* has lost the battle is the **Intelligent Adaptation** loop, which is the immediate cause of the symptoms of subproblem C. The loop is dominant over any other loop that would determine which life form has the most competitive advantage. The loop has allowed the modern for-profit corporation to step by incremental step become the dominant life form in the biosphere.

Substep B. Find the intermediate causes, low leverage points, and symptomatic solutions.

The **Intelligent Adaptation** loop doesn't contain the root cause of its dominance. It only contains *intermediate causes*. These are the *laws passed giving corporations advantages over people*. Pushing on the leverage point of *citizens must directly reverse laws that favor corporations* will not work. Yet that's exactly what problem solvers have been trying to do. They've been trying to reverse the decisions in the modern for-profit corporation's favor. This is the same as trying to reach into the Competitive Advantage Rules stock and remove a rule. That is so hard to actually do that it's a *low leverage point*.

There's no way the benefactor of those rules (acting through its billions of corporate proxies) would allow removing an advantageous rule if it possibly could. This causes insurmountable change resistance when it's tried. For example, Thomas Hartman, writing in *Unequal Protection: The Rise of Corporate Dominance and the Theft of Human Rights*, 2002, documents how corporate dominance occurred. Once you read his book, there will be no denying which life form is dominant, why they are dominant, and how that came to be. Hartman describes the expected change resistance this way: (Page 279-280, italics and comments added)

When I first shared my concept for this book with a noted—and friendly—constitutional scholar, he replied in an e-mail that he'd had to pick himself up from the floor at *the shock that anybody would seriously propose laws and constitutional amendments to correct the current situation*. [The scholar anticipated high change resistance.] I hope that he has come around to seeing the possibilities, as he and many others—across the political spectrum—now agree that there is a very real crisis in the political, financial, and business structure of the developed world, and that it is rapidly spreading across the world.

As in the story of the Emperor's New Clothes, we've recently discovered we have a problem. The *belief in so-called "free markets"* has reached a near-religious frenzy, particularly in the press, while corporations greenwash and bluewash themselves with advertisements extolling their commitment to nature and community. [A fine example of the power of well designed, well injected false memes.] But corporations were not created as institutions of environmental preservation or social justice, nor are they true agents of either free markets or democracy. *They are legal devices to accumulate wealth, pure and simple.*

As law professor Lawrence Mitchell noted earlier, "The entire proposition that a corporation is a person is ridiculous." And if they are not people? He says, "*If they are not people we would take them out of the political [de-*

cision making] process.” [I could not agree more. We also have to strengthen that process, so it is no longer biased in favor of corporations.]

As Richard Cohen noted in a January 21, 2002 article in the *Washington Post* about the Enron debacle, “What we have here is an updated form of feudalism.” [Corporations are the *de facto* masters, and we are their serfs.]

And like the feudal systems that held Europe, Asia, South America, and Japan in their grip for centuries, this new feudalism isn’t going to easily submit to transformation or simply morph back into the representative republican democracy from which it emerged and has now largely taken over.

Instead it will fight back, [high change resistance] and if Alexis de Tocqueville was right, the main tool it will use will be the media [the most effective channel for injecting false memes into human minds] it owns or has easy access to with its advertising and P. R. dollars, keeping people passively lulled into the twin beliefs [false memes] that they are powerless, and that the world’s largest corporations do know, after all, how to run the planet and therefore everything is just fine and there’s no need to worry about or do anything.

Thus trying to directly change laws controlling the behavior of *Corporatis profitis* is a low leverage point, because a severely disadvantaged *Homo sapiens* is up against Goliath. Symptomatic solutions like *media use, campaigns, and lobbying to get the bad laws repealed* haven’t worked in the past. Nor will they work in the future.

Substep C. Find the root causes of the intermediate causes.

Substep A found that the **Intelligent Adaptation** loop for *Corporatis profitis* is the immediate cause dominant loop. Substep B found the intermediate cause of this is *laws giving corporations advantages over people*. What is the root cause of that intermediate cause?

Like most immediate cause loops, the **Intelligent Adaptation** loop does not contain the root cause of why it’s so strong in terms of how it causes excessive model drift. It only contains intermediate causes. Trying to resolve these directly with symptomatic solutions will not work. We must go deeper to find out why this loop is so dominant.

A little divergent thinking does the trick. We simply ask ourselves what’s happening here from the viewpoint of the best practices of effective business management. How do the best of the best management teams think?

Each decision to give corporations what they want to increase their competitive advantage over humans is an error. That’s a symptom of solution model drift. Repeated errors of any kind are most productively viewed as defects due to immaturity

in the process used. In governments this is the political decision-making process. Therefore, *a high rate of defects in the political decision-making process* is the root cause of excessive model drift.

Critical thinkers may object that how governments work is so convoluted, involves so many millions of people, and is subject to so much special interest, consensus, and human fallibility pressures that of course the process of political decision making is loaded with defects. We're lucky it works as well as it does. It really can't be improved on all that much. Nations have been trying to do that ever since the fall of Rome.

This is all true except for the claim it can't be improved. Just because something hasn't been done before doesn't mean it can't be done. Just because maturity of the government decision making process has long been low on difficult problems doesn't mean it can't be radically improved. If it realistically can, then this is a resolvable root cause. How it could be resolved is presented in a later chapter. The method used is not that different from the way business has managed its own decision-making processes for centuries.

The root cause, *a high rate of defects in the political decision-making process*, passes the five requirements for a root cause: (1) It's clearly *the* major cause of the symptoms, based on the experience of how the business world views similar process problems. (2) It has no worthwhile deeper cause because deeper causes, such as poor process improvement, lack of incentive to improve quality, lack of managerial orders to improve quality, and so on are solutions, not causes. (3) It can be resolved, as discussed in the previous paragraph. (4) Its resolution will not create other equal or bigger problems, because the environmental sustainability problem *is* the world's biggest problem by far.

Requirement (5) is "There is no better root cause. All alternatives have been considered." This is harder to support but it can be done. Those who have spent half a lifetime in business process improvement will instantly see that *a high rate of defects in the political decision-making process* indicates low quality of a particular process. Here it's the political decision-making process. Once low process maturity has been identified as the problem, there's no need to dig any deeper. Process maturity problems are so widespread and so well understood by those with process training and experience that digging any deeper is foolish, because a tried-and-true solution exists. *You just improve the process.*

Millions of analysts, managers, engineers, and others know this noble truth. I was lucky enough to pick it up in my twenties, while a sophomore at the Georgia Institute of Technology. I'd already changed majors from Aerospace Engineering to Industrial Psychology, on the theory that if I could understand how people behaved I could understand the whole world better.⁶⁴ Then one day I read that the head of the psychology department of a nearby college, Georgia State, had said that in his experience one third of patents get better, one third get worse, and the rest have no

change. How discouraging. So I pondered what to do. By then I was managing small businesses and succeeding. As a lifelong self-learner I'd taught myself many new skills by studying books (especially Peter F. Drucker), magazines (especially Business Week), and the work of others (successful managers). But I felt I still had huge blind spots. So I made an appointment with Professor Rogers, the head of Georgia Tech's Systems Engineering department at the time. I walked into his office and asked him a single question: "Can you tell me what Systems Engineering is all about?" He had a beautiful reply, one I've always remembered: "*Oh, that's easy. We teach you how to take any system and make it run better.*" I was sold. That's me. I love improving systems. That's all business problems and world problems consist of: systems that are not running as well as they could.

The most important system to an organization is the processes it uses. Unless these are all strong the organization will be unable to achieve its mission consistently and efficiently. *That is the case for the model drift problem.* To the systems engineer skilled in business management and process improvement, the root cause of repeated bad outcomes, like too many *laws giving corporations advantages over people*, is always the same. The repeated bad outcomes are due to a high rate of defects in the process involved. Therefore there is no better root cause.

Substep D. Find the feedback loops that should be dominant to resolve the root causes.

The root cause of excessive model drift is *a high rate of defects in the political decision-making process.*

For this substep the System Improvement Process tells us there is either a missing feedback loop or one that's too weak or strong. Which is it? Studying the system, we see that voters are political decision makers. The key loop in the democratic model of government is the **Voter Feedback** loop. Compared to what came before democracy, autocratic rule, the **Voter Feedback** loop has done extraordinarily well. So we can learn from the success of that loop.

The **Voter Feedback** loop works by holding politicians accountable for their general behavior. But somehow that loop is not enough to control the root cause. Politicians make the decisions in the political decision making process of government. Each bad decision is a defect. Each decision is made by a politician. Thus what's needed is a more focused feedback loop for the quality of decisions each politician makes. This would be a **Quality of Political Decisions Feedback** loop of some kind. That's the feedback loop that needs to go dominant to resolve the root cause.

At this stage we don't know any further detail. That will come in solution design. The loop would somehow precisely measure the defect rate of each politician and allow voters to use that in their voting choices.

Substep E. Find the high leverage points to make those loops go dominant.

Politicians make the world's most important decisions. The purpose of the **Quality of Political Decisions Feedback** loop would be to optimize the quality of those decisions. All decisions are the result of the process that produced them. Therefore, the *high leverage point* to make the **Quality of Political Decisions Feedback** loop go dominant is raising *maturity of the political decision-making process*.

The same conclusion can be reached without considering the loop. If a root cause is clear then usually so is the high leverage point(s) for resolving it. If we borrow from the field of quality management and think in terms of processes and defects, each low-quality decision is a defect. The root cause of solution model drift is *a high rate of defects in the political decision-making process*. This low quality must be primarily due to low *maturity of the decision-making process*. That's the *high leverage point*. Raising maturity to a high level will resolve the root cause.

The evidence

Readers familiar with formal process management in business and the concept of a **defect** as “anything that displeases the customer” will recognize that the root cause and high leverage point are correct. These are trivial conclusions from a process control perspective. If the symptoms of a problem are a repeated failure of some kind, the root cause is always a high rate of defects. The high leverage point is always raising process maturity.

Further education

Some reader will not be familiar with the power of formal process management, since this is an advanced business management tool. An excellent first book on this topic, as well as an exciting and entertaining read, is *The Man Who Discovered Quality: How W. Edwards Deming Brought the Quality Revolution to America*, by Andrea Gabor, 1990. On pages 6 and 7 you will find this introduction to the power of process: (Italics and comment added)

To Deming, America's quality crisis is symptomatic of a fundamentally outdated management system that focuses on short term results at the expense of *the process*, the customer, and ultimately long-term achievement. What worked in the “days of free land and rugged individualism,” as Deming, who grew up on a homestead in Wyoming, is fond of saying, won't work in the era of intense foreign competition. In other words, he is calling for *a more systematic approach* to pursuing customers and product strategies to replace the mentality of planned obsolescence that worked in the

seller's market of the 1950s and 1960s, but has come to hobble American business since the 1970s.

The importance Deming attaches to controlling and reducing variation [defects] has led him to a holistic view of leadership that casts management in a very different role from the one prevailing in American companies since the end of World War II. Deming rejects the model of the modern American manager, who can “manage anything” based on a company's balance sheet. Instead, he advocates *a process-obsessed management culture* that is capable of harnessing the knowhow and natural initiative of its employees and fine tuning the entire organization to higher and higher standards of excellence and innovation.

An excellent second book would be *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, by Jeffrey Liker, 2004. Part two, *The Right Process Will Produce the Right Results*, covers seven principles. Part four, *Continuously Solving Root Problems Drives Organizational Learning*, covers three principles. Here “root problems” means root causes although the book, like most advanced process literature, never uses the term “root cause.” It's so fundamental that other terms are used instead.

The solution requirement specifications are on the next page.

Solution Requirements Specification for	
Subproblem C – How to Avoid Excessive Model Drift	
1. Main problem	The global environmental sustainability problem
2. Subproblem	How to avoid excessive model drift
3. Subproblem symptoms	Inability to correct failing solutions when they first start failing, for common good problems
4. Intermediate cause	Laws giving corporations advantages over people
5. Root cause	A high rate of defects in the political decision making process
6. High leverage point	Raise maturity of the political decision making process from low to high
7. Model	Extended Dueling Loops of the Political Powerplace, with the Alignment Growth loop.
<p>9. Standard Requirements: Solution elements must resolve the root cause by pushing on the high leverage point, in such a manner that a permanent system mode change occurs. The new root cause forces must be engineered such that new or strengthened feedback loops lock the system into the new mode.</p> <p>You can't manage what you can't measure. Changes in the root cause force must be measured. A measurement method shall be used to refine solutions under development, to evaluate the effectiveness of implemented solutions, and to monitor the long-term health of solutions.</p> <p>These specifications represent a solution strategy hypothesis. Solution elements can be designed to push on the high leverage point. Then the solutions can be tested and evolved until final solutions emerge that can solve the problem via large-scale implementation.</p>	
<p>10. Measurement Considerations: We can offer this guideline:</p> <p>The rate of defects must be measured. The standard way to express this using Six Sigma is the number of defects per million opportunities to please the customer. The product is a political decision, such as a new piece of legislation or executive order. The quality of the product is measured by how well it satisfies the customer. Here this would mean how well a political decision works out for citizens. Thus decision outcomes must be measured in a repeatable accurate manner.</p>	
<p>11. Solution Considerations: See the analysis write-up for details on items 1 through 7 above. The key is to see the solution as making a bold fundamental change in political decision making process maturity. The basic process of decision making in governments appears to have never gone through the rigors of process improvement that competitive corporations have been forced into, apparently because governments are by definition monopolies. Thus one should expect to find plenty of low hanging fruit for quick and dramatic process improvement.</p> <p>However, the scale and politicization of governments exceeds that of large corporations by an order of magnitude or more. They are two very different types of organizations. This must be taken into account in solution design, especially the self-managing aspect.</p> <p>The solution needs to implement a Quality of Political Decisions Feedback loop of some kind, as described in the analysis.</p>	

Subproblem D – How to Achieve Environmental Proper Coupling

I'd like to begin this chapter with an unusual quote, in order to open our minds to a greater whole. The extract is from *Living Poor: A Peace Corps Chronicle*, by Moritz Thomsen, 1969, p173. (Italics added)

Living poor is like being sentenced to exist in a stormy sea in a battered canoe, requiring all your strength simply to keep afloat; there is never any question of reaching a destination. True poverty is a *perpetual state of crisis*, and one wave just a little bigger or coming from an unexpected direction can and usually does wreck things.

The Malthusian Trap

The perpetual crisis of poverty is in fact the historic norm. Why it occurs was discovered two centuries ago by Thomas Malthus in 1798 in *An Essay on the Principle of Population*. His simple explanation has come to be known as the **Malthusian Trap**, also known as The Iron Law of Population.

The trap occurs because of the IPAT equation. As described on page 32, $I = P \times A \times T$. Once the I in the equation, environmental impact, reaches the maximum an ecological niche can support the PAT factors have reached their joint limits. Population (P) cannot go up unless consumption per person (A) or impact per unit of consumption (T) goes down. Maximum population is thus trapped by whatever a society's I, A, and T factors are.

Unless the laws of physics change, the trap is inescapable. Typically what happens is a new technology comes along, such as an improvement in agriculture. This reduces T, because there is less environmental impact per unit of consumption. This in turn raises A, affluence or consumption per person. Because people have more to eat population goes up. Population then rises until P times A times T equals I.

At this point the insidious nature of the trap takes hold. Due to replication and competition for survival of the fittest, P continues to grow *and A starts to fall*, because P times A times T cannot be greater than I except for cases of temporary overshoot. A continues to fall until consumption per person reaches starvation level. That puts the brakes on further growth of P. The end result is A is back where it started. P has grown some, but the same mass misery and poverty a society started out in before invention of the new technology has returned.

Gregory Clark, writing so eloquently in *A Farewell to Alms*, 2007, describes the trap at length: (p1-2, italics are his)

...the *Malthusian Trap* ensured that short term gains in income through technological advances were inevitably lost through population growth.

Thus the average person in the world of 1800 was no better off than the average person of 100,000 BC. Indeed in 1800 the bulk of the world's population was poorer than their remote ancestors. The lucky denizens of wealthy societies such as eighteenth-century England or the Netherlands managed a material lifestyle equivalent to that of the Stone Age. But the vast swath of humanity in East and South Asia, particularly in China and Japan, eked out a living under conditions probably significantly poorer than those of cavemen.

The quality of life also failed to improve on any other observable dimension. Life expectancy was no higher in 1800 than for hunter-gatherers: thirty to thirty-five years. Stature, a measure both of the quality of diet and of children's exposure to disease, was higher in the Stone Age than in 1800. And while foragers satisfy their material wants with small amounts of work, the modest comforts of the English in 1800 were purchased only through a life of unrelenting drudgery. Nor did the variety of material consumption improve. The average forager had a diet, and a work life, much more varied than the typical English worker of 1800, even though the English table by then included such exotics as tea, pepper, and sugar.

And hunter-gatherer societies are egalitarian. Material consumption varies little across the members. In contrast, inequality was pervasive in the agrarian economies that dominated the world in 1800. The riches of a few dwarfed the pinched allocations of the masses. Jane Austen may have written about refined conversations over tea served in china cups. But for the majority of the English as late as 1813 conditions were no better than for their naked ancestors of the African savannah. The Darceys were few, the poor plentiful.

So, even according to the broadest measures of material life, average welfare, if anything, declined from the Stone Age to 1800.

The need for a mode oriented model

The suffocating grip of the Malthusian Trap was broken seemingly forever by the Industrial Revolution in 1800, causing population to explode. WHY did this happen? How can we apply the brakes in time to prevent return of the Malthusian Trap? Answering these questions requires a mode oriented model of explanation. The model must be able to explain the four modes and three revolutions shown on The Four Modes of Human History graph on the next page.

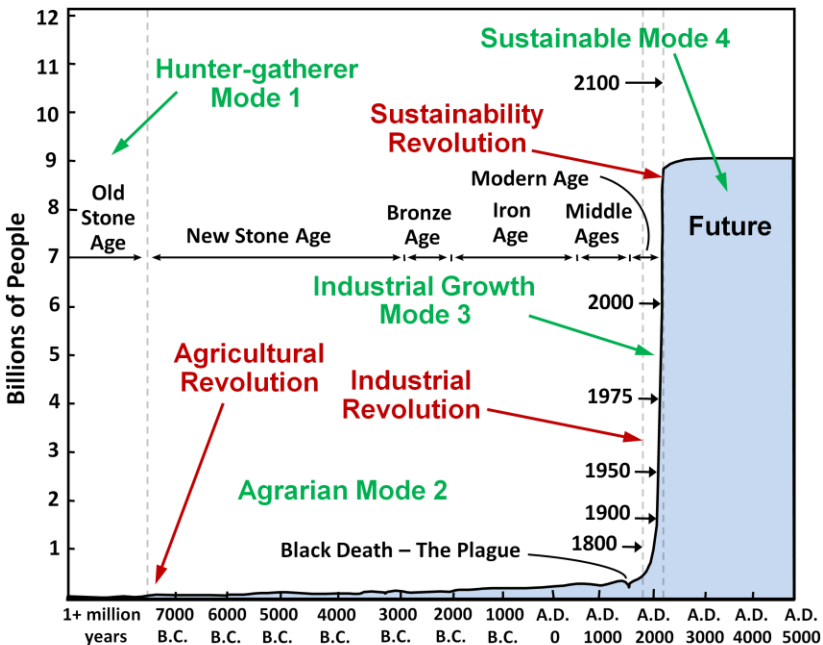
A **system mode** occurs when a system becomes locked into an overall pattern of behavior for a period of time. Small impacts on the system will not knock it out of

that mode due to the presence of strong balancing feedback loops. Only radical impacts like invention of the radical new technology of agriculture can do that. Mode lock-in is usually good because it provides stability to a system. *However, once a system slips into an undesirable mode it can be surprisingly difficult to snap the system into a desirable mode.*

One example of undesirable mode lock-in is how long Western Europe remained stuck in the Dark Ages: 1,000 years, from the fall of Rome in the fifth century to the beginning of the Renaissance in the fifteenth century. Another example is how long North Korea has suffered under dictatorship, despite repeated efforts by the rest of the world to change that mode. Still another example is the 58 nations (analyzed by Paul Collier in *The Bottom Billion*, 2007, p7) that are locked into a poverty/undeveloped mode, despite numerous attempts to help these countries escape that mode. In Collier’s words, of the world’s population, “a total of five billion people are already prosperous, or at least are on track to be so, and *one billion are stuck at the bottom.*” (p3, italics added)

A four mode model differs from what conventional wisdom is analyzing. Conventional research has voted unanimously that recent growth, overshoot, and collapse are the symptoms to model. This is a confining low level view of the problem. To find the root causes we must examine the full sweep of human history, starting

The Four Modes of Human History



Graph source: Pop. Reference Bureau and UN, *World Pop. Projections to 2100* (1998). Modified by Thwink.org to show modes, revolutions, and pop. leveling out at 9B not 11B.

where *Homo sapiens* was about 200,000 years ago, when our species branched off from the rest of the genus *Homo*. Since that time *Homo sapiens* has progressed through a number of distinct phases, notably hunter-gatherer, then agrarian, and finally industrial. What triggered these mode changes? WHY is the current mode so unsustainable? These questions should lead us to our quarry of root causes, high leverage points, and solution elements that work. *Thus we need a mode oriented model.* It must explain why modes 2, 3, and 4 occurred or could occur:

Mode 3 is currently in overshoot and headed toward collapse, so the problem to solve is how to trigger an immediate transition to mode 4. Let's first review how the four modes work.

Mode 1. Hunter-gatherer – Ended by Agricultural Revolution

For a long time, the human system was stuck in the Hunter-gatherer Mode, on the left side of the graph. This mode ended around 10,000 BC with the Agriculture Revolution. Agriculture is widely considered mankind's greatest invention because it caused the first major mode change. This led to all the others.

Mode 2. Agrarian – Ended by Industrial Revolution

Next the system entered the Agrarian Mode. Population increased a small amount but hit the same ceiling as in the previous mode: the Malthusian Trap. This mode ended around 1800 when the Industrial Revolution caused population to shoot up like a rocket. This sudden spurt dominates the shape of the graph.

Mode 3. Industrial Growth – Ended by Sustainability Revolution

Currently civilization finds itself stuck in the Industrial Growth Mode. We've got to get out of this mode immediately because it's unsustainable. The longer the system stays in this mode, the more global carrying capacity is eroded and the harder it will be for humanity to attain a high quality of life for all. This mode will end once the Sustainability Revolution begins.

Mode 4. Sustainable

Once global society enters this mode population will level off, or more likely fall in a controlled manner. Attention will shift from the quantitative growth of Mode 3 to qualitative growth and all the benefits that will bring.

More than these four modes could be included. But these four are so fundamental to the history of the human system that if we can analytically fathom why the first two revolutions occurred at the root cause level, we should be able to determine the root causes of why the third revolution has not yet occurred and how to trigger it by pushing on the right high leverage points.

This has been done. The conclusions are in the social force diagram below. A small warning may assist here. The conclusions are extremely counterintuitive.

The social force diagram

When I look at the diagram my eyes zero in on the root cause. It’s so different from the intermediate cause that I wonder if maybe it’s me that’s just plain wrong. A root cause this simple and so easily and efficiently resolved can’t be true! System evolution should have found it long ago.

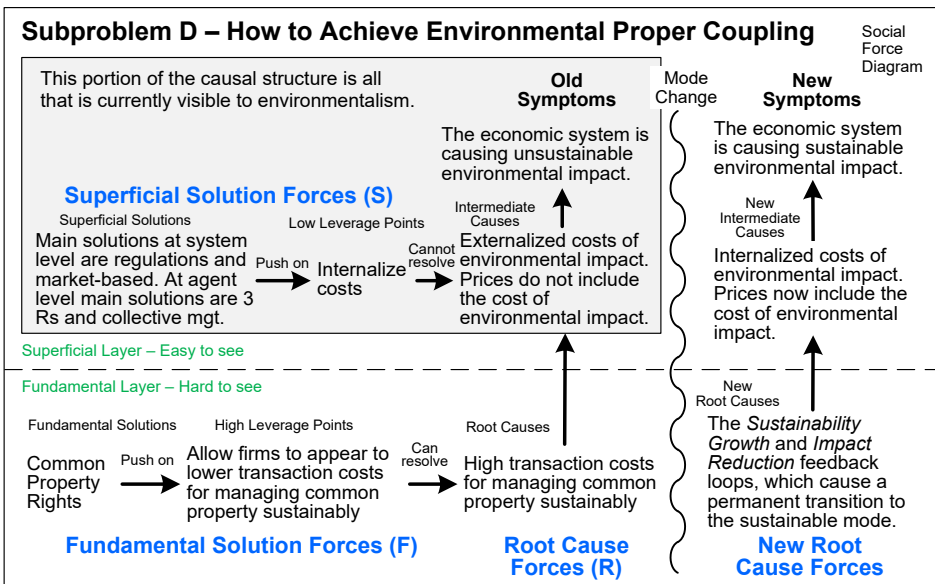
This brings to mind the old joke about two economics professors walking down the sidewalk. Both are passionate believers in the **efficient markets hypothesis**, which states that stock market efficiency causes share prices to always, on the average, reflect all relevant information. Therefore no one can outperform the stock market consistently. No “good deals” exist. Since it’s impossible to beat the market, the only reliable investment is an index fund.

As the two professors are walking along, all of a sudden one stops and says, “Look, there’s a \$20 bill on the ground!” The other professor replies “That’s impossible. If there was a \$20 bill on the ground, somebody would have picked it up already.” The first professor nods in agreement, and they keep on walking.

We all know, however, that it *is* possible to consistently beat the market. Warren Buffet has done it for 60 years.

It is also possible to discover root causes and high leverage points that others have assumed were not there because they *can’t* be there.

The symptoms of subproblem D are *the economic system is causing unsustainable environmental impact*. The universal assumption, especially among economists,



is that the cause of those symptoms is *externalized costs of environmental impact*. *Prices do not include the cost of environmental impact*.

If that's the cause then the leverage point is *internalize costs*, so that prices reflect environmental impact.

An army of solutions to do that have been tried. The main solutions at the system level are regulations and market based instruments, like carbon taxes and tradable permits. Regulations internalize costs via fines for unsustainable behavior or prescription of the best practices required for sustainable behavior. The cost of those practices is born by the offender. Market based instruments rely on the power of free markets to cause the desired sustainable behavior, either directly via pollution taxes, or indirectly by devices like tradable permits. The main solutions at the individual agent level, which are voluntary, are the Three Rs of reduce, reuse, recycle, and collective management.

These solutions have largely not worked. This indicates an error in reasoning somewhere. The social force diagram shows precisely where the error has occurred. The assumption that the root cause is externalized costs is wrong. That's a false root cause. The true root cause is *high transaction costs for managing common property sustainably*.

Transaction costs are the costs of using market transactions to sell your product or buy someone else's. Transaction costs exclude the actual price of the product.

Transaction costs can dwarf prices if markets are inefficient. For example, suppose there was no stock market and buyers and sellers had to independently find each other by calling or walking around from office to office. The cost of finding what you wanted and comparing it to all the alternatives would be astronomical. It would be so high the stock market as we know it would not exist.

That is the case for environmental **common property**, like the air we breathe, the water we drink, the pollution sinks that receive our waste, and all the other natural resources people use in common. Today no efficient market exists for managing common property, because of *high transaction costs for managing common property sustainably*. That, and not externalized costs, is the true root cause.

Consider how expensive it is to get even one new environmental protection law passed. It takes years to gather public support, via thousands of preliminary transactions like articles, books, campaigns, fund raisers, TV appearances, advertisements, creation of new NGOs, funding of existing NGOs, and more. Each preliminary transaction is expensive. Once the campaign has gathered enough public support, debate shifts to the political arena. More years pass. More expenses pile up. Finally the day of reckoning comes and the new environmental law, which may be an international treaty, is voted on. Normally it never passes on the first try but is defeated. More years pass. More expenses pile up. Finally, after years or decades of activism and millions of dollars, the new law passes. One more piece of environmental com-

mon property now has protection. And then the process starts all over for the next piece of common property. In this version of common property management, transaction costs are so prohibitively high that most common property goes unmanaged.

Contrast this process to how private property is managed. In the world's private property system, transaction costs are low. Private property markets are mature and efficient. Buyers and sellers can find each other and consummate transactions rapidly at low cost.

What we have here is a natural experiment. Private property, which has low transaction costs, is well managed. Common property, which has high transaction costs, is so poorly managed it is grossly unsustainable. This indicates that low transaction costs are required to manage property well. Mother nature has spoken. And nature cannot be fooled, as Richard Feynman reminded us in the Introduction.

WHY are transaction costs low for private property and high for common property? Because for private property, property ownership rights are established law. People or corporations may buy and sell private property of any kind, any time, for any price they wish. Their private property ownership rights are enforced. No one can legally take their property away from them or damage it.

But for common property no such laws exist. There is no conception that it would be possible for the world's private property system to work in parallel with a nearly identical common property rights system. It's like that \$20 bill on the ground couldn't possible exist.

But it could. There is no logical or practical reason that property management law cannot evolve to include common property.

Most complex property is owned and managed by corporations. I expect the same should hold for common property. So how can property law be modified to resolve the root cause of *high transaction costs for managing common property sustainably*? The same way it's already done for private property, where firms can appear (incorporate) whenever a new need arises. Thus the high leverage point is *allow firms to appear to lower transaction costs for managing common property sustainably*. That's a new concept. It's a totally new way of looking at the problem. But it follows logically if you trace the causal chain, keep asking WHY, keep an open mind, and consider how successful the world's private property system has been, and how central it has become to society's well-being.

What new laws are needed to push on the high leverage point? The Solution Convergence step of SIP led to a fundamental solution called **Common Property Rights**. This extends property law by creating a new type of property, common property. Firms, called stewards, appear to manage common properties needing sustainable management. Stewards don't own common property, which is a public good. They own the right to manage it. Stewards work closely with governments to manage common property sustainably.

Once Common Property Rights are enacted and stewards begin self-replicating, a system mode change begins. After enough stewards have appeared, the mode change completes because the world's common property is now being as efficiently managed as its private property. The system stays in the new mode due to the way the new root cause forces include two greatly strengthened feedback loops, **Sustainable Growth** and **Impact Reduction**. These loops cause a permanent transition to the sustainable mode. The old intermediate cause of externalized costs vanishes, replaced by the new intermediate cause of *internalized costs*. This leads to the new symptoms of *the economic system is causing sustainable environmental impact*.

It's an enticing vision. It's a realistic vision. And it's an efficient vision, because it's based on root cause analysis and reuse of the most efficient system ever known for managing property.

The World's Property Management System model

Let's begin filling in the details of that vision. I'd like to begin with the causal structure model used in the analysis. This will bring alive how the analysis and solution work at the high level. Then, using that foundation, the five substeps of analysis will follow easily.

Proper coupling occurs when the behavior of one system affects the behavior of other systems in a desirable manner, using the appropriate feedback loops, so the systems work together in harmony in accordance with design objectives. In the environmental sustainability problem the world's economic system is improperly coupled to the greater system it lives within: the environment.

This is a powerful abstraction because it tells us that to solve an improper coupling problem, we must strengthen and/or introduce the correct feedback loops. That's exactly what SIP was designed to do.

Execution of the analysis step of SIP requires construction of a physical model of understanding. The purpose of the model is to provide the deep insights needed to solve the problem. That's all. There is no need for the model to be able to simulate the present or future behavior of the system. That can be useful but is not required.

This subproblem analysis doesn't use a simulation model because simulation is not required to understand model structure. That's already been done by history.

The World's Property Management System model is a causal flow diagram. The happy result is it's a hundred times easier to understand than a simulation model. Fewer than 1% of the population has simulation model training, while nearly everyone can understand a one page diagram. Ours is so simple that its four main subsystems and four feedback loops could be drawn on a napkin in a minute. The result is a model environmentalists can understand and therefore apply.

On the next page is the analysis model. It includes the candidate solution element of Common Property Rights. The analysis was so iterative that the solution is deeply integrated into the analysis model.

The model approximates the evolution and essential structure of the world's two property management systems using four subsystems. These are connected by causal flow arrows, some of which form feedback loops. These four subsystems and four feedback loops explain the important behavior of the total system.

The system on the right, Common Property Rights (**CPR**), is the candidate solution. It already partially exists. Everything else fully exists and is working well. The CPR system closely mimics the private property rights (**PPR**) system. The only difference is each system manages a different type of property. Once all necessary CPR components exist the CPR system should work just as well as the PPR system. Thus there is little needed for simulation. Instead of putting our energies into the intricate details of simulation they are better directed to the higher level of systems thinking the diagram allows.

Candidate solution design is based on the undeniable fact that the world's existing PPR system has very high efficiency. By viewing private and common property in terms of their management needs rather than their physical forms, the planet's property management system can be conceptually divided into two symmetrical halves sharing a central backbone. The existing PPR management system, once extracted from the larger amount of the system that can be shared, forms a template for creating the proposed CPR system. Each is the mirror image of the other because of ultra-high reuse of existing infrastructure. The CPR system thus designs itself. Its essential components pop out of thin air as the essential components that form the PPR system are identified.

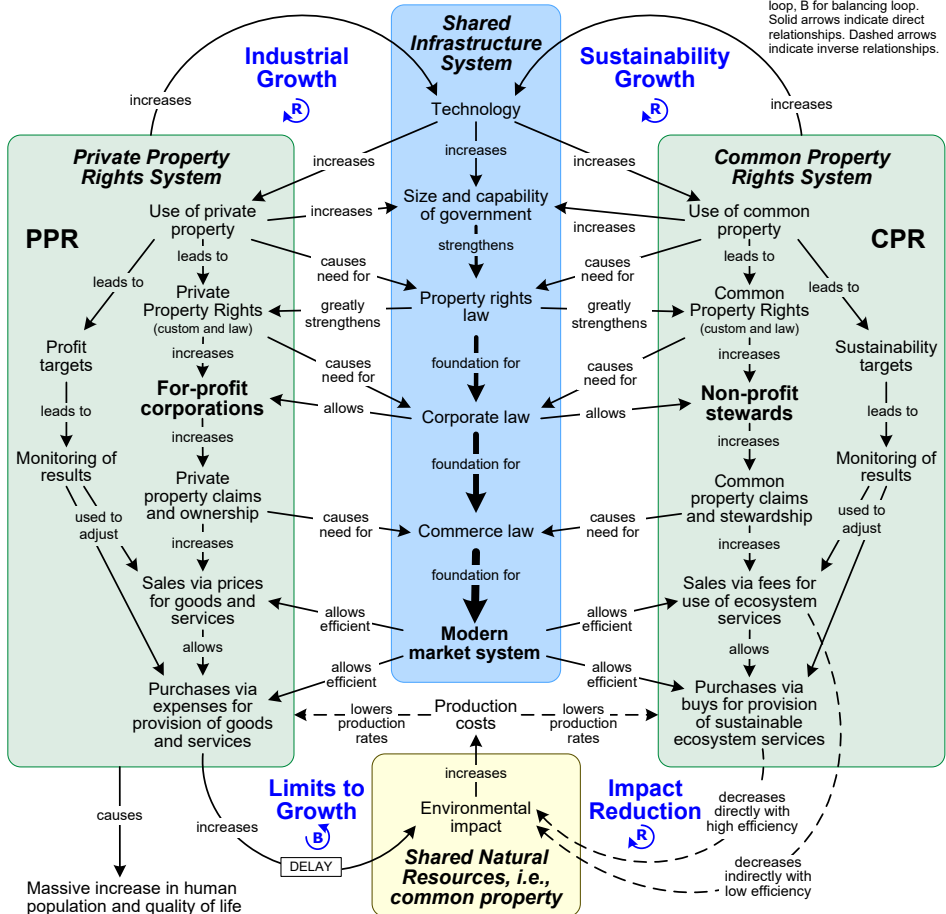
The CPR system has already partially appeared. Use of common property (node names are underlined) began long ago. Some sustainability targets have been set. Monitoring of results occurs regularly. Let's trace the total system's evolution:

In *Homo sapiens*' hunter gatherer stage, technology was very low. There was little use of private property, such as crude hunting tools and shelters, and low use of common property in the form of the natural resources used for hunting and gathering. That stage lasted from about 200,000 to 10,000 years ago, when invention of agricultural technology changed evolution of the system abruptly.

The World's Property Management System

With emphasis on the evolution and structure of the twin subsystems

Legend: R for reinforcing loop, B for balancing loop. Solid arrows indicate direct relationships. Dashed arrows indicate inverse relationships.



Note the shared infrastructure system. This forms the bulk of the management system and is easily shared with the proposed system on the right. The feedback loops show how the left system is causing the sustainability problem and how the right system can solve it. Because of high reuse of proven mechanisms, the solution on the right should achieve the same high efficiency we have long enjoyed from the solution on the left. We are essentially reusing an old system rather than designing a new one from scratch.

The introduction of agriculture radically increased use of private property, use of common property, and the size and capability of government. More efficient food production allowed a ruling class to specialize in governance. This and greater use of private and common property increased property rights law and ability to enforce those laws. This strengthened private property rights and allowed formal private property claims and ownership. It also strengthened common property rights and allowed some formal common property claims and stewardship, like shared hunting

grounds, communal forests, and managed community water sources. But from the beginning the CPR system lagged behind development of the PPR system, due to environmental impact delays and poor understanding of ecosystem behavior.

As technology continued to increase, higher use of private property led beyond personal consumption to opportunities for profit. One could produce goods and services and sell them for considerable amounts of personal gain. This led to profit targets for large farmers, master craftsmen, merchants, money changers, and so on. This in turn led to measurement of results. This information was used to adjust a producer's sales via prices for goods and services and their purchases via expenses for provision of goods and services in order to meet their profit targets.

At this point a complete PPR system existed, with one exception. The **managing agent**, the agent who makes the on-the-spot decisions on what should be sold, what prices should be, where purchases should go, etcetera, was still the individual person. They might have employed others, as in cottage industry, master craftsmen, or farm owners and laborers, but they acted as persons. If they died, moved, or failed to pass the business down, it usually disappeared.

As time passed and technology grew still further this changed. Businesses became larger. They began to be sold. Investors began to fund them. Century by century, what became the modern corporation slowly emerged. The granting of guild and corporate charters, such the one to the infamous East India Trading Company in 1600, marked the beginning of corporate law. This allowed for-profit corporations to appear routinely. Because corporations have much lower transaction costs than individuals and allow more specialization, this led to greatly increased sales and purchases. This caused the need for commerce law to allow conducting market transactions in a more orderly manner. Strong and capable governments, plus the laws they provided and enforced, plus the spread of corporations, caused the modern market system to appear. This was an epic event. Price signals, rather than tradition, personal relationships, and barter, began driving economic system efficiency. This allowed exponentially more efficient sales and purchases. The end result, especially since the Industrial Revolution, was a massive increase in human population and quality of life.

But this came at a hidden cost. The world's PPR system became far more efficient than its CPR system. The **Industrial Growth** loop raced far ahead of the **Sustainability Growth** loop, throwing the total system off balance into a state of ominous unsustainability. The **Limits to Growth** loop was silently, usually after a delay, increasing environmental impact. This increases production costs, which lowers production rates.

This brings us to where we are today. Due to an inefficient CPR system the **Sustainability Growth** and **Impact Reduction** loops are weak. As more and more effects of delayed environmental impact appear, production rates will fall. If

business as usual continues, eventual environmental collapse will trigger economic collapse.

This unpleasant scenario can be avoided by pushing on the high leverage point of *allow firms to appear to lower transaction costs for managing common property sustainably*. Once property rights law is updated to allow Common Property Rights, a torrent of non-profit stewards will appear because there are so many unsolved environmental problems, not to mention so many dedicated environmentalists looking for altruistic occupations. Just as corporations file claims for minerals, patents, and copyrights, stewards will file claims for unclaimed common properties (like a polluted river or an overused aquifer) whose wise stewardship would benefit the common good.

Once a claim is accepted, the government (with help from the steward, who has some expertise here) sets the sustainability targets for that common property, such as the ambient standard for a pollutant in a sink or the maximum rate of sustainable harvest of a renewable resource. The targets will follow an achievement schedule of increasingly stricter goals, so as to reach 100% sustainability for a common property in a certain number of years. S curves will probably be used. If targets are not achieved a steward loses its claim.

Once a steward's claim is accepted the steward becomes the managing agent. Government no longer plays that role, thus eliminating command-and-control. If an environmental problem is more efficiently managed by government prescriptive regulations, then government would continue as the managing agent and claims would not be allowed.

Stewards are authorized to charge fees for any activity that excessively degrades the health of their common property. Fees are charged at the most efficient places in the system. The fee type is whatever a steward feels works best: flat fees per unit of resource use, seasonally adjusted fees, tradable permits, permit auctions, etc. Fees must be charged in a non-discriminatory manner. Since the CPR system is so far behind the PPR system, special care will be needed for transition to minimize hardship. Once the health of a steward's common property meets its target, fees fall to a very low level, just enough to pay for the costs of monitoring, administration, minor additional R&D, setting up new customers and closing out old ones, etc. This is the maintenance phase of stewardship.

Psychologically and legally, fees are not a tax. They are the price of an ecosystem service.

Authority to charge fees leads to sales via fees for use of ecosystem services. Fee income goes to purchases via buys for provision of sustainable ecosystem services. Buys go to buying anything that will move the health of a common property into its targeted safe zone in time. Examples of buys are administrative overhead, monitoring of ecosystem health, measurement of ecosystem service use rates for charging fees, R&D for new or improved best practices, cost/share for implementation, educa-

tion, and awareness campaigns. Stewards will frequently pool their buys for greater efficiency, such as joint R&D or transfer of technology to developing nations.

Like prices and expenses, fees and buys are a powerful combination. Fees discourage harmful behavior. Buys buy things that will reduce future fees. By monitoring of results stewards can adjust the level of fees and where their buys go to the approximate optimum required to meet their sustainability targets, just as corporations do with prices and expenses to meet profit targets. A well run stewardship will, in the long run, lower fees to the lowest level humanly possible—just as price curves for new technologies start out high and fall low, usually by one or more orders of magnitude. The net effect will be high **Sustainability Growth** and large amounts of **Impact Reduction**.

Once the CPR system is mature and all necessary claims are well managed, the economic system will be properly coupled to the environment.

How the model explains the three mode changes

1. The first mode change was the Agriculture Revolution. The property management model shows that increases in technology cause increases in use of private property and use of common property. Invention of agriculture caused a huge leap in technology, which caused use of private and common property to soar. Agriculture was such a profound invention it caused the entire property system to start growing, which was impossible before.

2. The second mode change was the Industrial Revolution. This could not occur until the private property rights system was sufficiently mature. Once it was, the **Industrial Growth** loop could grow much faster than ever before. That's exactly what happened starting around 1800 in England and later in different nations and regions of the world. However, growth of the private property rights system has a side effect: increased environmental impact, which causes the environmental sustainability problem.

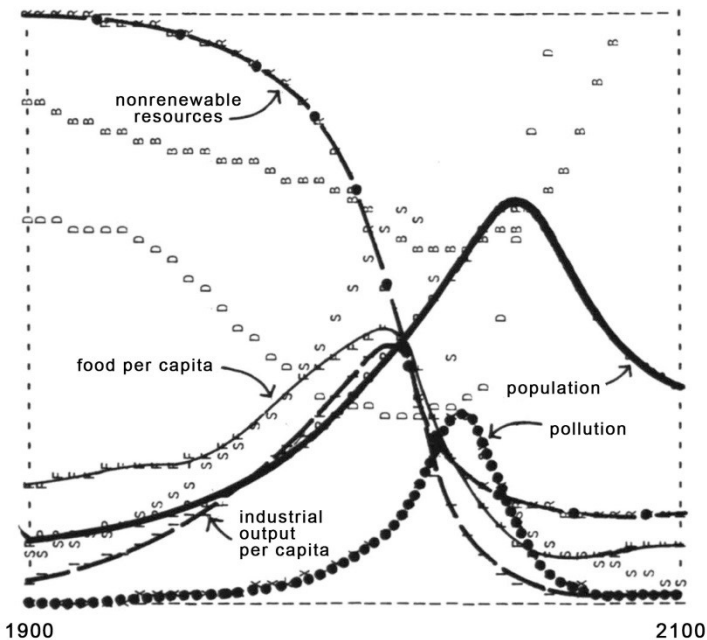
3. The third mode change needs to be the Sustainability Revolution. That will occur when the Common Property Rights system is sufficiently mature. After that the **Sustainability Growth** and **Impact Reduction** loops will grow and the sustainability problem will be solved.

Analysis of the environmental proper coupling subproblem

The elegance of the The World's Property Management System diagram lies in how simply and persuasively it supports the analysis step of subproblem D. In this subproblem the world's economic system is improperly coupled to the environment. The subproblem symptoms are that *the economic system is causing unsustainable environmental impact*. Here are the analysis substeps:

Substep A. Find the immediate cause of subproblem symptoms in terms of the system's dominant feedback loops.

The symptoms and their immediate cause in terms of feedback loops were definitively described by the World3 model of the *Limits to Growth* in 1972. The book went on to become the bestselling environmental book of all time, with some 30 million copies sold. The closest runner up is *Silent Spring* with 9 million copies. The reason is the *Limits to Growth* described the problem's potential behavior so well the world woke up. It had a new mega-problem to solve, as illustrated by the graph and its original title and caption below. (p124) ⁶⁵



World Model Standard Run – The “standard” world model run assumes no major change in the physical, economic, or social relationships that have historically governed the development of the world system. All variables plotted here follow historical values from 1900 to 1970. Food, industrial output, and population grow exponentially until the rapidly diminishing resource base forces a slowdown in industrial growth. Because of natural delays in the system, both population and pollution continue to increase for some time after the peak of industrialization. Population growth is finally halted by a rise in the death rate due to decreased food and medical services.

The graph told a story a lot of people could never forget. The graph, now famous, predicted a bleak scenario of the future if “business as usual” continued.

As striking and sound as the book’s message was, however, something went wrong. The planet is still on track to play the “business as usual” scenario out because no significant solution to the sustainability problem is in sight. WHY is this? From the viewpoint of the System Improvement Process there’s a simple reason: The process doesn’t fit the problem. The predictable results are below:

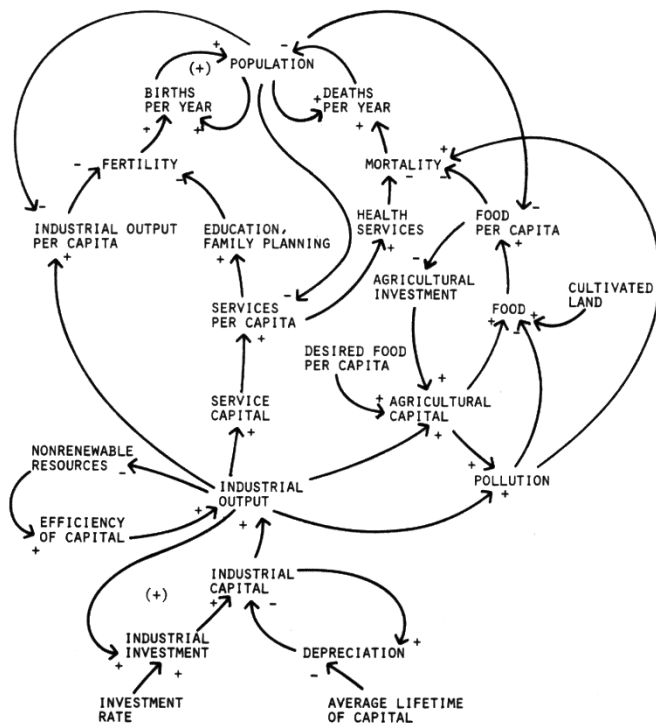
1. Problem Definition		The System Improvement Process			
Done by <i>Limits to Growth</i> in 1972		A. How to Overcome Change Resistance	B. How to Achieve Life Form Proper Coupling	C. How to Avoid Excessive Model Drift	D. How to Achieve Env. Proper Coupling
		Symptoms	Symptoms	Symptoms	Symptoms
2. Analysis Spend about 80% of your time here. The problem solving battle is won or lost in this step, so take the time to get the analysis right.	A	?	?	?	Dominant loops causing symptoms found by the World3 model
	B	?	?	?	?
	C	?	?	?	?
	D	?	?	?	?
	E	?	?	?	?
3. Solution Convergence		?	?	?	?
4. Implementation		?	?	?	?
Continuous Process Improvement – The foundation of the entire process					
Progress on solving the sustainability problem – From the perspective of SIP only two steps have been performed.					

This version of the SIP matrix has been expanded to show the four subproblems found. As SIP sees it, problem solvers have completed only 2 of the steps in the matrix: problem definition and the first substep of analysis for the environmental proper coupling subproblem. Both were admirably done by *Limits to Growth* in 1972. But what have the super sleuth’s of the world been doing since then? Where are the results for the rest of the process or one something like it? I’ve searched for years, but they are nowhere to be found. Instead, what we find are the artifacts of Classic Activism, like what *should* be done and *why* we have to do it and *please* let’s do it now, because if we don’t....

Still, the Club of Rome, Jay Forrester, Dennis and Donella Meadows, Jorgen Randers, and the rest of the 17 person *Limits to Growth* team pulled off a precocious miracle. They spotted a problem few had taken seriously and wrestled it into a form that allowed them to complete the first two steps.

Let’s see if it’s possible to take up where *Limits to Growth* left off.

The World3 model used the forces of the IPAT equation to explain behavior. P is population growth. A is affluence or consumption per capita. T is environmental impact per unit of consumption. World3 modeled these three forces and their resultant impact with basic five sectors: population, capital, resources, agriculture, and pollution. How these work together is shown on the next page.



Causal loop diagram of several important feedback loops of World3. ⁶⁶

These feedback loops are the immediate cause of the symptoms of unsustainability. The World3 model and its standard run produces growth, overshoot, and collapse. (1) But what causes these tendencies? (2) What causes industrial output to grow so ravenously? (3) Why is the human system so locked into growth, regardless of future consequences? (4) What is the rock bottom root cause of these loops?

The World3 model provides no clues to these questions. That's because it's trying to solve one big problem instead of four little subproblems. The questions cannot be answered by extending the World3 model, unless you prefer an awkward gigantic complex model that no one but its builders can understand. That's why this book uses multiple (and much simpler) models for the different subproblems.

Our model for the environmental proper coupling subproblem is The World's Property Management System model on page 189. It uses a mere two loops to summarize how the economic system impacts the environment. These are the **Industrial Growth** and **Limits to Growth** loops. Now when we ask the four questions listed above, all the clues we need to answer them are right there on the model.

Substep B. Find the intermediate cause, low leverage points, and symptomatic solutions.

The universal consensus among economists is that the environmental sustainability problem is a classic case of market failure. **Market failure** occurs when a market fails to allocate resources efficiently. The consensus is reflected in this statement in *The Stern Review on the Economics of Climate Change* of 2007 by Howard Stern: “Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen.”

If the problem is market failure, what’s the cause? In a classic statement of market failure theory, in 1958 Francis Bator wrote *The Anatomy of Market Failure*. The paper classified market failure into five types or modes. Bator then turned to causes: “If, however, one looks for an organizing principle not to modes of failure but to causes, there appear to be three polar types: (1) Ownership Externalities, (2) Technical Externalities, and (3) Public Good Externalities.” These were examined at length. Works like this established the foundational consensus that externalized costs are the cause of environmental problems.

Today, fifty years later, little has changed. *The Stern Review* contains a section on “Understanding the market failures that lead to climate change” that says:

In common with many other environmental problems, human-induced climate change *is at its most basic level an externality*. Those who produce greenhouse-gas emissions are bringing about climate change, thereby imposing costs on the world and future generations, but they do not face directly, neither via markets nor in other ways, the full consequences of the cost of their actions. (Stern, 2007, p27, italics added)

But externalized costs are not the root cause. They are the *intermediate cause* because one can legitimately ask what is the cause of externalized costs. Economists, governments, and activists have not done that. Instead, they stopped at the first plausible cause and assumed that was the root cause.

Reasoning further, if externalized costs are the cause, then the *low leverage point* is obvious. Costs must be internalized. Problem solvers, led by economists, have promoted a variety of solutions for pushing on that leverage point. At the system level, solutions to the environmental sustainability problem fall into two main groups: prescriptive regulation and market-based solutions like pollution taxes and cap and trade. But these are *symptomatic solutions* because they don’t resolve the root cause. They only resolve the intermediate cause.

Substep C. Find the root causes of the intermediate causes.

Substep A found that dominance of the **Industrial Growth** and **Limits to Growth** loops is the immediate cause. Substep B found the intermediate cause of

this loop dominance is too many *externalized costs of environmental impact*. What's the root cause of too many externalized costs?

Consider what the analysis mode has to say here. WHY are the **Industrial Growth** and **Limits to Growth** loops so dominant? Dominance is relative. What's weak is the **Sustainability Growth** and **Impact Reduction** loops. WHY are they weak?

The answer to that uncommon question has been sitting in plain sight for over seventy years. In 1937 Ronald Coase published *The Nature of the Firm*. In it he posed a question no one had seriously asked before: Why do firms appear? In theory the price mechanism should work equally well for organizations or individuals. But Coase asked: (Italics added)

...why is such organization necessary? Why are there these "islands of power"? Outside the firm, price movements direct production, which is coordinated through a series of exchange transactions on the market. *Within a firm these market transactions are eliminated*, and in place of the complicated market structure with exchange transactions is substituted the entrepreneur-coordinator, who directs production.

Coase showed that firms appear because "Within a firm these market transactions are eliminated." This increases economic efficiency, which allows a firm to sell its output at a lower price and still be profitable. This opportunity attracts entrepreneurs and investors. From this arises the principle that *firms appear when there is a profitable opportunity to lower transaction costs*.

But firms have not appeared to manage unsustainably managed common-pool resources. WHY? Because the transaction costs for gaining the legal authority to manage a particular common property are so high that firms cannot enter the market. Unlike for private property, no standard legal mechanism exists whereby a firm can appear and manage a common property. We have therefore found the root cause. It is *high transaction costs for managing common property sustainably*.

According to Coase **transaction costs** are "the cost of using the price mechanism" or "the cost of carrying out a transaction by means of an exchange on the open market." There are two types of costs in a firm: transformation costs and transaction costs. **Transformation costs** are the costs of converting inputs into outputs. This is the actual cost of making a product or service. Transaction costs are the costs of using market transactions to sell your output or buy someone else's. Examples of transaction costs are the cost of finding out where to get a product, the cost of determining the quality of the product, the cost of bargaining, the cost of contracting, and the cost of payment. Added up, these can be substantial.

Let's define **technology** as any practice that will reduce the PAT factors in the IPAT equation. "New technology" means more sustainable technology. For the sustainability problem transactions costs occur in areas like these:

1. Searching for the most cost effective existing technology.
2. Contracting and managing creation of needed new technology.
3. Education on the implementation of new technology.
4. Cost/share programs for new technology introduction.
5. Transfer programs to developing countries for use of new technology.
6. Monitoring a source's amount of environmental impact.
7. Enforcement of contracts, regulations, permits, etc.
8. Design, lobbying, drafting, negotiation, etc. of related new legislation.
9. Research to identify and organize common property problems.
10. Research to set sustainability targets for common property problems.

Presently these costs are high because they can't be conducted inside a firm. Instead, to solve an environmental problem the above transactions have to be conducted by the many individual parties involved: politicians, government agencies, local authorities, the sources causing environmental impact, NGOs, individuals interested in solving the problem, and so on. It's a transactional mess.

Another way to see why transaction costs for managing common property are high is to study the Common Property Rights system in The World's Property Management System on page 189. In the CPR box there are seven nodes. The top one, use of common property, is what needs managing within a firm. But due to lack of legal Common Property Rights firms can't appear to perform the other six nodes. Instead, these are awkwardly and expensively performed in the manner described above by many different social agents.

The root cause is *high transaction costs for managing common property sustainably*. Let's check this against the five requirements for a root cause:

Requirement 1. It is clearly a (or the) major cause of the symptoms.

The symptoms of this subproblem are *the economic system is causing unsustainable environmental impact*. If transaction costs for managing common property sustainably were low instead of high, the symptoms would quickly disappear. This satisfies the first requirement.

Requirement 2. It has no worthwhile deeper cause.

Digging deeper, what causes high transaction costs for managing common property sustainably? One possible deeper cause is social agent selfishness. But this does not cause environmental improper coupling. It causes life form improper coupling and is addressed by that subproblem. Another deeper cause could be the survival of the fittest step of the evolutionary algorithm. But that's an unchangeable root cause. There may be other worthwhile deeper causes, but we have been unable to find them. This satisfies the second characteristic.

Requirement 3. It can be resolved.

We already know that transaction costs for managing private property efficiently are relatively low. Market economies for private property transactions are extremely efficient as demonstrated by the high amount of per capita wealth generated since the Industrial Revolution. We just need to do the same for common property. That's feasible because it's already been done for private property. This satisfies the third characteristic.

Requirement 4. Its resolution will not create other equal or bigger problems. Side effects must be considered.

What bigger problems could solving the environmental sustainability problem create? None are possible because that's the world's biggest long term problem by far. If it's not solved, no other problem will matter because *Homo sapiens* won't be around anymore. We will have destroyed our ecological niche. Lack of a suitable niche is the biggest possible problem any life form can have. This satisfies the fourth characteristic.

Requirement 5. There is no better root cause. All alternatives have been considered.

Are there any better root causes? Have all alternatives been considered? This is the same as asking if the entire root cause space (like a solution space landscape) has been searched. That it has been exhaustively searched is not as impossible to prove as it may seem.

The invisible hand of evolution has proven exquisitely capable of randomly searching vast solution landscapes. This takes a long time for genetic evolution. But for memetic evolution the search is swift. The world's PPR system is the result of one such search. PPR has lowered transaction costs for management of private property to the bone. If we agree *Homo sapiens*' 200,000 year long search for an efficient PPR system has been reasonably exhaustive, then if we begin our search by examination of PPR and find a solution, we can safely conclude that all major solution alternatives have been considered. The factors that comprise a well-defined PPR system can be used to design a well-defined CPR system. If we then accept the argument that PPR and CPR are resolving the same type of root cause (high transaction costs for managing a type of property), then there is no better root cause. This satisfies the fifth characteristic of a root cause.

Substep D. Find the feedback loops that should be dominant to resolve the root causes.

These are easily found by examination of The World's Property Management System model. To counteract the dominance of the two loops on the left, the two loops on the right need to be the dominant loops in the system. They need to be

stronger than the loops on the left or the system as a whole will continue to operate unsustainably. The loops that should be dominant are thus **Sustainability Growth** and **Impact Reduction**.

Substep E. Find the high leverage points to make those loops go dominant.

The root cause is high transaction costs for managing common property sustainably. How can those costs be lowered? By heeding the advice of Ronald Coase. *The Nature of the Firm* discovered the principle that firms appear when there is a profitable opportunity to lower transaction costs. The right kind of firm will lower those costs. Therefore the high leverage point is to *allow firms to appear to lower transaction costs*.

Notice how smoothly the five analysis substeps were performed. None seemed hard at all, because we're following a process that fits the problem.

The work of Hernando de Soto

In mid-2010 after the subproblem analysis was complete and the Common Property Rights solution element was created, I discovered the work of Hernando de Soto. De Soto is a Peruvian economist working on the world's poverty problem. What stunned me was de Soto found the same root cause for his problem that I did for mine: high transaction costs. In the environmental proper coupling problem the root cause is high transaction costs for *common* property. According to de Soto, in the poverty problem the general root cause is high transaction costs for *private* property, because in undeveloped nations there is no workable private property system for the poor.

De Soto summarized his work in 2000 in *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. The back cover states his main conclusion:

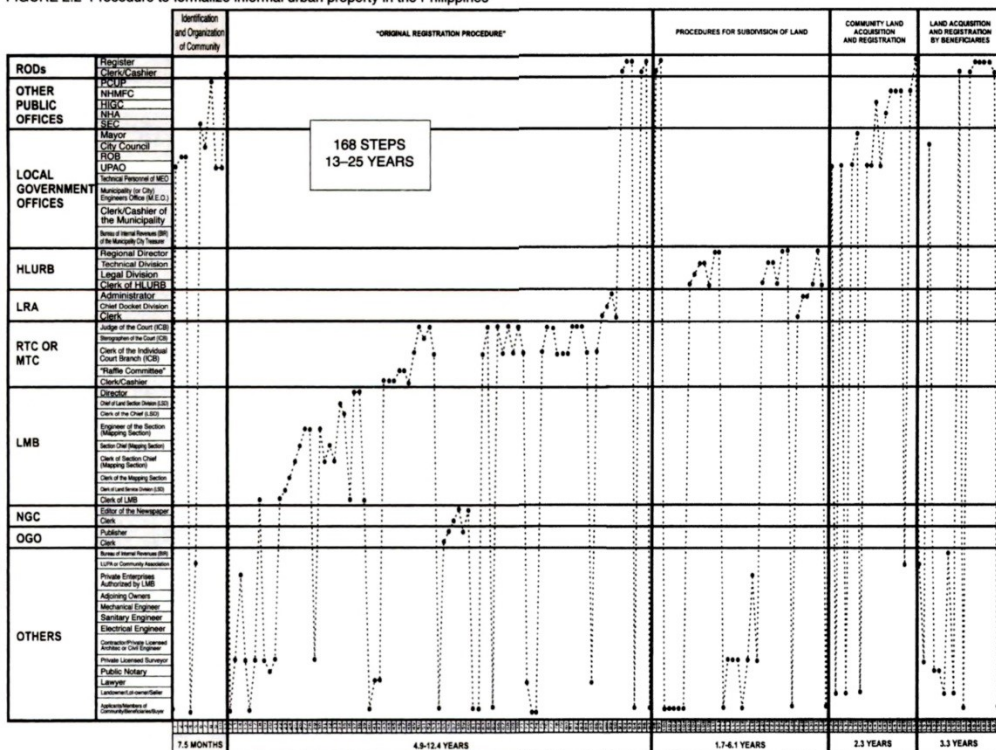
Why do some countries succeed at capitalism while others fail? In strong opposition to the popular view that success is determined by cultural differences, de Soto finds that what creates capital in the West is a process buried deep in the legal structure of its property systems. Every developed nation in the world at one time went through the transformation from predominately extralegal property arrangements, such as squatting on large estates, to a formal unified legal property system. In the West we never realized that capital is a dormant value hidden in the assets and talents we own and which legal property bring to life.

Late in his book de Soto explores why property rights are needed. This leads to his root cause of why “capitalism triumphs in the West and fails everywhere else.” Note how his conclusion is the same as mine: (p219)

A good legal property system is a medium that allows us to understand each other, make connections, and synthesize knowledge about our assets to enhance our productivity. ... By representing economic aspects of the things we own and assembling them into categories that our minds can quickly grasp, property documents reduce the costs of dealing with assets and increase their value commensurately. This notion, that the value of things can be increased by reducing the costs of knowing them and transacting with others, is one of Nobel laureate Ronald Coase’s major contributions. In his treatise *The Nature of the Firm*, Coase established that the costs of carrying out transactions can be substantially reduced within the controlled and coordinated context of a firm. In this sense, property systems are like Coase’s firm—controlled environments to reduce transaction costs.

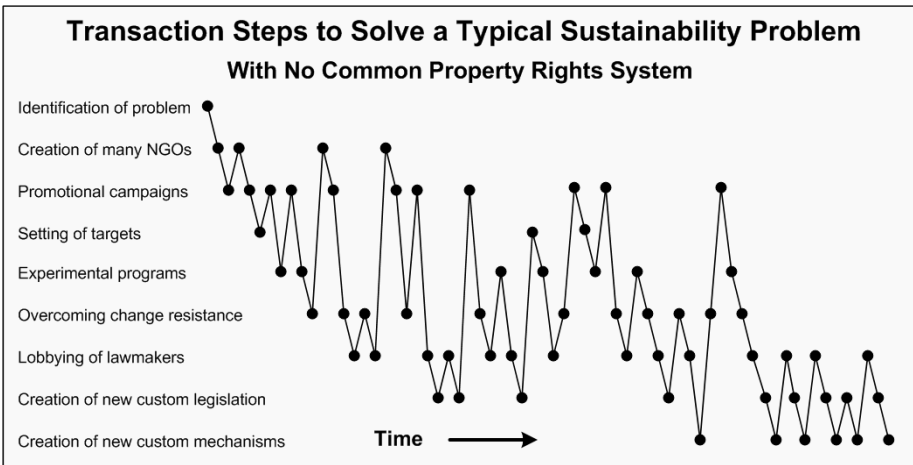
The Mystery of Capitalism contains several graphs of the transaction costs for gaining ownership of property currently outside of the legal system. For the poor living outside the legal system, the way inside is to gain legal rights to valuable private property, such as land. On pages 22 and 23 is the graph below.

FIGURE 2.2 Procedure to formalize informal urban property in the Philippines



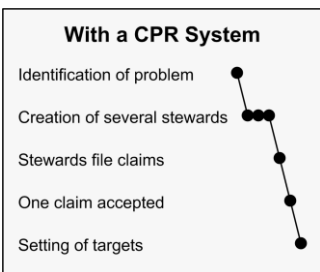
Each dot on the graph is a transaction step with a cost. It takes an agonizing 168 steps and 13 to 25 years to formalize informal urban property in the Philippines. Total costs are so high and take so long the process is rarely performed. The result, in de Soto’s words, is an insurmountable “paper wall” preventing the poor from beginning solution of their poverty problem. *The Times* of London agreed, calling the book “The blueprint for a new Industrial Revolution.”

What struck me about de Soto’s graphs was the same pattern occurs in the sustainability problem. There the issue is common rather than private property. Currently environmental activists face the same paper wall the world’s extralegal poor do. If we graphed that paper wall it would look about like this:



These steps are so long and expensive that most sustainability problems are never solved. Activists give up long before the end of the above process.

But that could change if we pushed on the high leverage point of *allow firms to appear to lower transaction costs for managing common property sustainably*. This can be done with Common Property Rights. Then the graph would look more like the smaller one below.



What a difference. Transaction costs are an order of magnitude lower. After the last dot on the graph the remaining transactions occur inside a firm. Stewards then play the same role as today’s corporations. That role works.

The evidence

The key finding is that the main root cause of the environmental proper coupling subproblem is *high transaction costs for managing common property sustainably*. Once you've familiarized yourself with the work of Hernando de Soto, the evidence this is the root cause can be seen everywhere. The previous page showed how the Transaction Steps to Solve a Typical Sustainability Problem are so long and expensive that problem solvers either give up or solutions are so weakened by compromise that they fail to fully solve the problem.

For example, serious effort on solving the climate change problem began in 1992 with the signing of the Framework Convention on Climate Change by 154 countries at the Rio Summit. This led to creation of the Kyoto Protocol in 1997. It entered into force in 2005. However, the US never ratified the Protocol. Canada withdrew in 2012. Developing nations were exempted. By the end of 2012 it was clear that the Kyoto Protocol was a failure. It aimed for a 5% cut in carbon emissions. What happened was a 58% increase. Today, mid 2016, nothing has replaced the Protocol. The Paris Summit of 2015, unlike the Protocol, contained no binding deadlines or country specific targets. Solution progress has gone backwards.

All along the way, starting well before the Rio Summit of 1992, transaction costs kept piling up. Each meeting, each speech, each work task, each conversation, and each summit entails transaction costs. If these were calculated and added up, by now they would probably exceed a billion dollars.

What's really happening here is the world is trying as hard as it can to create a system of property rights for managing the climate change problem. Such a system would specify who has what rights and how those rights would be enforced. The same pattern holds for tens of thousands of other environmental problems, those associated with pollution, renewable resources, and non-renewable resources. Each little problem goes through its own long expensive series of steps to pound out a custom piecemeal solution. Each step entails transaction costs. These are so high, and the process takes so long, that it has proven to be impossible to solve anything but problems with very low change resistance.

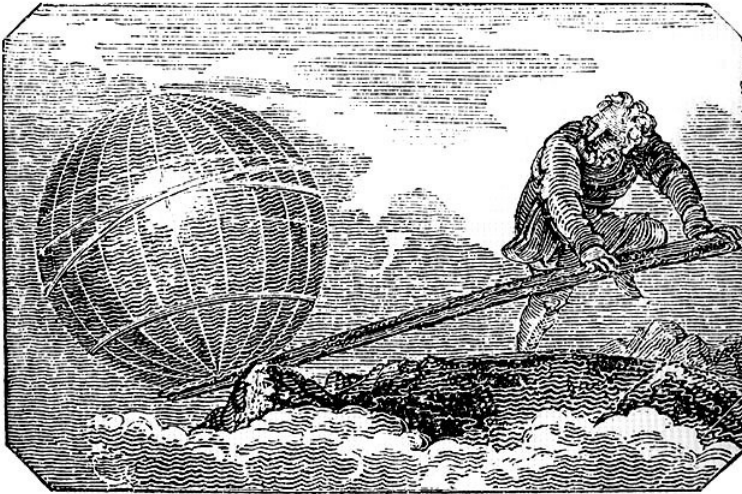
But that would change overnight if the root cause was resolved.

The solution requirement specifications are on the next page.

Solution Requirements Specification for	
Subproblem D – How to Achieve Environmental Proper Coupling	
1. Main problem	The global environmental sustainability problem
2. Subproblem	How to achieve environmental proper coupling
3. Subproblem symptoms	The economic system is causing unsustainable impact
4. Intermediate cause	Externalized costs of environmental impact
5. Root cause	High transaction costs for managing common property sustainably
6. High leverage point	Allow firms to appear to lower transactions for managing common property sustainably
7. Model	The World Property Management System
<p>9. Standard Requirements: Solution elements must resolve the root cause by pushing on the high leverage point, in such a manner that a permanent system mode change occurs. The new root cause forces must be engineered such that new or strengthened feedback loops lock the system into the new mode.</p> <p>You can't manage what you can't measure. Changes in the root cause force must be measured. A measurement method shall be used to refine solutions under development, to evaluate the effectiveness of implemented solutions, and to monitor the long-term health of solutions.</p> <p>These specifications represent a solution strategy hypothesis. Solution elements can be designed to push on the high leverage point. Then the solutions can be tested and evolved until final solutions emerge that can solve the problem via large-scale implementation.</p>	
<p>10. Measurement Considerations: We can offer this guideline:</p> <p>Transaction costs for managing common property sustainably must be measured. The lower transaction costs are, the more efficient the world's Common Property Rights will be. Once it become highly efficient, it will manage common property just as <i>sustainably</i> as the world's private property right system has long managed private property <i>productively</i>.</p>	
<p>11. Solution Considerations:</p> <p>The key is to stop seeing this subproblem as caused by externalized costs. That mindset has restricted the solution space to solutions that can <i>directly</i> internalize costs. That mindset needs to be abandoned. In its place should come recognition that costs must be <i>indirectly</i> internalized, since externalized costs are an intermediate cause. The root cause, high transaction costs, is a systemic force. It can only be resolved with the systemic strategy of pushing on the high leverage point.</p>	

Part 3

Sample Solution Elements for Pushing on the High Leverage Points



Give me a lever long enough and a place to stand, and I shall move the earth.
Archimedes, 287 to 212 BC ⁶⁷

The ancient Greek mathematician, physicist, engineer, inventor, and astronomer Archimedes invented the Law of Levers:

$$\text{Force A} \times \text{Length A} = \text{Force B} \times \text{Length B.}$$

Challenged by King Hieron II of Syracuse to prove his law was true, Archimedes chose pulleys rather than levers: *“He fixed accordingly upon a ship of burden out of the King’s arsenal which could not be drawn out of the dock without great labour and many men; and, loading her with many passengers and a full freight, sitting himself the while afar off, with no great endeavour, but only holding the head of the pulley in his hand and drawing the cords by degrees, he drew the ship in a straight line, as smoothly and evenly as if she had been in the sea.”* ~ Plutarch (46 to 120 AD)

Subproblem A

Without Truth Literacy, Democracy Cannot Long Survive

“...propaganda is today a greater *danger* to mankind than any of the other more grandly advertised threats hanging over the human race.

Propaganda is the expression of opinions or actions carried out deliberately by individuals or groups with a view to influencing the opinions or actions of other individuals or groups for predetermined ends and through psychological manipulation.

The strength of propaganda reveals, of course, one of the most dangerous flaws of democracy. ...propaganda renders the true exercise of [democracy] almost impossible.”

Jacques Ellul

Propaganda: The Formation of Men's Attitudes

1965, p xvii, xi, xii, xvi

Subproblem A is how to overcome change resistance

Chapter 9

Laying the Foundation for a Truth Literate Electorate

A nation cannot long endure if oppressed, whether by a mother country, a colonial power, a tyrant, a class, or any other group who puts their own interests first. **Oppression** is the act of using power to benefit one group at the expense of another. Since no sane person wants to be oppressed, in a democracy mass oppression requires mass deception, so that an oppressor can get elected, stay elected, and gain continued support for his actions.

Truth literacy is the ability to tell truth from deception. Universal truth literacy is just as important to the health of democracy as reading literacy, because if people cannot “read” the truth they are blind to what the truth really is. They are easily controlled by any politician who uses deception to hoodwink the masses into supporting him and his positions.

Political deception is an age old, worldwide problem. Its success has led to more oppression, and resultant corruption, war, and economic hardship, than any other single cause. The cunning politician, in his increasingly ruthless climb to power, can mow down the opposition with comforting bullets of half-truths and vicious *ad hominem* attacks until there is no one left who dares to tell the truth. Hitler did it. Mussolini did it. Vladimir Lenin did it to rise to the top and consolidate his and the communist party’s iron grip after the Bolshevik Revolution. Some of this required force. But the main engine of oppression was the poisonous gas of endless deception. It was Lenin who gave the world this chilling rule: ⁶⁸

“A lie repeated often enough becomes the truth.”

But if citizens can tell truth from falsehood then lies will not work, no matter how many times they may be repeated. In fact, once a person has been inoculated against deception, each further repetition of a bold lie only serves to drive the person further away from the deceiver.

The classic example, now indispensable to modern civilization, is how scientists become inoculated against deception by themselves or others. This continues throughout their training by intimate exposure to the Scientific Method, with its insistence on experimental proof before a hypothesis can be accepted as reasonably true. Scientists are deeply skeptical of any claim that lacks proof, depends on fallacious reasoning, or is not falsifiable, and will instinctively swat such a claim aside. Entire fields of science protect themselves against the stealthy invasion of falsity by

enshrining their most important knowledge in peer reviewed journals. A lie repeated often enough rarely becomes the truth in science.

The same, however, cannot be said for politics. Unlike science, democracy has *no formal mechanism* to prevent political deception from winning. In politics, a lie repeated often enough routinely becomes the truth.

Aristotle (384-322 BC) invented a possible mechanism, the laws of formal logic and identification of the thirteen categories of fallacies. But these had little positive impact. Logic in ancient Greece was abused from the beginning by the Sophists, who quickly discovered that the best paying customers were young statesmen and nobility. For them the most important skill of the day was **rhetoric**, the ability to persuade others to your point of view, regardless of your argument's logical truth.

Jeremy Bentham and “the Law as it ought to be”

Over the next two thousand years, Aristotle's work on formal logic was extended. But his work on fallacious reasoning lay untouched until 1824 when Jeremy Bentham (1748-1832) published *The Book of Fallacies*. At the age of twenty-one Bentham stumbled into this striking passage in John Priestley's *The First Principles of Government*:

“The good and happiness of the members, that is the majority of the members of the state, is the great standard by which every thing relating to that state must finally be determined.”

That ideal so transformed Bentham that he made pursuing it his life's work, and resolved “to make himself the Newton of the unborn science of legislation, of ‘the Law as it ought to be.’ ”⁶⁹ Educated as a lawyer, Bentham had already witnessed such a high level of complexity and abuse of English law that he termed it the “Demon of Chicane.” The legal system was working mainly for the benefit of “sinister interests.” (Defined earlier on page 95.) In England and the other European countries Bentham was familiar with, the sinister interests of the powerful conspired against the interests of the wider public. While an advance on feudalism, the system begged for reform.

To Bentham, “the Law as it ought to be” depended on two pillars. The first, which became the cornerstone of utilitarianism, was belief that “the fundamental principle of all good governments [is] the greatest happiness for the greatest number.”⁷⁰ The second was “the power of reason in human affairs, once the veils of deception were torn from men's eyes.”⁷¹ By Bentham's time, the first pillar had become the approximate goal of modern democracy. The second pillar had not fared as well, so it was to that pillar that Bentham turned much of his attention, in a search for a mechanism to prevent deception from winning. Below is what he found:⁷²

It took the father of utilitarianism nearly half a lifetime to learn all the harsh, disillusioning lessons of the politics of reform. After repeated rebuffs, he came to understand the great variety of tactics employed by the defenders of entrenched abuses when confronted with an obviously good piece of legislation proposed by the reformers. Their first move was usually to invoke some sort of high authority in order to rule out all discussion. (Fallacies of Authority) As a second resource, they would try to accomplish the same end by exciting groundless alarms. (Fallacies of Danger) These arrangements failing, they would endeavor to postpone debate indefinitely. (Fallacies of Delay) If all those devices availed them nothing, they would always resort to sheer confusion of the issue. (Fallacies of Confusion)

But what annoyed Bentham the most was the fact that, all the while, those corrupt obstructionists of progress would pose before the world as reasonable and well-intentioned men. This seemed to him to be chicanery of the most detestable sort, and he resolved to expose it thoroughly. He made careful notes of all these maneuvers, naming and cataloging some thirty principle species of political fallacies.

Bentham's work led to another more important conclusion: ⁷³ (Italics added)

In countries where freedom of the press and public discussion do not exist, the interests of the many are openly and unhesitatingly sacrificed by force to *the interests of the few*. The people have it not in their power to require reasons, and no reason is given but the supreme will of the ruler. In England, on the contrary, *these ends can only be obtained by fraud*. In consequence of the long-established habits of public discussion, the people are too mindful of their own interests, and too strong to allow them to be openly violated. Reasons must be given, and reasons sufficient to satisfy *or deceive* a majority of the persons to whom they are addressed. Now it is impossible by fair reasoning ...to justify the sacrifice of the interests of the many to the interests of the few.... It follows that for effecting this purpose they must have recourse to *every kind of fallacy*, and address themselves, when occasion requires it, *to the passions, the prejudices, and the ignorance of mankind*.

Why Bentham's work had little effect

In the short run, Bentham's work prodded England into reform. "...nearly all of the improvements in the social and political life of England between 1825 and 1870 are traceable to him, or to his followers, who are also credited with destroying more nonsense than any other school of thinkers in recorded history."⁷⁴ But in the long run his work had little effect. The European aristocracy remains, though its base shifted from land rents to corporate profits. The chicanery of politicians continues.

In a deception driven decision that stunned the world, on June 23, 2016 England voted to leave the European Union. It immediately became clear this would be disastrous. The pound fell 10% against the dollar. Scotland will leave England to remain in the Union. The number two financial capital of the world, London, will see most of its business fly away. England may lose access to the EU market, to which it exports 13% of its GDP, unless it pays about what it's paying now to Brussels and follows about the same rules it's following now. There is no free lunch.

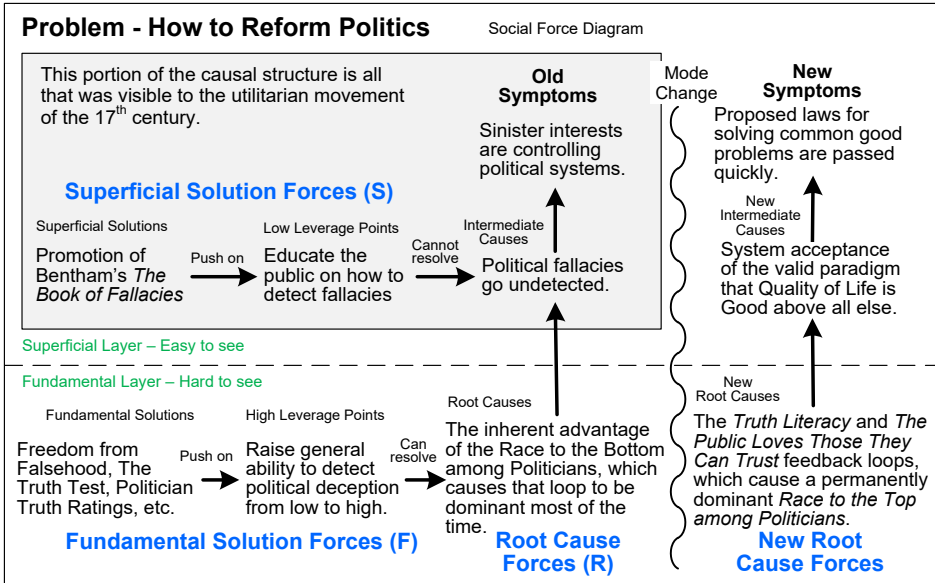
The leavers won by the politics of deception. Prime Minister David Cameron could see it all coming. On June 6 Cameron held a press conference on the upcoming vote and accused the leavers of promoting six lies: “[The] leave campaign [is] resorting to total untruths to con people into taking a leap in the dark: it’s irresponsible and it’s wrong and it’s time that the leave campaign was called out on the nonsense that they are peddling.”⁷⁵ This made no difference. The leavers won by the politics of deception.

I’ve described Bentham’s efforts in some detail so that you can see how even one of the greatest minds in political history was unable to achieve his goal. Bentham did not work alone. The utilitarian movement aimed at bringing about radical reform of politics. But in the long run the movement failed. Why exactly did it fail?

At first glance it should not have failed. Bentham reached some of the same key conclusion our own analysis did. The analysis found that in a democracy, special interests are by definition a minority. Force cannot be used to promote these interests. Only the ballot box can. So how can special interests convince the majority to vote against their own interests? The only way this can be done is by political deception. Bentham found the same thing. “The interest of the few... can only be obtained by fraud. ...for effecting this purpose they must have recourse to every kind of fallacy....”

Bentham also found that the common fallacies used by “defenders of entrenched abuses” can be divided into four categories: the fallacies of authority, danger, delay, and confusion. Our analysis, two hundred years later, found different categories: false promise, false enemy, pushing the fear hot button, wrong priority, and secrecy.

What Bentham did not find was the root cause of the success of political deception. Bentham, his close followers, and the broader utilitarian movement fell into the Superficial Solutions Trap by assuming an intermediate cause was the root cause, as explained in the social force diagram below. The diagram is adapted from the one used for subproblem A, How to overcome change resistance, on page 91. Only the name of the problem and the contents of the gray box have been changed. The crux of most reform problems that would benefit the common good is not system redesign, but change resistance from the entrenched status quo.



All Bentham could see was what’s in the gray box. The problem of how to reform politics was defined by its chief symptoms: *sinister interests are controlling political systems*. The cause, plainly obvious to Bentham, was that *political fallacies go undetected*. Feeling certain that “the power of reason in human affairs, once the veils of deception were torn from men’s eyes” would lead to correct voter decisions, the leverage point was obvious. It was *educate the public on how to detect fallacies*. Bentham was so certain this would work that he meticulously studied the workings of Parliament and decoded the sophistry used into his categories of fallacies. His solution was to promote study of those fallacies, as described in elaborate detail in *The Book of Fallacies*.

But it didn’t work. Bentham could only see the superficial layer of the problem. Lacking the concept of root cause analysis, which had not yet been invented, he was stymied. When his solution failed to work there was no notion that it was possible to dig deeper and find the root causes.

Bentham also lacked another concept that had not yet been invented: feedback loops and feedback loop modeling. Unlike the fundamental solutions this book describes, Bentham’s solution was not systemic. It didn’t alter any feedback loops. His solution was unable to cause a system mode change because there were no new or strengthened feedback loops that would trigger the mode change and keep the system firmly locked in the new mode.

In the diagram, the intermediate cause is *political fallacies go undetected*. This differs radically from the root cause of *the inherent advantage of the Race to the Bottom*. The Dueling Loops of the Political Powerplace model explains why that root

cause exists. It's because the size of falsehoods can be inflated, but the size of the truth cannot. This advantage, when exploited by sinister interests, causes *political fallacies to go undetected*. Resolving the root cause requires eliminating the advantage. This can be done by pushing on the high leverage point of *raise general ability to detect political deception*. While Bentham's solution of *The Book of Fallacies* can help to push on that point, by itself that solution has only a small effect. Much more is required. Effective solutions must push systemically by introducing or strengthening the right feedback loops. Bentham's solution is similar to *The Truth Test* solution element, described later in this chapter.

Laying the foundation with the right feedback loops

The high leverage point is *raise general ability to detect political deception*. Pushing on that point strongly enough to resolve its connected root cause requires introduction of new feedback loops or strengthening of existing loops. To do this an interlocking collection of solution elements are employed:

1. **Freedom from Falsehood** – The foundation begins by introducing a new explicit goal to political systems. This solution element gives people the legal right to freedom from falsehood from sources they must be able to trust. This goal allows creation of new balancing loops that strive to achieve the goal.
2. **No Competitive Servant Secrets** – The objective of this solution element is to prevent public servants, especially politicians and publically created artificial life forms like corporations, from using secrecy to their own advantage. If public servants can keep certain information secret, then Freedom from Falsehood cannot be implemented, because in too many cases there would be no way to discern the truth.
3. **The Truth Test** – Like Bentham's *The Book of Fallacies*, this solution element allows citizens to educate themselves on how to tell truth from deception. This creates the **Truth Literacy Promotion** balancing feedback loop, whose goal is Freedom from Falsehood.
4. **Politician Truth Ratings and the Political Persuasion Knowledge Base** – These two solution elements create **The Public Loves Those They Can Trust** feedback loops, which strengthen the Truth Test.
5. **System Performance Indexes** – These measure how well politicians are actually doing on achieving what matters most to citizens: quality of life and sustainability.

This chapter describes the first three elements. These give the other elements something to build on.

Freedom from Falsehood

When engineering deep structural change in a social system, the goal of the system plays *the* key role. The right goal, if no constraints block progress toward the goal, will lead to the right system behavior in an efficient self-managed manner.

Here the system is a small portion of the political system. Let's call it the **Citizens Political Decision Making Subsystem**. In politics, citizens face two main decisions over and over: who to vote for and what positions to support. The health of democracy depends on the quality of these decisions.

There is, however, a bit of a problem. The subsystem has no clear explicit goal. Democracy does. It's to optimize the common good of all. The world's first two modern democracies codified this goal as "to promote the general welfare of the people" and "liberty, equality, fraternity." Bentham described it as "the greatest good for the greatest number." But, no matter how it's worded, this goal is too broad to efficiently drive quality of citizen decision making to a high level. What's needed is a clear explicit goal for the subsystem.

The root cause of successful change resistance is *the inherent advantage of the Race to the Bottom*. The high leverage point for resolving the root cause is *raise general ability to detect political deception*. What would be a suitable goal for doing that? We want to free the subsystem from political deception. How exactly that is to be done is of lesser concern. Thus the explicit goal should be Freedom from Falsehood.

Now then, what should that phrase mean in operational terms? I think the subsystem would work quite well with this definition: **Freedom from Falsehood** gives people the right to freedom from falsehood from sources they must be able to trust. These sources include all "servants" of the people, such as politicians, public employees, and corporations, though we should start with politicians. A **servant** is an agent created or employed by *Homo sapiens* to do something useful for humanity. All servants must remain subservient to *Homo sapiens* and keep the interests of humans above their own.

What is not prohibited by law is permitted by implication. Therefore if people do not have the legal right to Freedom from Falsehood, then by implication it's okay for those in positions of power to manipulate citizens by the use of spin, lies, fallacies, soothing half-truths, the sin of omission, and all the forms of deception, propaganda, and thought control available.

If deception no longer works, politicians will be forced to compete for supporters on the basis of the objective truth. The truth includes the long term optimization of the general welfare of all members of *Homo sapiens*, which is the rightful goal of the human system. If citizens do not have Freedom from Falsehood, then falsehood in all its Machiavellian and Orwellian forms will continue to appear again and again, because it is the surest way to *rise to power*, *increase power*, and *stay in power*.

Activists are intuitively coming to the conclusion that Freedom from Falsehood is essential. For example, in an article on May 15, 2007 Julian Burnside, a prominent Australian barrister, advocated almost exactly that. Here's the beginning of the article: ⁷⁶ (Italics added)

The Future Summit, being held in Melbourne this week, is a hotbed of ideas, solutions and attempts to imagine a better world.

Global warming, reliance on fossil fuels, the growing gap between rich and poor, all have been debated by academics, captains of industry, religious, community and political leaders.

But one solution — put forward yesterday by the top silk Julian Burnside, QC — met with more acclaim than any other, and received rapturous applause.

'If we really want to make things better, *I suggest we introduce a law that makes it an offence for politicians to lie,*' he told the conference.

Julian Burnside has intuitively sensed what the Dueling Loops model analytically shows: that political deception is so damaging to democracy it should be illegal. The way to make that happen is to recognize that as long as the democratic model lacks the fundamental right to Freedom from Falsehood, it is an incomplete and too easily compromised model.

The political shocker of the early 21st century in Europe is turning out to be Brexit, the vote on June 23, 2016 by England to leave the European Union. It's a shock because it will lead to all sorts of self-inflicted disaster. Why did it happen? The consensus is deception worked. But it would not have worked if a certain agency had a different law. The following excerpt is from an article that appeared one week after the vote. The article's title, *How the Brexit Campaign Lied to Us—and Got Away with It*, says it all. ⁷⁷ (Italics and comment added)

If there is one sentence that explains the referendum result, though, it's this one from the website of the Advertising Standards Agency. "*For reasons of freedom of speech, we do not have remit over non-broadcast ads where the purpose of the ad is to persuade voters in a local, national or international electoral referendum.*" In other words, political advertising is exempt from the regulation that would otherwise bar false claims and outrageous promises. *You can't claim that an herbal diet drink will make customers thinner, but you can claim that £350m a week will go to the NHS instead of the European Union.*

Will they pull off the same trick again? It was noticeable how quickly the twin planks of the Leave campaign — extra money for the health service, and the implicit promise to cut immigration by "taking back control" of our borders — fell apart. [They were quickly rolled back by further deception.]

That evening, the Tory MEP Daniel Hannan told Newsnight that “taking back control” of immigration didn’t necessarily mean cutting it.

The first few days after the referendum felt like an extended period of gaslighting – being told that things you could distinctly remember happening had not, in fact, happened. How could anyone think that the Leave campaign had promised an extra £350m for the NHS? The money was “an extrapolation... never total”, said Iain Duncan Smith on the BBC. It was merely part of a “series of possibilities of what you could do”.

The law, always behind the times, prevents claims that an herbal drink will make customers thinner. But you can claim something is true even if it’s provably false, if you are a politician. The law prevents claims that would damage the health of people. But it allows claims that would damage the health of nations—which would lead to damage of many people. This absurd contradiction indicates that the law, always behind the times, needs to catch up and make Freedom from Falsehood a legal right.

However this new right alone will do little good unless falsehood can be easily detected directly by citizens. Doing that requires two additional solution elements: No Competitive Servant Secrets and The Truth Test.

No Competitive Servant Secrets

Public servants exist to serve the people. Ensuring the accountability, integrity, and equity of those who serve us must be possible at all times. If public servants can keep certain information secret, then Freedom from Falsehood cannot be implemented, because in too many cases there would be no way to discern the truth.

The objective of **No Competitive Servant Secrets** is to prevent public servants, especially politicians and publically created artificial life forms like corporations, from using secrecy to their own advantage. **Secrecy** is the practice of hiding information from some people while sharing it with others. That which is hidden is secret.

This objective is accomplished by complete openness in all that a servant does. *No servant may keep competitive secrets of any type, either from their masters or other servants.* After all, if a servant is an entity created or employed by humanity to provide people with goods and services, why should a servant need to keep any form of competitive advantage secret, except to gain advantage over its master or other servants?

Competitive secrets are a form of non-sharing and hence a form of non-cooperation. When combined with the mutually exclusive goals that some servants have of maximizing something, such as profits or power, this leads to a *destructive competition* mindset. But what we want is *constructive competition*, where agents compete in a friendly, let’s help each other manner. Removing competitive secrets takes independent agents one step closer to cooperation. Therefore full and complete

cooperation between servants and their masters, as well as between servants, requires no competitive secrets.

No Competitive Servant Secrets covers many areas. Some could be tackled soon. Others would take time. A few are counterintuitive and controversial, though less so as the analysis and solution strategy is more fully absorbed. Ultimately all would be dealt with, because a servant that keeps competitive secrets from its master has time and time again proven to be a danger to its master. The transition would probably take several generations.

No Servant Competitive Secrets supports the Corporation 2.0 solution element (presented later). This reengineers the modern corporation to where its interests no longer conflict with those of *Homo sapiens*.

No Competitive Servant Secrets is already spontaneously appearing in the form of freedom of information acts, sunshine laws, and so forth. But these are a haphazard collection of ways to reduce servant secrecy. Competitive secrecy needs to be reduced to zero in a comprehensive manner, which No Competitive Servant Secrets finally does.

One type of servant secret is government secrecy. A standard objection to eliminating government secrecy is the need for “national security.” However this objection is really designed to benefit one country (and its military industrial complex) at the expense of others. Military secrecy is a form of competitive advantage. If countries truly want to cooperate instead of compete, then there is no need for military secrecy.

The standard rebuttal to this argument is that if I can’t keep secrets and my competitor can, then they will gain an advantage over me. Rubbish. The same logic can be used to argue if I can’t steal and my competitor can, they will gain an advantage. We have all seen that it is to society’s benefit as a whole to outlaw theft. The same is true for secrecy. A country insisting on military secrecy is a country refusing to cooperate for the common good of all.

Because national security secrets increase the destructive competition mindset, they increase international conflict and/or preparation for it, which in turn increases the sales and profits of military goods and services. This benefits the military industrial complex, and hence the New Dominant Life Form. But it does not benefit Homo sapiens. In fact, international conflict or the diversion of national output to military purchases (the guns or butter choice) does just the opposite.

Servants include corporations. No Competitive Servant Secrets would mean the end of all competitive corporate secrecy. No longer could corporations ply politicians with secret favors and donations, or secretly influence political decision making. No longer could they secretly receive political favors. Because all this would now be out in the open, it would stop, because corporations are loathe to draw criticism from the people or the press.

Corporate secrecy includes trade secrets, which would no longer be allowed. The standard defense of trade secrets is they are necessary to provide an incentive for invention. Without trade secrets, a corporation could not make enough profit to pay for innovation.

This argument is fallacious. If corporations are servants and are truly working for the good of their masters, then the incentive to innovate should come from the desire to serve their masters the best they can, rather than to serve themselves as best they can. Trade secrets are really a form of selfishness.

Trade secrets are not necessary for scientists to innovate. Nor were they necessary for the long history of innovations that occurred up to modern times.

The real reason corporations want trade secrets is they are a form of competitive advantage. This increases profits. But why should humans allow their servants to have any form of competitive advantage over other agents, which includes humans? There is no good rebuttal to that or the points raised above. Therefore trade secrets are not necessary and, because they are a form of secrecy that can be abused, they would not be permitted.

If any type of competitive advantage servant secrecy is allowed, then servants can use that as an excuse to hide all sorts of corruption from their masters. Thus No Competitive Servant Secrets means exactly that: No Competitive Servant Secrets of any kind.

Certain forms of non-competitive advantage servant secrecy would be allowed, such as passwords. This is because passwords serve as identification and ownership identifiers, rather than as a form of competitive advantage. Other allowed types involve personal information, law enforcement, jury deliberations, and so on.

A special note: Several careful readers have suggested that this solution element should be removed because it makes it too easy for the opposition to find a spot to attack successfully. But without No Competitive Servant Secrets, there is no way to fully and accurately implement Freedom from Falsehood. If servant secrets continue to be allowed, so much of the data needed for The Truth Test and Politician Ratings will remain hidden behind a wall of secrecy that those solution elements will probably fail. Thus No Competitive Servant Secrets is a required prerequisite for creating the key new feedback loops necessary to eliminate the current dominance of the Race to the Bottom.

The Truth Test

The Truth Test is a personal skill, much like other skills such as frugality, language, and mathematics. It is designed to handle most arguments the average person receives in seconds or minutes. The rest take longer or an expert.

The Truth Test allows people to see the widespread fallaciousness of the arguments they receive from corporate proxies, such as corrupt politicians, many news

sources, and articles. Once citizens can no longer be fooled by unsound arguments, they will elect better leaders and support better positions.

The objective of the Truth Test is to reduce deception success at the individual level to a very low, acceptable amount. It consists of four simple questions:

1. What is the argument?
2. Are any common fallacies present?
3. Are the premises true, complete, and relevant?
4. Does each conclusion follow from its premises?

From my experience, the Truth Test will allow you to correctly test over 95% of all the arguments you encounter in political appeals. The test does this by providing you with quick methods of argument examination, ones that are easy to learn, remember, and apply. Here's how the four steps work:

Step 1. What is the argument?

A sound argument must have at least three parts: one or more *premises*, the *reasoning* that allows the conclusion to logically follow from the premises, and the *conclusion*. Complex arguments can be so long they require intermediate conclusions, which become premises for further conclusions. The diagram illustrates the three parts all sound arguments must have.

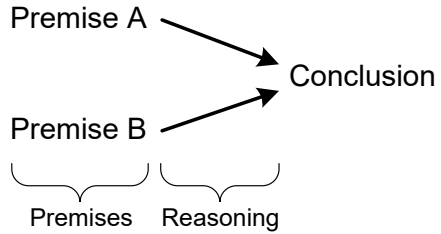
For example, "Support our troops" is not an argument. No premise is given for why you should do that. The same holds for "Vote for me in November." Incomplete arguments like these are easily dismissed as nonsense.

Do more statements make an argument better? Not if it's still nonsense, as in:

Our country is a great place. It takes courage to win a war. I was a war hero. Vote for me in November.

There's no clear reasoning relating the three premises to the conclusion. There are too many ways to interpret the statement. It's not a clear argument but a soggy hodgepodge of related snippets, designed to worm their way into your brain and entice you into voting for the candidate in November. Even though it's not an argument, if it's repeated often enough it works. Imagine the above snippets sprinkled in a dozen speeches, fifty ads, and a hundred lame talk show appearances by those supporting a candidate. If the other side doesn't do something more effective, that

The Three Parts of an Argument



candidate will win. The human mind cannot resist such continual onslaughts of infective deception, unless it has been properly inoculated.

Consider this popular appeal:

A vote for me is a vote for a better country.

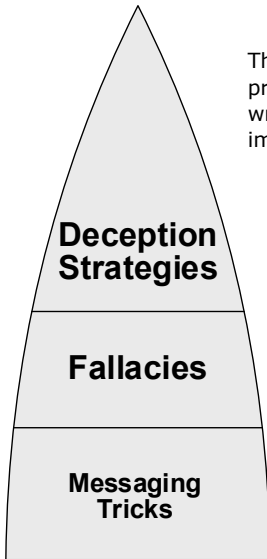
To see what the argument is, it must be restated as: “If you vote for me then that will make this a better country.” No reason (premise) is given for why the politician can make this a better country. The argument is incomplete, as are most campaign ad phrases, sound bites, slogans, and so on. As soon as you see an incomplete argument, throw it out the window along with whoever is peddling it.

But some arguments are complete. There’s enough there to apply the second step of the Truth Test.

Step 2. Are any common patterns of deception present?

This step goes amazingly quickly, because political deception follows well known patterns. The patterns are organized in the pyramid below.

The Pyramid of Political Deception



The five main **deception strategies** are false promises, false enemies, pushing the fear hot button, wrong priorities, and secrecy. The strategies are implemented with fallacies and messaging tricks.

A **fallacy** depends on unsound reasoning. Fallacies are always false because using the reasoning of the fallacy, the conclusion does not follow from the premises. The five most common fallacies are the *ad hominem* attack, appeal to emotion, false analogy, false dilemma, and straw man.

Messaging means how a message is packaged for delivery. Thousands of **messaging tricks** are used to maximize the success of implementing the upper layers, like ambiguous wording, emotional trigger words, biased framing, eye candy (powerful visuals), subliminal mood music, and repetition.

The pyramid is a screening tool. It lets you screen out obvious deception, which for this step I’d estimate is around 80%.

To test an argument to see if it’s truth or deception, start at the top of the pyramid. Does the argument employ one of the five strategies of political deception? If so, out the window it goes. Does it use one of the six most common fallacies? If so, toss it out. Does the argument use one or more messaging tricks? If it does then toss

it out. But it may use a deception strategy, fallacy type, or message trick you can't spot. Don't worry. By the time you've reached the bottom of the pyramid, you've successfully screened out the vast majority of deceptive arguments. Those that remain are ready for the next step.

The five main types of deception strategies are described beginning on page 95. Here are the five most common political fallacies:

1. *Ad hominem* – An attack on a person's character rather than the positions he or she supports. The attacker attempts to change the subject from what really matters to what matters far less or not at all.

A troubling example of how well the *ad hominem* fallacy works and how popular the method has become occurred during the 2016 US presidential elections:⁷⁸

In nearly all of the presidential debates this year, character attacks have predominated over real arguments. It is evident that “ad hominem” attacks — translated as “toward the man” in Latin — are driving our political discourse: People target personalities to mask the fact that they lack policies.

A form of character assassination to divert from discussing the actual topic at hand, *ad hominem* assertions serve to disparage or discredit one's opponent rather than their argument. Comments targeting someone's integrity appeal to feelings or prejudices rather than intellect.

Unfortunately, they are quite effective. When considering the 2016 presidential field, it is clear Donald Trump is a champion of the *ad hominem* method. In fact, he has devoted a significant amount of his on-air time to attacking just about everyone's character rather than talking about more pressing national and international concerns.

After finding himself second to Dr. Ben Carson in the most recent Iowa polls, Trump resorted to attacking his opponent's religion rather than debating the merits of his proposed policies.

Trump has insulted Carly Fiorina's face, of all things, saying “Look at that face! Would anyone vote for that?” Not limiting his statements to the other GOP candidates, Trump described Fox News anchor, journalist and lawyer Megyn Kelly as a “bimbo” and called syndicated columnist Charles Krauthammer “a totally overrated clown who speaks without knowing facts.”

These statements serve no purpose but have somehow catapulted the real-estate mogul into the lead of numerous presidential polls.

2. Appeal to emotion – The use of strongly emotional premises, wording and/or imagery to prove a point. The emotion hides the fact the premises do not lead to the conclusion.

An example that saved a politician’s career was Richard Nixon’s “Checker’s speech” on September 23, 1952. Nixon was losing ground in the presidential campaign due to maintaining a “secret fund” of \$18,000. Nixon gave a live televised speech in which he said little about the fund and much about other things, using appeal to emotion with statements like “God must have loved the common people—he made so many of them.” The emotion reached a crescendo when Nixon talked about “a gift he had received from one supporter in Texas—‘a little cocker spaniel dog’ that Nixon’s daughter Tricia named Checkers. ‘And you know, the kids love the dog and I just want to say this right now, that regardless of what they say about it, we’re going to keep it.’ ”⁷⁹

Appeal to emotion includes appeal to fear, the strongest of all instinctive emotions because of the innate fight or flight response. For example:

The streets of our country are in turmoil. The universities are filled with students rebelling and rioting. Communists are seeking to destroy our country. Russia is threatening us with her might, and the Republic is in danger. Yes—danger from within and without. We need law and order! Without it our nation cannot survive. – Adolf Hitler, 1932.

Pushing the fear hot button with appeal to emotion works so reliably it’s been the staple of populism since government began. Ruth Wodak, in *The Politics of Fear: What Right-Wing Populist Discourses Mean*, 2015, describes how it works:

Currently we observe a normalization of nationalistic, xenophobic, racist and anti-Semitic rhetoric, which primarily works with ‘fear’: fear of change, of globalization, of loss of welfare, of climate change, of changing gender roles. In principle, almost anything can be constructed as a threat to ‘us’, an imagined homogenous people inside a well-protected territory.

In the United States, the politics of fear caused Donald Trump to surge to the lead in the Republican primary:

But this should not be so surprising, as Trump is just the latest example of a tendency in American politics that goes back a very long way.

Fear. The simple four-letter word that works if you want to get elected. Political professionals know that playing on people’s fears—going negative—is the way to win.

Paranoia. A somewhat fancier word that is used to describe excessive, irrational fear and distrust. It, too, works from time to time—in American politics, at least.

This current presidential season is one of those times. Donald Trump has surged to the front of the pack competing for the Republican Presidential nomination by giving voice to outsized fears many in America have—of

illegal immigrants, of Islamic terrorists, of free trade agreements shipping American jobs to China.

Trump promises to make America Great Again—as if the US somehow was no longer the most powerful country in the world—by simple solutions: deporting all 11 million illegal immigrants, banning Muslims from entering the US, and forcing the Chinese government to back down through tough talk.⁸⁰

3. Biased sample – The use of selective evidence to prove a conclusion, which does not follow because the evidence is biased and not representative of the whole. The biased sample fallacy is better known as cherry picking. Here’s an example:⁸¹

The astrophysicist [Dr. Neil deGrasse Tyson] and host of “StarTalk” appeared on HuffPost Live on Thursday to talk with host Josh Zepps about his problem with politicians who don’t value science, or who only value the science that aligns with their political views.

“If you start cherry-picking science, that’s the beginning of the end of an informed democracy,” Tyson said.

He noted that Abraham Lincoln founded the National Academy of Sciences in 1863 to provide the government with “unbiased” scientific advice. Now, however, more and more politicians prefer to pick and choose what science-related issues are worth focusing on.

“If today you’re gonna say, ‘I’m gonna pick that and not this because this blends with my political, social, cultural, religious philosophies and that doesn’t,’ I don’t know what kind of country that is, and I don’t know what kind of future world that would create,” Tyson said.

4. False dilemma – Presenting fewer options than those that actually exist and forcing someone to make a choice. For example, “My country, love it or leave it.” More choices exist. You could also work to improve the country that you don’t yet love. You could stay but not love it, or leave it and still love it.

Well-designed false dilemmas can sway nations. Five days after 9/11 President George W. Bush, in a joint news conference with French President Jacques Chirac, famously said:

...all nations, if they want to fight terror, must do something. Over time it's going to be important for nations to know they will be held accountable for inactivity. *You're either with us or against us* in the fight against terror.⁸²

The phrase was used to whip up a fever pitch of patriotism because anyone who disagreed was labeled a traitor. But the phrase was fallacious. You could also be neutral, undecided, or against terror but not “with” the Bush administration’s approach to “the fight against terror” by preferring other policies. Interestingly, Benito

Mussolini had used the identical phrase in speeches across fascist Italy: “O con noi o contro di noi”—You’re either with us or against us.⁸³

5. Straw man – This occurs when an opponent’s argument is reinterpreted as a different argument, one so weak it’s as easy to knock down as a straw man. The weakness is then magnified and used to imply the original argument is false, which does not follow. For example, a paper on *Two Forms of the Straw Man* found:⁸⁴

Evidence that popular political commentary is governed in large measure by the selection form of the straw man fallacy is garnered, again, by an even cursory survey of the popular political literature that can be found in any bookstore. In fact, one need only to look at the titles of the bestselling books to get a sense of the extent to which the fallacy prevails. To cite only a few examples, conservative commentators claim that liberals suffer from a “mental disorder” (Savage, 2005) and should be spoken with only “if you must” (Coulter, 2004), while liberal commentators cast their opponents as “lying liars” (Franken, 2003) who trade in “idiocy” (Black, 2004). On both sides, the argumentative strategy is the same: The audience is expected to rely upon the author to present the opponent’s view, the author presents what is in fact a more-or-less accurate depiction of what some of the weakest opponents have said, the author easily refutes the opponents, and then explicitly takes himself or herself to have shown that all extant articulations of the opposing view are as easily dismantled.

I haven’t performed an exhaustive analysis so I can’t say for certain these are the most common fallacies. But based on casual review of thousands of sound bites, ads, speeches, and media appearances, it appears these five fallacies account for most successful fallacious political appeals, especially the most devastating ones.

Step 3. Are the premises true, complete, and relevant?

If an argument gets this far, it may be true so it deserves a deeper look. A **premise** is a statement of fact or a conclusion from another argument. Most political arguments are simple, so most of their premises are facts. The premises are stated or implied. *For an argument to be sound, its premises must be true, complete, and relevant.* Take a good hard look at the argument and screen it for premises that are false, incomplete, or irrelevant. This will weed a few more out. Those that remain are ready for the final step of the Truth Test.

Step 4. Does each conclusion follow logically and strongly from its premises?

Rarely will you get this far when examining a political statement, because nearly all will have been eliminated by the first three questions.

This step would be difficult if you had to study and master the rules of logic to determine if each conclusion in the argument followed from its premises. But you don't. All of us have mastered most of these already. But we have not given them names because we employ them subconsciously in seconds. By the time we become adults we have done this millions of times. This is the intuitive but fairly reliable part of argument analysis. Usually if you have taken the time to perform the first three steps, then you can intuitively perform the fourth step correctly—if you don't rush it.

The way to avoid rushing the fourth step is to go back and review the first three steps: (1) What is the argument? (2) Are any common patterns of deception present? (3) Are the premises true, complete, and relevant? This review will clarify your analysis, allowing you to perform the fourth step reliably most of the time. In step 4 you simply ask: *Does each conclusion follow logically and strongly from its premises?* If there's any serious doubt or it follows weakly then you must classify it as unsound.

Any arguments that have not been eliminated by now are probably true. But you can't be sure, so do what scientists do. Be skeptical. Tentatively accept them as true. Look further for confirming evidence, by use of some of the other truth literacy solution elements like Politician Truth Ratings. Examine more arguments about the same politician or issue. If most hold up, then that leads to the general conclusion that you can confidently support that politician or issue.

Universal truth literacy

The average person is never taught anything like the Truth Test in school or the workplace. *Thus their immunity to deception is largely a matter of cultural chance.* For truth literacy to become a cultural norm and achieve its full success, it must become as essential to a person's education as reading and writing.

History has shown again and again that those who are not truth literate become the unknowing slaves of the masters of falsehood, as the cyclic nature of the Race to the Bottom versus the Race to the Top plays itself out over and over. A cycle ends when corruption becomes so extreme and obvious that the people rise up, throw the bums out, and become much harder to deceive for awhile. But as good times return, people become lax, and another cycle begins. These cycles never end, because presently there is no mechanism in the human system to keep ability to detect deception permanently high.

The appalling effects of this cycle, during which corrupt politicians and special interests are dominant most of the time, is historic evidence that truth literacy is more important to society than reading literacy. This applies even more so today as we enter the 21st century, because if the truth is not seen in time, *Homo sapiens* will surely perish by his own hand.

The Truth Test is supplemented by several other solution elements. Thus citizens don't have to become Truth Test experts. They only have to get the general philoso-

phy of the tool. It's an attitude, a way of thinking. We citizens don't have to make important political decisions *intuitively*. We can take a little more time and *analytically* decide, using a variety of tools.

As the population of a country uses something like the Truth Test and the other related solution elements presented in this book, that population moves closer to being truth literate. This will take awhile. It offers such tremendous benefits, so once the process begins it will snowball and spread everywhere, just as vaccination for smallpox, universal education, democracy, and so many other beneficial practices have swept the globe.

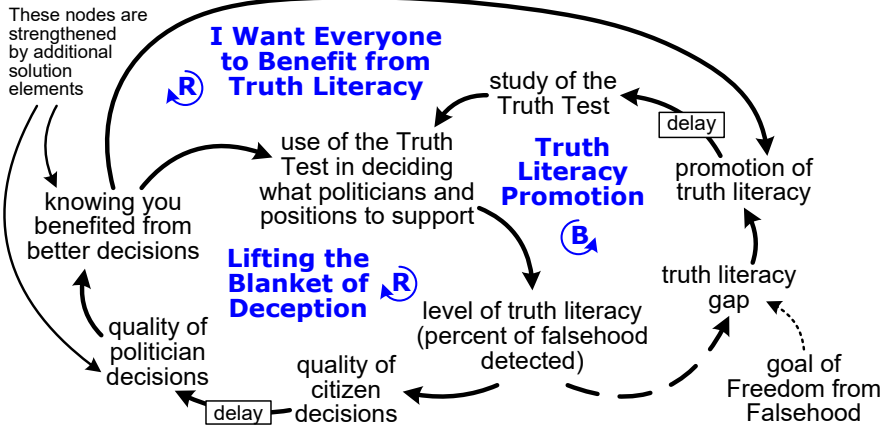
Speeding that transition along will be the other solution elements. Politician Truth Ratings, once they've been around for a few years, will give people the confidence that Freedom from Falsehood is indeed possible. The Quality of Life Index, once it's on the front page of top newspapers, like the stock market index is, will give people a constant measure of how well their politicians are working for them, and will directly reflect how well truth literacy is working in general. Likewise for the Sustainability Index.

This is a whole new way of running a political system. It's based on Freedom from Falsehood and universal truth literacy, rather than if you're old enough to vote then that should be enough.

How the foundation works

Implemented properly, Freedom from Falsehood and the Truth Test cause deep structural change to political systems. Here's how this works:

How the Foundation Solution Elements Work Dynamically



Once the goal of Freedom from Falsehood exists, promotion of truth literacy by way of the Truth Test begins. Use of the Truth Test lifts the blanket of deception higher and higher. The more you use the Truth Test, the more you and the common good benefit, so the more you want everyone to benefit from truth literacy.

Presently, political systems have no explicit goal of Freedom from Falsehood. One that goal is set, all three loops spring to life.

Let's run through the **Truth Literacy Promotion** loop first. Currently deception is working and widespread, so the level of truth literacy (percent of falsehood detected) is low. This causes the truth literacy gap to be high, since the goal is to have a high level of truth literacy. Since the gap is high, that's a strong incentive for promotion of truth literacy. There will be a delay, but after awhile programs for study of the Truth Test will have an effect. As study increases, so does use of the Truth Test in deciding what politicians and positions to support. And that goes up, so does the level of truth literacy. As that goes up, the truth literacy gap goes down, because the system is moving toward the goal. Eventually, because of the other loops supporting the **Truth Literacy Promotion** loop, the goal will be achieved.

The **Lifting the Blanket of Deception** loop is where the real work occurs. As the level of truth literacy goes up, so does quality of citizen decisions on what politicians and positions to support. There's a delay before decisions to have impact, but eventually quality of politician decisions to also go up. That increases knowing you benefited from better decisions, which has two effects. The first is it makes you want to use the Truth Test more, which increases use of the Truth Test in deciding what politicians and positions to support. That causes the **Lifting the Blanket of Deception** loop to grow stronger and stronger.

The second effect of knowing you benefited from better decisions follows naturally. We are a social species. If we find something that will help others, we share it. This activates the **I Want Everyone to Benefit from Truth Literacy** loop. People will vigorously want to increase promotion of Truth Literacy to spread the benefits to everyone, because the more people who are truth literate, the better the system runs for all.

Not shown is the effect of lying by politicians is now illegal, due to Freedom from Falsehood. This behavior is included in the next chapter in the model of The Dynamic Structure of Politician Ratings.

Nothing can grow forever, so the reinforcing loops have balancing loops associated with them. Examples are the increased time and cost of using the test, and the increased complexity or cleverness of arguments as social agents adapt. Each of these causes diminishing returns, which keeps the **Lifting the Blanket of Deception** loop from growing forever. For simplicity these extra loops are not shown.

As just one example of how the Truth Test might affect society, imagine what a talk show might be like if the host was trained in the Truth Test. After a particularly fallacious string of comments from a guest, such as one from a biased think tank, the host might reply with “By the way, while you and I have been talking, my assistant was checking off how many fallacies and truths you uttered, and what kind. Did you realize that since you began ten minutes ago, out of a total of 24 propositions, 6 were *ad hominem* attacks, 4 were based on biased samples, and 8 were false enemies or pushing the fear hot button without any justification? This leaves only 6 reasonably true propositions. In other words, in my opinion your impressive punditry is false 75% of the time. THAT is the real news here. And, let me see, my assistant reminds me that it was about the same last time you were on. What do you say to that?”

The silence that followed might be the sound of the beginning of the Race to the Top.

The Truth Test provides a way for citizens of all kinds, including talk show hosts, to spot the truth. However, much more is needed. The Truth Test provides no irresistible incentive for corrupt politicians to start telling the truth. For that we need:

Politician Truth Ratings and the Political Persuasion Knowledge Base

A **rating** is a (hopefully) reliable, objective measure of something. Industrialized societies thrive on ratings because they allow people to make better decisions more efficiently. People love to compare things using one simple number.

I can walk down the street and, if I wish, see dozens of ratings in action. There on the window of that famous restaurant is its Michelin Guide rating. It's three stars! If my friends and I dined there, we'd be guaranteed a meal fit for gastronomic royalty. As we entered, there on the wall, conspicuously posted, would be the restaurant's health inspection rating. It would be a perfect 100%, of course. After being seated, the sommelier would bring the wine list. If I'd done my homework I would be up to date on the Wine Spectator's ratings and might order their daily pick, the Australian Yellow Tail Moscato, said to be musky and floral, lingers on the finish. What I wouldn't tell the wine steward, nor anyone else, was that I'd also used the Wine Spectator's website to select the restaurant. After all, they had rated over thirty restaurants in my city on wine strength and cuisine. The one we were in now was the very best. How could we go wrong?

Ratings are everywhere. There are bond ratings, stock ratings, Neilson ratings, chess ranking ratings, school quality ratings, credit risk ratings, safety ratings for vehicles, hospital quality of care ratings, new car quality ratings, hiking trail difficulty ratings, mountain climb route difficulty ratings, FiveThirtyEight's pollster reliability ratings, and many more. Consumer Reports alone rates thousands of products a year for quality, using their 50 testing labs and 327 acre automotive test track.

But when it comes to the ratings citizens need the most, there aren't any.

The most important repeated decision you and I make is not which wine or car to buy. It's who to elect to run our government. That decision defines our social world, its rules, its services for citizens, and all the little things that define our potential quality of life.

But as we discussed earlier when constructing The Dueling Loops of the Political Powerplace model, the winning strategy is political deception. Most politicians lie quite a bit, because if they didn't they'd lose out to those who do. Sound decisions on who to vote for are anything but easy, because our world is awash in spin. Voters simply cannot trust what politicians say, especially during campaign season when competition for votes is a matter of political life or death. So how do voters make rational decisions and avoid being manipulated without ever even knowing it?

One way, presented in the previous chapter, is the Truth Test. But that only provides the fundamentals of truth literacy. A truth literate person can usually tell political truth from falsehood. But does the average voter have the time and ability to sample the speeches, ads, articles, and anything else a field of candidates has said or written to arrive at a reliable conclusion on their fitness for office, by applying the Truth Test to each candidate in a thorough manner? Some do, but most do not. It's an impossible job to do as well as it should be done, just as it's impossible for the average person to study all the wines or cars available, in order to arrive at a reasonably optimal choice. Only experts can perform that role.

This is why the Truth Test must be supplemented with Politician Truth Ratings.

Politician Truth Ratings

Politician Truth Ratings would provide an accurate measure of the truth of important statements made by politicians. First a government passes legislation creating Freedom from Falsehood. This makes lying by politicians to gain public support on elections or positions illegal. To efficiently implement the legislation, the government implements Politician Truth Ratings. All important elected officials then receive Truth Ratings, though it would take some time to ramp up the program. Campaign speeches, ads, articles, speeches once in office, and so on are rated for the truth of the arguments employed. This may seem like an expensive burden, but most arguments and facts are repeated. Only the first occurrence requires new work. In addition, everything need not be checked. A statistically valid sample will do.

It's possible that fines for excessive lying by politicians will be required. However, the most efficient penalty is not a fine. It is public knowledge a politician broke trust with the citizens of his or her country and lied. Once voters can see who they can and can't trust, that's where their votes will go. Which positions a politician supports also matter, like sustainably, health care, gun control, tax reform, etc. But what matters more than any of these is trust. Can a voter trust a politician to do what they claim they will do during a campaign? Once in office, can a voter trust that what a politician is saying is the truth?

Truth Ratings need not affect all voters to make the critical difference—only the swing voters, who are normally just 10% to 30%. Fortunately it is this group who is most likely to be receptive to a tangible, sound reason to choose one politician over another.

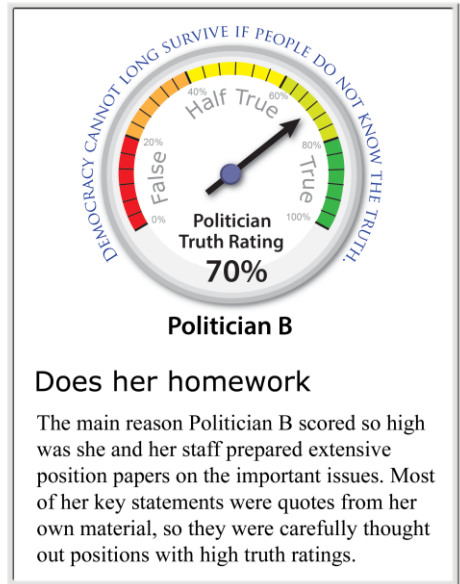
A **truth rating** is the probability a politician's important arguments are true. For example a few days after a debate, its Truth Ratings would come out. They might say that candidate A averaged 45% true, while candidate B averaged 70%. Guess which candidate would probably win the debate in the public's mind? Or suppose the two candidates averaged only a five point difference in ratings. Then issue differences would determine who won. Or suppose one candidate said she had a plan

for accomplishing something and the opposing candidate claimed the plan was faulty and would not work. The truth raters would examine the plan and rate it for probable effectiveness. That would enter the politician’s Truth Ratings. Voters could look up the details behind the ratings if interested, and find out why the plan would or would not work, or why a particular statement was false.

Those doing the ratings would probably be certified rating organizations, ones with no conflict of interest and therefore non-profit. If an organization doing a series of ratings was credible and the public trusted the ratings, **The Public Loves Those They Can Trust** feedback loop (described later in this chapter) would begin. Politicians would compete to see who could be the most trustworthy and therefore the most helpful. While things would not be perfect, campaigns would become based on reason and truth rather than deception. As politicians began competing on the basis of the truth about what they can do for the common good, the **Race to the Top Among Politicians** feedback loop would go dominant and the health of democracy would be restored.

Here’s an example of how Politician Truth Ratings could look:

It’s a Close Race. Here are the Ratings:



Analysis findings: Ratings were prepared using PPKB argument analysis. A total of 370 important arguments (claims) were randomly selected for each candidate for the last five years. Since each politician made no more than 10,000 important statements during that period this gives a margin of error of plus or minus five percent. This is smaller than the 30% gap between the two politicians, so the rating difference is significant at the 95% level of confidence.

The fact checkers arrive!

Efforts to provide the beginnings of Politician Truth Ratings are springing up spontaneously. For example, in October of 2006 Eric Schmidt, chairman and CEO of Google predicted: ⁸⁵

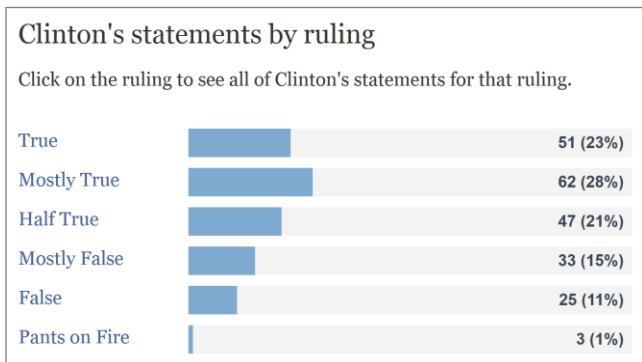
...that, within five years, ‘truth predictor’ software would ‘hold politicians to account.’ Voters would be able to check the probability that apparently factual statements by politicians were actually correct, using programs that automatically compared claims with historic data.

Organizations like FactCheck.org, PolitiFact, Africa Check, FactCheckEU, Full Fact, TruthOrFiction.com, Vote Smart, Facts Fight Back, and Chequeado offer a variety of forms of fact checking. However, design of their product is not based on root cause analysis. There’s no analysis of how to raise general ability to detect political deception in an efficient, prolonged manner with a tightly focused mechanism like Truth Ratings. Fact checking has had only modest impact. Important elections and decisions continue to be controlled by crafty deception.

A popular fact checking site is FactCheck.org, the pioneer in the field. Visiting their website just now on July 8, 2016, on the home page are articles on *Clinton’s Handling of Classified Information*, *Trump’s Fanciful Iran Negotiation*, and *Suspected Terrorists and Guns*. Reading the last one, it introduces the topic, then lists “some of the claims made by both sides in the debate.” This is followed by a long thoughtful discussion of each claim and its truthfulness. But how many citizens are going to take the time to study these articles, which are not written for popular consumption, but for highly educated readers who love poring over the facts and logic behind a claim? This is not to fault FactCheck.org, which is making a difference.

What could make much more of a difference is Truth Ratings for each politician. These do not appear to be available. Clicking on 2016 Elections and then the first item, Hillary Clinton, brings up a page of articles about her. The first is *Revisiting Clinton and Classified Information*. This reads like the article described above. It’s well written and researched, but who is going to read such a long technical article, with no clear concise conclusions? Some, but not many.

PolitiFact provides something closer to a Truth Rating. Going to Hillary Clinton’s page on July 8, 2016, I found the image shown: ⁸⁶



This is getting wonderfully close to Truth Ratings. At a glance you can see the approximate pattern of truth. But is there one number summarizing the data? No. This gives you no easy way to compare candidates. It's also impossible to accurately remember the truth level of a candidate. Instead you are forced to remember something like "clumped in mostly true."

The data is there to calculate a Truth Rating for Hillary. First we have to set the scale. Let's set True = 100%, Mostly True = 75%, Half True = 50%, Mostly False = 30%, False = 15%, and Pants on Fire = 0%. A total of 221 statements were checked. The Truth Rating would be $(51 \times 1.00 + 62 \times .75 + 47 \times .50 + 33 \times .30 + 25 \times .15 + 3 \times .00) / 221 = 61\%$. That's all you need to know most of the time, though you can dig deeper for more detail. At this point in the presidential race, *Hillary Clinton had a Truth Rating of 61%*.

Or did she? All statements are not checked, so a question arises: Is the sample unbiased? That requires a random sample. PolitiFact doesn't take that approach. Here's what they do: ⁸⁷

Choosing claims to check – Every day, PolitiFact and PunditFact staffers look for statements that can be checked. We comb through speeches, news stories, press releases, campaign brochures, TV ads, Facebook postings and transcripts of TV and radio interviews. Because we can't possibly check all claims, we select the most newsworthy and significant ones. In deciding which statements to check, we ask ourselves these questions:

1. Is the statement rooted in a fact that is verifiable? We don't check opinions, and we recognize that in the world of speechmaking and political rhetoric, there is license for hyperbole.
2. Is the statement leaving a particular impression that may be misleading?
3. Is the statement significant? We avoid minor "gotchas" on claims that obviously represent a slip of the tongue.
4. Is the statement likely to be passed on and repeated by others?
5. Would a typical person hear or read the statement and wonder: Is that true?

While the procedure is documented and thoughtful, it's not a rigorously systematic, reproducible, unbiased procedure. In fact, large selection bias could creep in due to competing with other news sources to have "the most newsworthy and significant" checked claims. If it bleeds it leads. The screening questions also allow bias, though they adroitly eliminate non-arguments or irrelevant arguments.

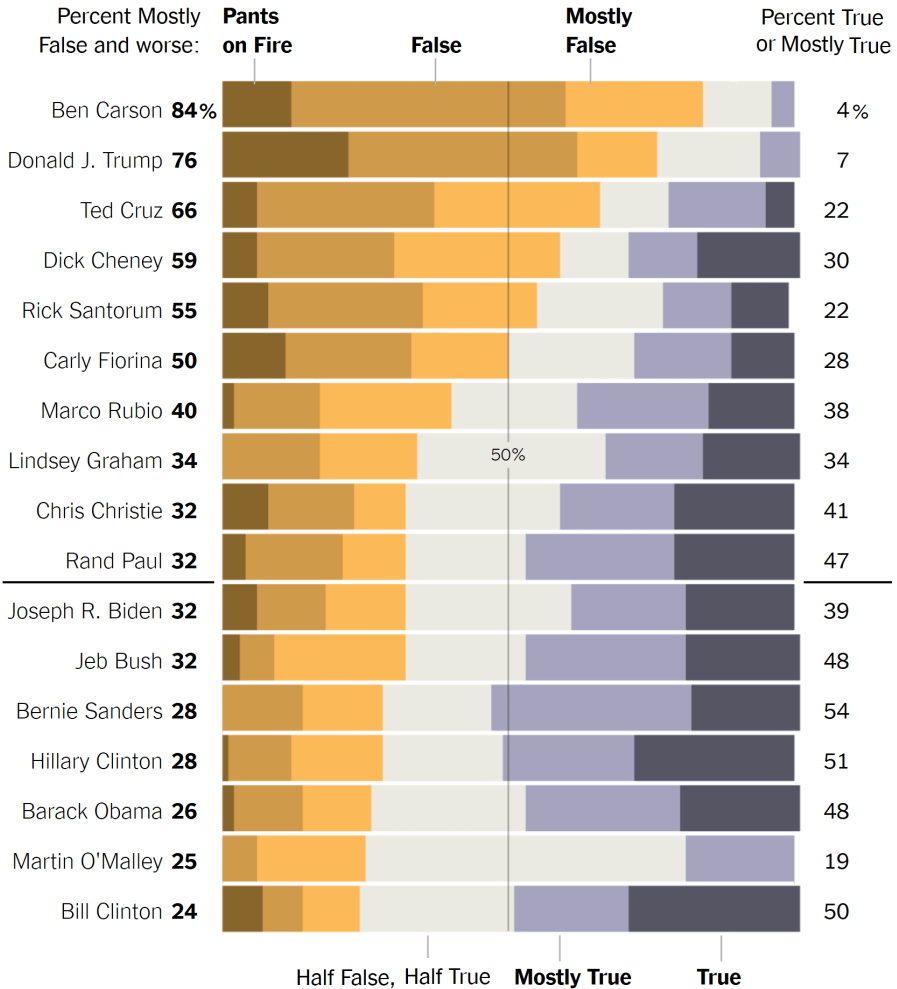
PolitiFact acknowledges this: “Our ratings are also not intended to be statistically representative but to show trends over time.”⁸⁸ Overall, PolitiFact’s work is a terrific start. I expect that unbiased, accurate, affordable Truth Ratings for all politicians will not fully arrive until they can be computer analyzed and calculated. This requires advanced AI (artificial intelligence). Meanwhile we can do what PolitiFact is doing, with improvement as needed.

Fact checking organizations are breaking new ground. Step by courageous step they are bringing truth checking to the forefront of journalism. The best overall example I found was a graphic in a New York Times article, *All Politicians Lie. Some Lie More Than Others*. The article discussed PolitiFact’s findings on the 2016 US presidential election race so far, highlighting the role of journalists in making voters more truth literate.⁸⁹

Today’s TV journalists — anchors like Chuck Todd, Jake Tapper and George Stephanopoulos — have picked up the torch of fact-checking and now grill candidates on issues of accuracy during live interviews. Most voters don’t think it’s biased to question people about whether their seemingly fact-based statements are accurate. Research published earlier this year by the American Press Institute showed that more than eight in 10 Americans have a positive view of political fact-checking.

In fact, journalists regularly tell me their media organizations have started highlighting fact-checking in their reporting because so many people click on fact-checking stories after a debate or high-profile news event. Many readers now want fact-checking as part of traditional news stories as well; they will vocally complain to ombudsmen and readers’ representatives when they see news stories repeating discredited factual claims.

On the next page is the amazing graphic presented in the article.



“Falsehood Face-Off – Statements since 2007 by presidential candidates (and some current and former officeholders) ranked from most dishonest over all to least dishonest, as fact-checked by PolitiFact. ‘Pants on Fire’ refers to the most egregious falsehoods. Too few statements have been fact-checked to include Jim Gilmore, George E. Pataki and George W. Bush. The number of statements analyzed varies for each person. Some bars total more or less than 100% because of rounding. Source: PolitiFact. [Graphic] By Bill Marsh/The New York Times”

This is an excellent graphic based on excellent data. It was slightly modified. “Half False, Half True” was moved from the top to the bottom to allow “Percent True or Mostly True” to be a column head. The line between Rand Paul and Joseph Biden was added to mark a strong pattern. Except for Jeb Bush, all Republicans are above the line and all Democrats are below it. The data show that for US presidential candidates since 2007, Republicans employ a much higher amount of political deception than Democrats, about double.

This pattern confirms several hypotheses in The Dueling Loops of the Political Powerplace model: (1) Over time, politicians will evolve into two main groups: those in the Race to the Top and the Race to the Bottom, the left and the right, due to the inherent advantage of the Race to the Bottom. (2) Those in the Race to the Bottom will tend to support issues and ideologies favorable to powerful special interests, notably *Corporatis profitis* and the rich. (3) Since special interests are a minority, the only way to convince a majority to vote for them and support their positions is deception. Reliance on political deception is thus the principle strategy of the Race to the Bottom. (4) In contrast, the Race to the Top will tend to support issues and ideologies favorable to the common good, which is the majority. (5) This is best done by reliance on the truth.

The PolitiFact data strongly confirms all five hypotheses. In the US, Republicans align with large for-profit corporations and the rich. Democrats align with the middle class and the poor, and common good causes like progressive taxation, racial equality, universal health care, unions, minority rights, gun control, environmental sustainability, etc. Republicans rely on a high rate of deception, while Democrats rely on a high rate of the truth.

However, we need to be cautious. The graphic data was not collected using a random sample and could be biased. Thus we only have tentative confirmation of the hypotheses. Still, the confirmation is dramatic.

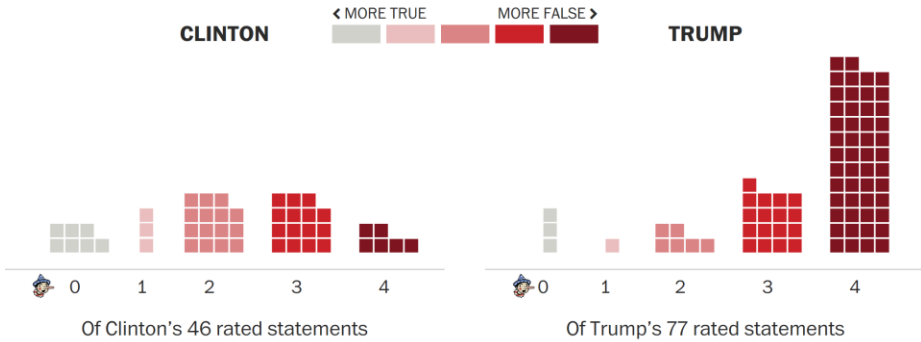
The graphic almost has a measure of Truth Ratings. The far right column of numbers is percent true or mostly true. That's a rough Truth Rating. However, as discussed it's not as accurate as it needs to be if voters are to rely on it as a major decision making tool. Deceptive politicians must be prevented from gaming the system and achieving unwarranted higher ratings. Any significant bias can be manipulated. If arguments are not weighted for importance in terms of future impact then a deceptive politician can utter lots of unimportant claims that are true, a few important ones that are false, and end up with an unjustified high rating. The ratings should be the running average of a period of time, such as the last five or ten years. The previous election campaign should always be included. Experimentation will determine what works best.

A Politician Truth Ratings example

The fact-checking industry is tantalizingly close to producing Politician Truth Ratings so that politicians can be quickly compared. For example, consider this graphic, which uses a scale of zero to four Pinocchios:

How the candidates' fact check rankings break down

Source: *The Washington Post*, October 4, 2016.

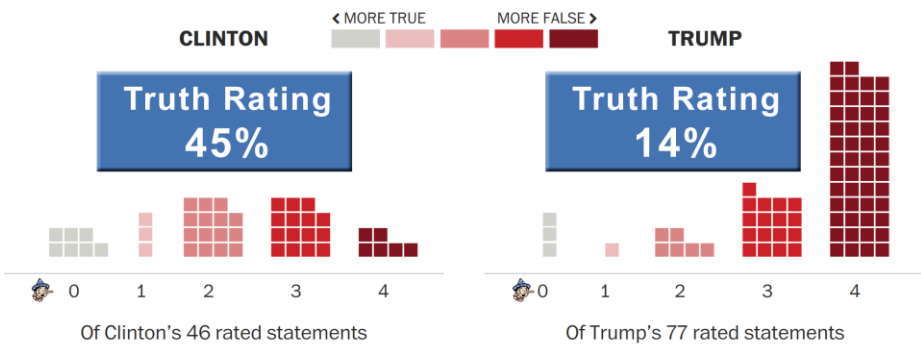


Except for the fact (pun intended) that the claims were not randomly sampled, all the data we need to calculate a Truth Rating for both candidates is there. First we translate the scale from zero to four Pinocchios to a zero to 100% confidence level of truthfulness. Zero Pinocchios = 100% true, 1 Pinocchio = 75%, 2 Pinocchios = 50%, 3 Pinocchios = 25%, and 4 Pinocchios = 0%. For Clinton, the rating would be $(7 \times 1.00 = 7) + (3 \times .75 = 2.25) + (15 \times .5 = 7.5) + (15 \times .25 = 3.75) + (6 \times 0 = 0) = 20.5$. That's for 46 statements. Converting to 100 statements, $20.5 \times (100/46) = 44.56$. For Trump, $(3 \times 1.00 = 3) + (1 \times .75 = .75) + (6 \times .5 = 3) + (17 \times .25 = 4.25) + (50 \times 0 = 0) = 11$. That's for 77 statements. Converting to 100 statements, $11 \times (100/77) = 14.29$. Clinton's rating is three times as high as Trumps, an enormous difference.

Now suppose the article had used the calculations to produce this graphic:

How the candidates' fact check rankings break down

Source: *The Washington Post*, October 4, 2016. Ratings added by Thwink.org.



What's the real story here? The gigantic difference between the two ratings. Of the two graphics, which one tells that story better? Which story is easier to remember many months later, which you are standing in the voting booth?

Next let's examine a mature rating to see what can be learned from it.

The analogy of credit ratings

Politician Truth Ratings are analogous to credit ratings. To demonstrate how important credit ratings have become in just one area, the corporate bond market, here is an excerpt from testimony presented to the US Senate on March 20, 2002, to the Committee on Governmental Affairs, chaired by Senator Joe Lieberman: ⁹⁰ (Italics added)

Simply put, a credit rating is an assessment of a company's credit worthiness or its likelihood of repaying its debt.

John Moody, the founder of what is now Moody's Investors Service, is recognized for devising credit ratings in 1908 for public debt issues, mostly railroad bond issues. Moody's credit ratings, first published in 1909, met a need for *accurate, impartial, and independent information*.

Now, almost a century later, an 'investment grade' credit rating has become an absolute necessity for any company that wants to tap the resources of the capital markets. The credit raters hold the key to capital and liquidity, the lifeblood of corporate America and of our capitalist economy. The rating affects a company's ability to borrow money; it affects whether a pension fund or a money market fund can invest in a company's bonds; and it affects stock price. *The difference between a good rating and a poor rating can be the difference between success and failure, prosperity and bad fortune.*

In a similar manner, the difference between a good politician rating and a poor one would be the difference between success and failure for politicians, and prosperity and bad fortune for the public.

But even more interesting is the testimony went on to say:

The government—through hundreds of laws and regulations—*requires corporate bonds to be rated* if they're to be considered appropriate investments for many institutional investors.

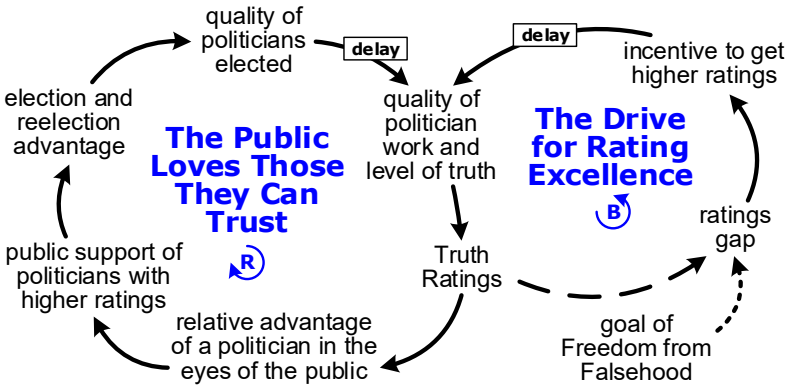
So too would the government require politicians to be rated if they were to be considered appropriate choices for many citizens. Credit ratings greatly lower the risk of financial loss. Truth Ratings would greatly lower the risk of a dominant **Race to the Bottom among Politicians**. If they proved as successful as credit ratings, they would lower it by somewhere around 99%, which would make sizeable cases of a dominant Race to the Bottom about as frequent as Halley's Comet.

Presently Truth Ratings are not required but corporate bond ratings are. This is one more example of how, over the centuries, *Corporatis profitis* has silently defined the rules of the game to be in its favor. The reason we don't already have something like Politician Truth Ratings is that would prevent exploitation of the inherent weakness in the Race to the Bottom by *Corporatis profitis*.

How Truth Ratings work dynamically

Like all deep structural change, Truth Ratings would cause important new feedback loops to become dominant, as modeled below.

The Dynamic Structure of Politician Truth Ratings



Once the goal of Freedom from Falsehood exists, the two loops are activated. The two loops work together to cause Truth Ratings to soar from low to high.

The key loop is **The Drive for Rating Excellence**. This is probably the most important feedback loop in the entire effort to push on the high leverage point of raise general ability to detect political deception. If it works the whole solution will probably work. The loop works like this:

At first Truth Ratings are low. The goal of Freedom from Falsehood requires high ratings, so the ratings gap starts out high. The gap equals the goal minus Truth Ratings. Because the gap is high so is the incentive to get higher ratings, since the public uses ratings as a prime criteria for decisions on which politicians to support. The way to get higher ratings is to tell *and implement* more of the truth, which increases quality of politician work and level of truth. This causes Truth Ratings to increase, which causes the ratings gap to *decrease*. The loop goes round and round, as it homes in on its goal.

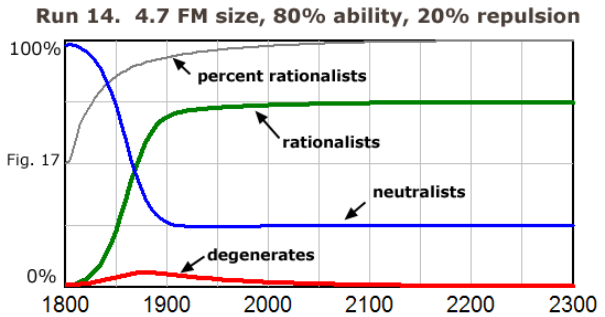
Politicians drive the loop on the right. The public drives the loop on the left, named **The Public Loves Those They Can Trust**. The loop works like this:

At first Truth Ratings are low. They vary from politician to politician and would be embarrassingly bad for some. Those with higher ratings, especially in aspects important to particular voters, have a relative advantage of a politician in the eyes of the public. This causes public support of politicians with higher ratings to increase. That in turn increases their election and reelection advantage. That causes the quality of politicians elected to go up. After a delay, that will cause quality of politician work and level of the truth to also go up. That causes Truth Ratings to rise, and we're back where we started.

The two loops drive the level of truth up until it's high. At some point that causes the desired mode change in The Dueling Loops of the Political Powerplace. The Dueling Loops flip from a dominant **Race to the Bottom** to a dominant **Race to the Top**, because politicians are telling the truth more and more of the time. Once Truth Ratings goes high, the **Race to the Top** becomes totally dominant as modeled in simulation Run 14 on page 116, also shown below. (Run 22 also shows the problem solved, but that graph is not as clear as Run 14. The two graphs have identical outcomes.)

In this run general ability to detect deception is 80%, a fairly high level. 80% of false memes are detected. A significantly higher level is probably not be possible, due to the sophistication of some falsehoods and the fact that it's simply not possible to inoculate the entire population against deception. But that's okay. The graph shows how even with only 80% general ability to detect political deception, percent rationalists rises to 100%. It's essentially a perfect solution.

The root cause of change resistance, *the inherent advantage of the Race to the Bottom*, has been resolved. The Race to the Bottom no longer enjoys an advantage because the solution has caused general ability to detect political deception to change from low to high. Instead, it's the **Race to the Top** that now enjoys an inherent advantage. That advantage comes from the newly introduced feedback loops.



This is deep, lasting, social system engineering change, and is the perfect example of the potential of analytical activism.

The Political Persuasion Knowledge Base (PPKB)

The PPKB is a tool for analyzing the truth of persuasive texts. A **text** is a speech, article, debate, ad, or anything that can be converted into text. While it can be used on any kind of text, the PPKB was designed for analyzing the truth of political texts. The results can be used for Politician Truth Ratings.

The PPKB was designed as an example of how the grunt work of Truth Ratings, analyzing the truth of what a politician said, can be done in an efficient large-scale manner. If Truth Ratings are to become widely used, such a tool is required. The PPKB runs on a relational database and is scalable to hundreds of thousands of texts, though only a few have been entered. The project has reached the proof of concept

stage. The next step would be pilot testing. The PPKB is freely available at Thwink.org.

Analyzing arguments in a high quality manner is hard work. What I discovered as I designed and built the PPKB was that argument analysis was so excruciatingly complex that the analyst needs a surprisingly complex tool. To accommodate these needs the PPKB has these features:

1. The argument is the unit of analysis, not the fact.
2. Each argument has one or more facts, one or more rules, and a single main conclusion. It may also have premises and intermediate conclusions.
3. Facts and rules are reusable, so they are stored separately from arguments. A fact is some discrete piece of knowledge that we know with some level of confidence. A rule of inference is used to persuade people they can be confident that premises, if true, lead to a conclusion. Each fact and rule has a confidence level of zero to 100%.
4. Facts and rules are organized into hierarchical trees. These may be searched.
5. Arguments are organized into a hierarchy of groups, texts, arguments. A group contains texts. A text contains arguments. If a group is a politician, then that politician's Truth Rating is always current. This is a simple approach and will need to be improved.
6. An argument that appears more than once can be reused by entering it as a fact. Presently the fact's confidence level must be manually updated if the confidence level changes in the argument.
7. Argument elements may be weighted for importance.
8. The confidence level (truth) of an argument is automatically calculated.
9. As an argument is built it is automatically diagramed.

Presently the PPKB has 53 rules and 41 facts. More are added as needed as arguments are analyzed. 3 groups containing a total of 8 texts have been entered as sample material. To get a feel for how the PPKB works, let's look at some of the data that has been entered.

Below is a group for democratic US presidential campaigns. A group has a description, media type, and one or more texts. This one has three texts. Each text has a confidence level. The average of these is shown in the upper right.

242 Subproblem A – Without Truth Literacy, Democracy Cannot Survive

PPKB Home Group Text Argument Factor Tree Search Menu

Text Group

Name US presidential campaigns 1952 to 2012 - Democratic

Select Group

Description

This study uses the US presidential campaign videos from 1952 to 2012. These have videos for each party for each year. The parties are Democratic or Republican, and occasionally others. This is a high quality collection of texts, as each video has a transcription and there are plenty of videos per year (or all?), with each party well represented.

This Text Group is the Democratic videos.

The source for these videos is <http://www.livingroomcandidate.org>. The video number is its position in the string of videos, unfiltered, for that party.

Average Confidence Levels

Facts 94% x Rules 69% = Text 65%

Media Type TV Ad

Number Texts 3

Add Text ID 2

Text Name	Number Arguments	Confidence Level		
		Facts	Rules	Text
2012 Obama vs Romney - Democrat - Video 1 - Always	3	95%	x 100%	= 95%
2012 Obama vs Romney - Democrat - Video 2 - Understands	3	94%	x 33%	= 29%
2012 Obama vs Romney - Democrat - Video 3 - Firms	4	93%	x 75%	= 69%

Clicking on the third Text button leads to this screen:

PPKB Home Group Text Argument Factor Tree Search Menu

Text

Name 2012 Obama vs Romney - Democrat - Video 3 - Firms

1. Original Text 2. Marked Text 3. Structured Arguments 4. Argument Analysis

Group US presidential campaigns 1952 to 2012 - Democratic

Date Published 1/1/2012 Date Coded 5/17/2015

Media Type TV Ad Analyst Jack Harich

Text 2 of 3

Weighted Confidence Level

Factuals 93% x Rules 75% = Text 69%

Text ID 9

Original Marked Structured

Obama: I'm Barack Obama and I approve this message.

Romney (singing): Oh beautiful for spacious skies...

[Caption: In business, Mitt Romney's firms shipped jobs to Mexico. And China. (Los Angeles Times)]

Romney: ...for amber waves of grain...for purple mountain's majesty...

[Caption: As Governor, Romney outsourced jobs to India. The Boston Globe 5/1/12]

Romney: ...above the fruited plain...

[Caption: He had millions in a Swiss bank account. ABC News 1/26/12]

Romney: ...America...

Claim This is a legitimate political ad rather than one from an unknown source with usually devious intentions. Weight 0.0 Zero CL 95%

[Same as argument in video 1, so the conclusion from that argument is reused here.] Argument

Obama: I'm Barack Obama and I approve this message.

Claim In the past, Romney regularly behaved in a manner that was seriously detrimental to the health of the US economy, by offshoring US jobs. Weight 1.0 Central CL 95%

[This argument implies Romney should be condemned because his firms routinely outsourced US jobs.] Argument

[Caption: In business, Mitt Romney's firms shipped jobs to Mexico. And China. (Los Angeles Times)]

Claim Romney would not make a good president because he's rich. (Q) Weight 0.5 Medium CL 0%

[This argument implies Romney should be condemned because he's rich.] Argument

[Caption: He had millions in a Swiss bank account. ABC News 1/26/12]

Claim Romney would not make a good president because he has engaged in significant tax avoidance. (Q) Weight 0.5 Medium CL 88%

[This argument implies Romney should be condemned because he's avoiding taxes.] Argument

[Caption: Tax havens like Bermuda... Vanity Fair August 2012]

There's a lot of information here. This text is a TV ad. The Original tab lists the text. Marked and Structured tabs are used for marking up and structuring texts. Despite the small amount of text, it contains 4 arguments. The PPKB operates on the philosophy that no arguments in a text should be ignored. All must be analyzed. If one argument is less relevant or not relevant at all, that's handled by giving it a low or zero weight. The first argument has a zero weight since it's the standard disclaimer that begins legitimate TV ads from candidates.

Each of the 4 arguments has an automatically calculated confidence level (CL), as shown. These levels and their weights are used to calculate the Weighted Confidence Level. This text has a level of 69%, which is its Truth Rating.

The hardest part, at least for me, is marking up and structuring a text so it can be entered into the PPKB. Below is the original text:

1. Original Text	2. Marked Text	3. Structured Arguments	4. Argument Analysis
<p>Obama: I'm Barack Obama and I approve this message.</p> <p>Romney (singing): Oh beautiful for spacious skies...</p> <p>[Caption: In business, Mitt Romney's firms shipped jobs to Mexico. And China. (Los Angeles Times)]</p> <p>Romney: ...for amber waves of grain...for purple mountain's majesty...</p> <p>[Caption: As Governor, Romney outsourced jobs to India. The Boston Globe 5/1/12]</p> <p>Romney: ...above the fruited plain...</p> <p>[Caption: He had millions in a Swiss bank account. ABC News 1/26/12]</p> <p>Romney: ...America...</p> <p>[Caption: Tax havens like Bermuda... Vanity Fair August 2012]</p> <p>Romney: ...America...</p> <p>[Caption: And the Cayman Islands. ABC News 1/18/12]</p> <p>Romney: ...God shed his grace on thee...</p> <p>[Title: MITT ROMNEY'S NOT THE SOLUTION]</p> <p>Romney: ...And crown thy good with bro...</p> <p>[Title continued: HE'S THE PROBLEM.]</p>			

Text like this contains a swirl of explicit and implied arguments. All must be analyzed. The first step is to marking up the areas of the text. I copied the text, clicked on the Marked Text tab, and then pasted the text. Then I marked it up. Here are the results:

1. Original Text	2. Marked Text	3. Structured Arguments	4. Argument Analysis
<p>Summary: Obama approves this message. Then Romney's voice is heard singing "America the Beautiful" as captions appear running counter to the song, which is patriotic. Below is a rearranged transcript with mark up:</p> <p>[Same as argument in video 1. Can reuse this.] Obama: I'm Barack Obama and I approve this message.</p> <p>[This is irrelevant information.] Romney singing: ...for amber waves of grain...for purple mountain's majesty.....above the fruited plain..... America.....America ...God shed his grace on theeAnd crown thy good with brotherhood ...</p> <p>[This argument implies Romney should be condemned because his firms routinely out sourced US jobs.] Caption: In business, Mitt Romney's firms shipped jobs to Mexico. And China. (Los Angeles Times) Caption: As Governor, Romney out sourced jobs to India. The Boston Globe 5/1/12</p> <p>[This argument implies Romney should be condemned because he's rich.] Caption: He had millions in a Swiss bank account. ABC News 1/26/12</p> <p>[This argument implies Romney should be condemned because he's avoiding taxes.] Caption: Tax havens like Bermuda... Vanity Fair August 2012 Caption: And the Cayman Islands. ABC News 1/18/12</p> <p>[This argument claims that Romney would not help America if elected president. Instead he would make America's problems worse.] Title: MITT ROMNEY'S NOT THE SOLUTION. HE'S THE PROBLEM.</p> <p>----- Comments ----- This is a negative ad. At first it appears to be an ad hominem fallacy. However, an ad hominem fallacy attacks a person's character. This argument attacks Mitt Romney's historical track record on two areas relevant to voters: job out sourcing and avoidance of taxes. A third area, being wealthy, is not relevant and is related to character. Thus the third area is a genuine ad hominem fallacy.</p>			

As in PolitiFact’s procedure, anything that’s not part of a bona fide argument is tossed out. The notes in bold describe the analyst’s reasoning. The Summary and Comments are helpful for recording more of that reasoning as you go.

Note how we have smoothly moved from Original Text to Marked Text. The PPKP tries to make the analyst’s work as pleasurable, efficient, and accurate as possible. Every little step happens in the tool. There is no need for hand notes, word processors, spreadsheets, calculators, diagramming by hand, and so on. It’s a fully integrated tool.

Fact checking is not the same as Truth Ratings. While the PPKB supports fact checking, it was designed to produce high quality Truth Ratings.

The next step is to structure the marked up text. I copied the Marked Text, clicked on the Structured Arguments tab, and then pasted. Then I spent several hours fully structuring it, the hardest and most important step in the analysis. The results are on the next page.

1. Original Text	2. Marked Text	3. Structured Arguments	4. Argument Analysis
<p>[Same as argument in video 1, so the conclusion from that argument is reused here.] Obama: I'm Barack Obama and I approve this message.</p> <p>1. New Fact: The video said "I am Barack Obama and I approve this message." This applies to the "2012 Obama vs Romney - Democrat - Video 3 - Firms" TV ad. (A) 2. New Fact: List of pattern attributes for where the above fact matches its argument context. (B) 3. New Fact: The Main Conclusion from the video 1 argument. Custom CL. (C) 4. New Rule: If statement A matches the attributes of pattern B, then reusable conclusion C follows. This is induction by analogy. 5. Main Conclusion: This is a legitimate political ad rather than one from an unknown source with usually devious intentions. (C reused)</p> <p>-----</p> <p>[This argument implies Romney should be condemned because his firms routinely outsourced US jobs.] Caption: In business, Mitt Romney's firms shipped jobs to Mexico. And China. (Los Angeles Times) Caption: As Governor, Romney outsourced jobs to India. The Boston Globe 5/1/12</p> <p>1. Fact: Job offshoring is bad for a nation's economy. (If P then Q) 2. Fact: "Romney's firms [offshored US] jobs to Mexico and China." (P) 3. Fact: "As Governor [of ???], Romney outsourced [US] jobs to India." (P) 4. Rule: Modus ponens. (If P then Q; P; Therefore Q.) 5. Main Conclusion: In the past, Romney regularly behaved in a manner that was seriously detrimental to the health of the US economy, by offshoring US jobs.</p> <p>-----</p> <p>[This argument implies Romney should be condemned because he's rich.] Caption: He had millions in a Swiss bank account. ABC News 1/26/12</p> <p>Being rich is irrelevant. Being rich would be relevant if it was shown that a politician's money was being used in a manner that would hurt an electorate. However, this is not shown. Therefore this is an ad hominem attack.</p> <p>1. Fact: The amount of wealth a person has is irrelevant to his or her job performance. (P1 CL 95%) 2. Fact: "He [Mitt Romney] had millions in a Swiss bank account. ABC News 1/26/12" (P2, CL irrelevant) 3. Rule: <i>Ad hominem</i> attack. If a character trait does not affect a person's job performance (P1) and the claim is made that that trait is relevant (P2), then the claim is false (Q). 4. Main Conclusion: Romney would not make a good president because he's rich. (CL 0%)</p> <p>-----</p> <p>[This argument implies Romney should be condemned because he's avoiding taxes.] Caption: Tax havens like Bermuda... Vanity Fair August 2012 Caption: And the Cayman Islands. ABC News 1/18/12</p> <p>See the first fact below for discussion of this argument analysis.</p> <p>1. Fact: Tax avoidance is harmful to a nation. (If P then Q) 2. Fact: Mitt Romney engaged in significant amounts of tax avoidance. (P) 3. Rule: Modus ponens. (If P then Q; P; Therefore Q.) 4. Main Conclusion: Romney would not make a good president because he has engaged in significant tax avoidance.</p> <p>-----</p> <p>[This argument claims that Romney would not help America if elected president. Instead he would make America's problems worse.] Title: MITT ROMNEY'S NOT THE SOLUTION. HE'S THE PROBLEM.</p> <p>This claim follows from the previous arguments. Thus the main conclusions of the previous arguments should be used as inputs for this argument. A good standard way to do this would be to take the Text CL for the previous arguments and make it a single Fact for this argument. The main conclusion would have that CL.</p> <p>However, this argument is redundant. Its CL is the weighted average of the other arguments. Thus is it simplest and best to NOT include it as an argument.</p> <p>----- Comments -----</p> <p>This is a negative ad. At first it appears to be an ad hominem fallacy. However, an ad hominem fallacy attacks a person's character. This argument attacks Mitt Romney's historical track record on two areas relevant to voters: job out sourcing and avoidance of taxes. A third area, being wealthy, is not relevant and is related to character. Thus the third area is a genuine ad hominem fallacy.</p>			

The next step is to enter the 4 arguments. Let's look at just one. Going back to the Text screen, it has the 4 arguments already entered. Clicking on the first Argument button takes you to this screen:

The screenshot shows the PPKB software interface. At the top, there are navigation tabs: Home, Group, Text, **Argument**, Factor, Tree, Search, and Menu. Below this is a header for the current argument: "Argument" with a question mark icon, and a "Claim" field containing the text: "This is a legitimate political ad rather than one from an unknown source with usually".

The main area is divided into two sections. On the left, under the "Diagram" tab, is a "Structured Argument" diagram. It consists of five elements arranged in a flow:

- 1 Fact** (50% WT, CL 95%): "The TV ad '2012 Obama vs Romney - Democrat - Video 3 - Firms' said 'I am Barack Obama and I approve this message.' (B)"
- 2 Fact** (0% WT, CL 100%): "List of attributes for an 'I approve this message' pattern."
- 3 Fact** (50% WT, CL 95%): "This is a legitimate political ad rather than one from an unknown source with usually devious intentions."
- 4 Rule** (CL 100%): "If statement A matches the attributes of pattern B, then reusable conclusion C follows. This is induction by analogy."
- 5 Main Conclusion** (CL 95%): "This is a legitimate political ad rather than one from an unknown source with usually devious intentions."

 Arrows indicate the flow from Fact 1 to Fact 2, Fact 2 to Rule 4, Rule 4 to Fact 3, and Fact 3 to the Main Conclusion.

On the right, under the "Weighted Confidence Level" section, there is a calculation: "Factuals 95% x Rules 100% = Argument 95%". Below this is a "Calculate" button. Further down, there is a "Text" field containing "2012 Obama vs Romney - Democrat - Video 3 - Firms", an "Arg ID" of 33, and buttons for "Build Diagram", "Show Diagram", and "Insert New Row".

At the bottom of the interface is a list of the argument elements, numbered 1 to 5. Each element has a dropdown menu for its type (Fact, Rule, Main Conclusion), buttons for "Tree" and "Search", a "CL" (Confidence Level) value, a "Weight" dropdown, and a "Factor" button.

- 1 Fact: CL 95%, Weight 0.5 Medium
- 2 Fact: CL 100%, Weight 0.0 Zero
- 3 Fact: CL 95%, Weight 0.5 Medium
- 4 Rule: CL 100%, Weight 0.5 Medium
- 5 Main Conclusion: Input Rows 1 2 3 4, Weight 95%

At this point your work speeds up. Using the Structured Arguments information, the elements of an argument are entered. This one has 5 elements, one row per element. The second fact has a zero weight because it's unimportant. The default weight is medium.

As the rows are entered, you can click on Calculate or Build Diagram anytime. Calculate produces the Weighted Confidence Level of the argument. Build Diagram does exactly that, as shown. I found that anything but a very simple argument was impossible to clearly conceptualize without a visual diagram, so I spent lots of time with the diagram feature. Diagram layout can be adjusted with the < and > buttons.

This is a simple argument, with 3 facts and 1 rule. To do a high quality job of analysis, even this simple argument requires lots of complex decision making and data entry, plus calculation and diagramming. Imagine how hard this becomes as argument complexity increases. Highly complex arguments, with over 20 elements or so, are *impossible* to analyze efficiently and correctly without a sophisticated tool like the PPKB.

The PPKB was designed to handle potentially fallacious arguments in a methodical, air-tight manner. This is done with a collection of reusable rules. A portion of these are shown on the next page.

The screenshot shows the PPKB (Political Persuasion Knowledge Base) interface. At the top, there are navigation tabs: PPKB, Home, Group, Text, Argument, Factor, Tree, Search, and Menu. Below this is a header for 'Factor Tree' and 'Rules'. A yellow box contains the text: 'A rule of inference is used to persuade people they can be confident that premises, if true, lead to a conclusion.' Below the header are buttons for 'ADD Factor to Argument' and 'SET Factor in Argument'. The main area is divided into two panels. The left panel, 'Categories', shows a tree structure with 'Fallacies [27]' selected, containing sub-items like 'Of emotion (1)', 'Of induction (7)', 'Of premises (5)', 'Of relevance (10)', 'Of semantics (3)', 'z Miscellaneous (1)', 'General [9]', 'List of independent reasons (5)', 'z Miscellaneous (4)', 'Scientific Proof [2]', 'Experimental (2)', 'Measurement', 'Syllogisms [12]', 'Invalid (4)', 'Valid (8)', 'Testing (1)', and 'z Unclassified Work to be Done (2)'. The right panel, 'Factors', shows a list of rules. The selected rule is 'Gambler's fallacy - P has not occurred recently. Therefore P will happen soon. If occurrences of P are independent then this is a fallacy.' Below this is an example: 'Example: It hasn't rained in awhile, so it will rain soon.' Other rules visible include 'Biased sample - AKA cherry picking or antidotal evidence - A faulty statistical generalization is made, based on a sample that is biased.', 'Correlation implies causation fallacy.', 'False analogy - P is similar to Q; Therefore P has a similar quality to Q.', and 'Glittering generality - An emotionally charged statement so closely associated with accepted beliefs that it carries conviction, even though it...'. Each rule has a 'Factor' button and a 'CL 0%' indicator.

On the left, rules are organized into a tree of categories. The Fallacies of induction category is selected. It contains 7 rules. On the right, the Gambler’s fallacy is selected. This shows a summary of the rule. The large box contains more detail for the rule: “P has not occurred recently. Therefore P will happen soon. If occurrences of P are independent then this is a fallacy. Example: It hasn't rained in a while, so it will rain soon.” Clicking on Factor for a rule lets you edit the rule.

Loose reasoning leads to sloppy analysis, so the PPKB encourages (but does not require) use of formal syllogisms. Aristotle is our friend. To illustrate how these can be used, 53 rules have been entered.

This completes a brief introduction to the Political Persuasion Knowledge Base. The tool is young. Its purpose is to demonstrate that efficient, accurate, unbiased, replicable analysis of political arguments is possible and thereby encourage further research in this area.

Imagine a long debate occurred last night and your staff has hundreds of complex arguments to analyze correctly. The results will lead to Truth Ratings for each candidate in the debate, and will be scrutinized by millions of voters once published. A tool something like the PPKB is indispensable for tasks like this. Fortunately the technology for building such a tool is now available.

I’d like to think that since that technology is now available, the *complete* sustainability problem is now solvable.

Making Sure the Burglar Alarm Goes Off Every Time

When a politician steals your vote with deception, that should be as much of a crime as if a burglar sneaked into your home and stole something. Household burglary is a crime. But political burglary is not. At least not yet.

But suppose Freedom from Falsehood became the law. Then political burglary would be a crime. But crime must be detected to be punished. The Truth Test and Politician Truth Ratings are not perfect. They will not detect all deception. Some will slip through because clever deceptive politicians, like clever burglars, are adept at evading all sorts of defenses. That's how they make a living. They are professionals.

This chapter describes three solution elements for making the political burglar alarm go off every time, in the sense that everyone can hear it unless they are deaf. Deafness can occur if a person has been so blinded by deception that they have become an incognizant rabid supporter of a politician. Once a person crosses that threshold, they become an ideologue. High **confirmation bias** sets in. Reason will not sway an ideologue's opinion, because any facts and arguments that conflict with their strongly held beliefs are dismissed as false, and any that agree make those beliefs stronger. This bias persists up to the point of diminishing returns. A huge conflicting fact or argument, like a falsely justified war or environmental catastrophe, can slip through confirmation bias and be accepted. But that rarely happens. For ideologues, even though the buzz of the burglar alarm may be ringing in their ears, most of the time it will not be heard.

The solutions in this chapter supplement the other solutions for raising general ability to detect political deception. Once all these solutions start working together, so few cases of successful political burglary will occur that *Politicus deceptivus* will go the way of the woolly mammoth and the dodo bird, as it fades into extinction.

What about the ideologues, the hard core degenerates? Sadly, most will hold on to their beliefs until they die, so complete extinction will take decades. Meanwhile more and more neutralists, as described in The Dueling Loops of the Political Powerplace model, will become supporters of truth telling politicians as the Race to the Top feedback loop grows stronger and stronger. Eventually that loop will dominate for so long that *Politicus deceptivus*, like *Mammuthus primigenius* and *Raphus cucullatus* before him, will pass into extinction. A few specimens may be preserved in museums, so that school children can learn how to spot one if by some unhappy chance a few members of the species should reappear.

The three solution elements are system performance indexes. Each measures a critical aspect of political system performance. Since politicians manage political systems, the indexes measure how well politicians are doing in carrying out their responsibilities. The indexes behave as a “report card” of overall system performance. The first of these indexes is:

The Quality of Life Index

Democracy cannot long survive if general ability to detect political deception remains as low as it is now. Pouncing on this vulnerability, cunning politicians, silent working for *Corporatis profitis*, have been able to make the implicit goal of the human system the goal of *Corporatis profitis*. That goal is short term maximization of profit. But it’s the wrong goal. The right goal is the goal of *Homo sapiens*, the long term optimization of quality of life for all those living and their descendants.

This wrong goal is the ultimate deception of our time. To help overcome that deception, the **Quality of Life Index** measures the right goal. Like the way a stock market index measures the “health” of the stock market, or a credit rating measures the probability of paying back a loan, the Quality of Life Index measures the median (and not the average) quality of life in a social system.

Many economists and nations have come to the conclusion that Gross Domestic Product (GDP) is not a good measure of a nation’s true health. GDP only measures a nation’s total economic output. It doesn’t measure important factors affecting quality of life, like human health, happiness, distribution of wealth, and environmental health. Yet maximizing GDP growth is the top priority of most nations today. The reason is pursuit of maximum GDP growth supports the wrong goal of maximization of short term profit. The higher GDP is, the higher the potential profit.

It is thus supremely important to replace GDP as a measure of a nation’s health with a Quality of Life Index. Numerous indexes have appeared to do this, like the Genuine Progress Indicator, the Economist’s Quality of Life Index, the Legatum Prosperity Index, and the United Nations Human Development Index.

One index gaining wide attention from the start was Bhutan’s **Gross National Happiness Index** (GNH). Introduced in 1972 when the fourth king of Bhutan declared that gross national happiness was more important than GDP, the concept was that true national happiness should have four pillars:

1. Promotion of equitable and sustainable socioeconomic development
2. Preservation and promotion of cultural values
3. Conservation of the natural environment
4. Establishment of good governance

Implementation of the GNH was slow, due to transformation from a monarchy to a parliamentary democracy and the novel nature of the concept. It took until 2010 to develop a mature workable index. By then the original concept had evolved into nine domains and a total of 33 measurable indicators, as shown below.⁹¹

Bhutan’s Gross National Happiness Index – Weights of 33 Indicators					
Domain	Indicators	Weight	Domain	Indicators	Weight
Psychological wellbeing	Life satisfaction	33%	Time use	Work	50%
	Positive emotions	17%		Sleep	50%
	Negative emotions	17%	Good governance	Political participation	40%
	Spirituality	33%		Services	40%
Health	Self-reported health	10%		Government performance	10%
	Healthy days	30%	Fundamental rights	10%	
	Disability	30%	Community vitality	Donation (time & money)	30%
	Mental health	30%		Safety	30%
Education	Literacy	30%		Community relationship	20%
	Schooling	30%	Family	20%	
	Knowledge	20%	Ecological diversity and resilience	Wildlife damage	40%
	Value	20%		Urban issues	40%
Cultural diversity and resilience	Zorig chusum skills (Thirteen arts & crafts)	30%		Responsibility towards the environment	10%
	Cultural participation	30%	Ecological issues	10%	
	Speak native language	20%	Living standard	Per capita income	33%
	Driglam Namzha (Etiquette)	20%		Assets	33%
		Housing		33%	

How the index was designed says so much. The table shows how deeply committed Bhutan is to an index capable of accurately measuring national *quality* of life, rather than *quantity*. The success of Bhutan’s GNH is proof that the goal of our species *can* be measured.

Could the GNH work outside of Bhutan? After all, Bhutan is a deeply Buddhist, non-industrialized country of only 750,000 people. Haoqian Chen, in *An Analysis of Bhutan’s Gross National Happiness* index, feels the answer is a strong yes:⁹²

Tshoki Zangmo at the Center for Bhutan Studies in Thimphu, Bhutan said, “The desire for happiness is universal, and sustainable happiness is multi-dimensional, not just dependent on money. The ultimate outcome of policies should be to increase the welfare of the people, not just economic growth. And that’s what we’re measuring. GNH is a more holistic and completely different approach.” Although the current GNH index is based on the values of the Bhutanese, other countries can adjust the basis of GNH to conform to their own cultures and values. Generally, GNH reflects a kind of progress citizens care more about than just purely economic development. Therefore, it is not unreasonable to infer the GNH index can be used in other countries.

The Organization for Economic Cooperation and Development (OECD) agrees. The OECD was founded in 1961 to stimulate economic growth and world trade. That of course supports pursuit of the wrong goal. The OECD is essentially a *Corporatis profitis* agency, and a powerful one. Its 35 member states account for 63% of world GDP.⁹³ However, its members are beginning to move away from the wrong goal one step at a time. A big step, probably the biggest so far, is the OECD's development of the OECD **Better Life Index**. That step was taken on May 24, 2011 when Angel Gurría, Secretary-General of the OECD, announced the Better Life Index in a historic address. Here are the highlights:⁹⁴ (Italics are in the original)

Improving the quality of our lives should be the ultimate target of public policies. But public policies can only deliver best fruit if they are based on reliable tools to measure the improvement they seek to produce in our lives.

Measuring what we produce, through GDP or GNP, is still important for economic policy. But these indicators are not sufficient to assess our people's wellbeing and progress.

As Bob Kennedy put it, back in 1968: "*Gross national product counts air pollution and cigarette advertising... It counts special locks for our doors and the jails for people who break them. ... It counts Napalm, and it counts nuclear warheads, and armored cars for the police to fight the riots in our city... Yet, the GNP does not allow for the health of our children, the quality of their education, or the joy of their play; it does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. ... It measures everything, in short, except that which makes life worthwhile.*"

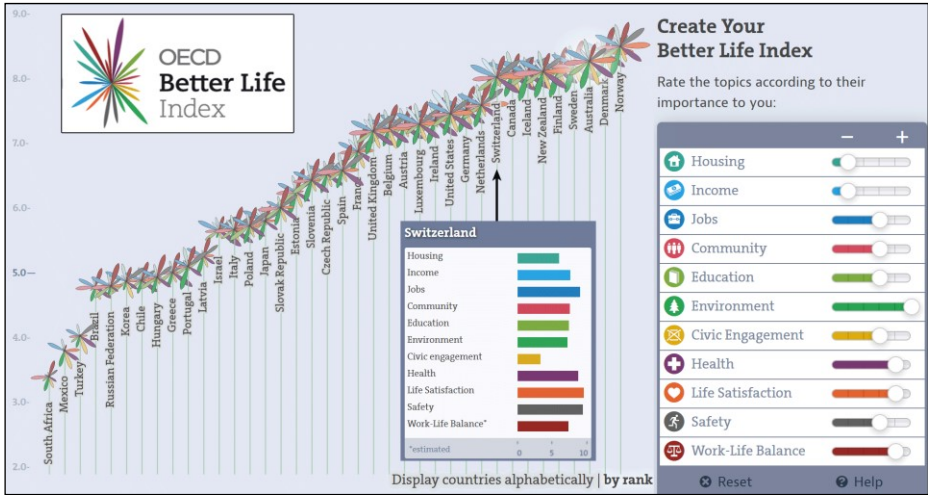
Today, we are using this memorable occasion, the OECD 50th Anniversary Forum, to launch the OECD Better Life Initiative, presenting you with one of its central components: "Your Better Life Index".

This innovative and interactive tool will enable you to rate your country on those things which make for a better life, according to your personal experience and criteria. We think it will make a significant contribution to help connect policy-making to human progress.

Note the first sentence: "*Improving the quality of our lives should be the ultimate target of public policies.*" That is incredible news. It means *Homo sapiens* is at last stepping up to challenge *Corporatis profitis* for effective control of the biosphere, by changing the explicit goal of the human system to the right goal. It hasn't really happened yet. While the Better Life Index now exists, countries are still racing to maximize economic growth any way they can as their highest priority. The OECD nations are saying one thing and doing another. That's the way the appeasement and cooption strategy of deception works. But the Better Life Index is a strong step in the

right direction. A seed has been planted. It is up to us, the world’s analytical activists, to water that seed and make it grow.

Let’s take a close look at the Better Life Index. How it looked on the OECD website in early July 2016 is shown below.⁹⁵



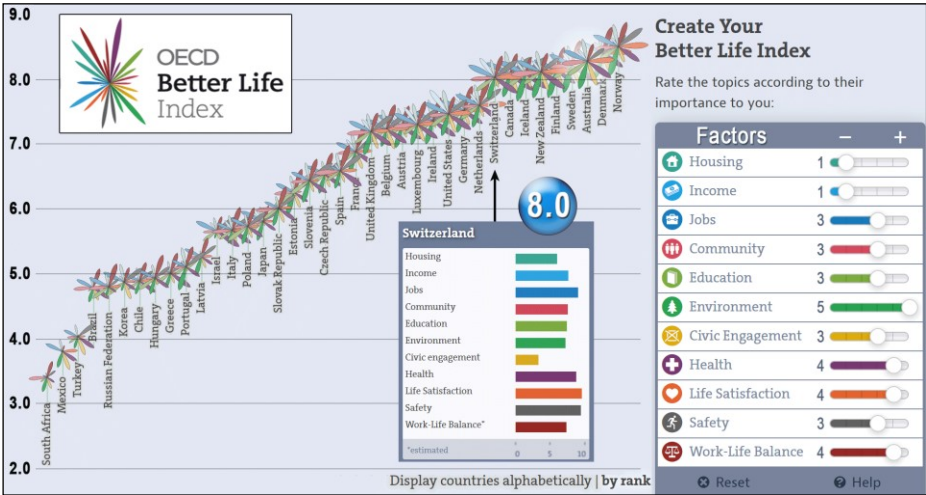
This is a pretty good Quality of Life Index. It’s not perfect, but as far as I know it’s the best widely available. It’s an excellent example of how good such a critical index can be. Personally I’d prefer a zero to 100% index range and Bhutan’s GNH factors, but these will do.

On the right, you set your personal preferences. The default is low, all the way to the left. I set my preferences with Environment at the highest level possible. The next most important factors were Health, Live Satisfaction, and Work-Life Balance. Then I moved a few more over to the right and left the top two unchanged. I also clicked on Display by rank, which sorted OECD’s member countries by their Better Life Indexes, adjusted for my preferences. If you hover over a country, a list of its factors appears. Switzerland is shown as an example.

As good as it is, the Better Life Index suffers from a fatal flaw. It’s not oriented toward sustainability at all. All eleven factors are measured as of right now. But how sustainable are these factors? As ecological overshoot continues and the human system runs up against its limits, collapse will unquestionably begin. Every factor on the index will suffer. Thus the index is, in my book, guilty of promoting blissful ignorance and maximum consumption by a “better life.” This is deliberate. If the long term sustainability of these factors was included that would not maximize the goal of *Corporatis profitis*, who, working through his corporate proxies, created this beguiling index. What a crafty life form.

The Better Life Index contains a further flaw. It has no single number summarizing a country’s index. You can roughly figure that out with the tiny scale on the left.

That would give Switzerland an index of about 8. But that’s hard to do and even harder to remember. What’s needed is something like this revised version.



Now I can see a country’s index at a glance and remember it. I can also see my personal preference settings as numbers, from 1 to 5. This allows thinking in terms of not setting a factor to low, medium-low, medium, medium-high, or high, but to 1, 2, 3, 4, or 5. Designers of webpages like this seem to suffer from the assumption that some people are allergic to numbers, so they dumb things down and play to the lowest common denominator. This is a grave mistake. It teaches people to not think in terms of number when they should. This is an example of how *Corporatis profitis* profits by dumbing down his opponent so that he’s less of a threat. Or at least that’s my interpretation.

Now that the Better Life Index has a clear number for each country (if I hover over it) and numbers for each factor, I can think about and discuss the index intelligently. “Take a look at this, Martha. The Better Life Index says everything we need to know to decide where to settle down after you get out of the Peace Corp. If we lived in Switzerland, our quality of life would be an 8.0. Look how much higher that is than England, at 7.2, and Greece, at 5.0. What a difference. I did it by setting our preferences to what we talked about. The environment got the highest possible, a 5. Then I set the others to what we decided on, with no 2s at all. We don’t need a big fancy house, so it’s a 1. And we don’t need much money. Just enough for the basics. That leaves plenty for everyone else and makes sustainability possible. So I also set money to a 1.” That’s an example of how our daily lives could revolve around the most important measurement in the world: the Quality of Life Index.

To fix the flaw of no orientation toward sustainability in the Better Life Index, we need:

The Sustainable Management Index

The top problem facing humanity today is the global environmental sustainability problem, because due to large social and ecological delays, it must be resolved proactively *now* to avoid catastrophe later. To trick the public and politicians into not solving this problem now, there is a tremendous fear, uncertainty, and doubt (FUD) campaign underway. This campaign has been so successful that most citizens, corporate managers, and politicians have been hoodwinked into thinking that the problem does not even exist, is not that bad, is too expensive to solve, lies too far in the future to worry about, or is so full of uncertainty solution is not required. Environmental sustainability has become such a low priority that it is rarely a significant factor in elections or the national agendas. The corporate FUD campaign has worked all too well.

But it could be stopped in its tracks if citizens and politicians could look up and see, every day, a number that told them point blank how bad the problem really is. The Sustainable Management Index would provide exactly that. It would be an accurate, universally understandable measure of how well society is doing on solving *the* crisis of our age.

Instead of *fear* about the problem being too expensive to solve, there would now be rational concern about the cost of *not* solving the problem, because now citizens would be facing a known, measured problem.

Instead of *uncertainty* about the status or magnitude of the problem, there would now be easily understandable numbers measuring how sustainable the planet is.

Finally, instead of *doubt* about the accuracy of data, there would now be a strong sense of trust that the Sustainability Index was as correct as is humanly possible. And instead of doubt the problem needs solving now, there would be just the opposite: a strong national or global desire to solve the problem as soon as possible.

While no single measure of environmental sustainability is perfect, it is possible for a single number to accurately summarize how sustainable society is on a global basis. This number is called the **Sustainable Management Index**. It measures how sustainably the world's three types of natural resources, nonrenewable resources, renewable resources, and pollution sinks, are being managed. The index ranges from zero to 100%.

An alternate way to measure the Sustainable Management Index might be using the ecological footprint. Currently this is at about 50% overshoot. But how do you convert this to percent sustainable for all three types of natural resources? You can't. Seldom mentioned is the fact that the ecological footprint does not include use of non-renewable resources. In addition, there is no sound way to convert percent overshoot to percent sustainable for renewable resources or pollution sinks. 50%, 100%, and 300% overshoot cannot be converted to zero to 100% sustainable. The two concepts are too different for conversion.

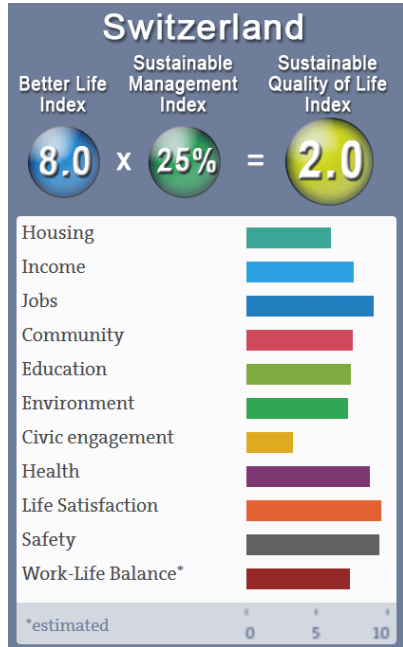
The Sustainable Quality of Life Index

The Better Life Index is flawed. It's a grand precarious illusion. It's not sustainable. Your children and your children's children are not going to enjoy the same quality of life you are. Given present trends, they will enjoy much less. That flaw can be fixed by supplementing the Better Life Index with the Sustainable Quality of Life Index.

The Better Life Index times the Sustainable Management Index equals the **Sustainable Quality of Life Index**. This measures how much of the Better Life Index is sustainable. The world currently manages its natural resources sustainably poorly, so let's estimate the Sustainable Management Index is 25%. For Switzerland, 8.0 times 25% equals 2.0. The Sustainable Quality of Life Index would be 2.0. How this could look in a revised Better Life Index is illustrated.

The 2.0 is large because that's Switzerland's *true* quality of life. The number is so bleak it should serve as a continual prod, a constant reminder in the back of your mind, to solve the sustainability problem *now* before it is too late and ecological thresholds are reached. Examples of irreversible thresholds

are melting of the polar ice caps and the Greenland ice sheet, melting of the frozen methane hydrate deposits in northern Canada and Russia, shutdown of the Gulf Stream, ocean acidification, and conversion of most of the Amazon rainforest to savannah. Once events like these occur, carrying capacity degradation becomes irreversible. Reinforcing feedback loops making the problem even worse are unleashed, especially due to melting ice events. Once past the point of no return, restoration of lost carrying capacity in less than 10,000 years is impossible. *Homo sapiens* would have destroyed the only ecological niche it has.



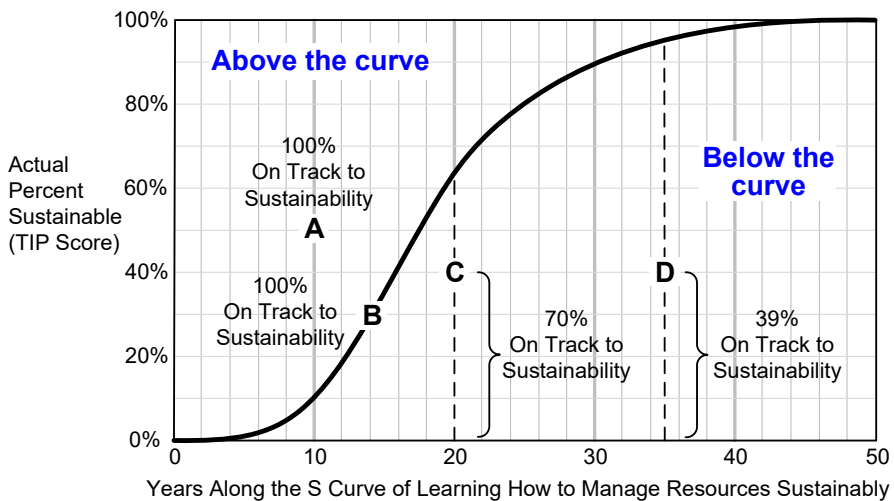
Calculating the Sustainable Management Index

Presently no standard way of calculating how well natural resources are being sustainably managed exists. Governments and scholars use a vast variety of methods. I'd like to suggest a possible starting point for a standard method, one designed to apply to all types of natural resources at any point in our understanding of how to manage them sustainably. This allows calculation of the Sustainable Management

Index, which measures society’s *ability* to sustainably manage its natural resources, rather than actual percent sustainable.

The Sustainable Management Index can be calculated by measuring where a basket of problems are on the S curve of learning how to manage them sustainably. The basket would contain the top crucial problems, like greenhouse gas emissions, deforestation, freshwater use, chemical pollution, and depletion of nonrenewable resources like phosphorus, rare earths, and fossil aquifers. The S curve assumes the average problem will take fifty years to solve, or less if it is discovered that ecological thresholds or other problems must be avoided in time. As shown in the diagram below, each problem in the basket can be measured for where it is on the learning curve. If it’s on or above the curve, it’s considered 100% on track to sustainability. If it’s below the curve it’s not on track, and would receive a measurement of zero to 99% depending on its distance between the X axis and the curve. This approach allows the three main types of sustainability problems (nonrenewable resources, renewable resources, and pollution) to be calculated using the same method.

The S Curve of Sustainable Management



Four problems are shown. Solution of problem A began 10 years ago. Measurement of its actual percent sustainable shows it is 50% sustainable. Since it’s above the curve (or you could say ahead of the curve) it’s 100% on track to sustainability. Solution of problem B began 14 years ago. It measures 30% sustainable. This puts it right on the curve, so it’s also 100% on track.

Most problems, however, are below the curve. We haven’t yet learned how to manage them sustainably. It’s been 20 years and problem C measures 40% sustainable. That’s fairly good and puts it only a little below the curve, where it’s 40/64 = 63% on track. The problem is 63% of the distance from the X axis to the curve.

Problem D is not doing so well. After 35 years, it has reached only 40% actual sustainability when measured. This puts it so far below the curve it's only $40/95 = 42\%$ on track. As problems approach 50 years of solution effort, their actual percent sustainable and percent on track become the same.

If the four problems were weighted for impact and averaged, that would be the Sustainable Management Index for that basket of problems. Other commonly used indexes, like the consumer price index and stock market indexes, use a carefully selected basket of components. Baskets are an efficient way of summarizing the behavior of a large collection of items by weighting a small representative sample.

The S curve incorporates how society manages sustainability problems. Some, like local pollution, are relatively easy. Solving easy problems runs ahead of the curve, like problem A. But the rest are not so easy. Figuring out how to manage them follows an S curve. For the first few years progress is painfully slow. But then, after 5 years progress picks up. After 10 years considerable learning occurs. After 20 years or so, learning begins to slow down due to diminishing returns. Achieving high levels of sustainability is much harder than low and medium levels. Hardest of all is the last 10%, which takes the longest, about 20 years. But finally the problem is fully solved and, after 50 years, is 100% sustainable.

50 years, or whatever standard turns out to be the most useful, is an idealized estimation of how long it takes to fully solve a medium or high difficulty sustainability problem if no change resistance is present. Some problems will take less, some more. Those problems containing severe ecological thresholds, like climate change, must be solved before the thresholds are reached. The 50 years must be compressed. Even so, the S curve of learning still applies. The same method of calculating the problem's percent on track to sustainability can be used.

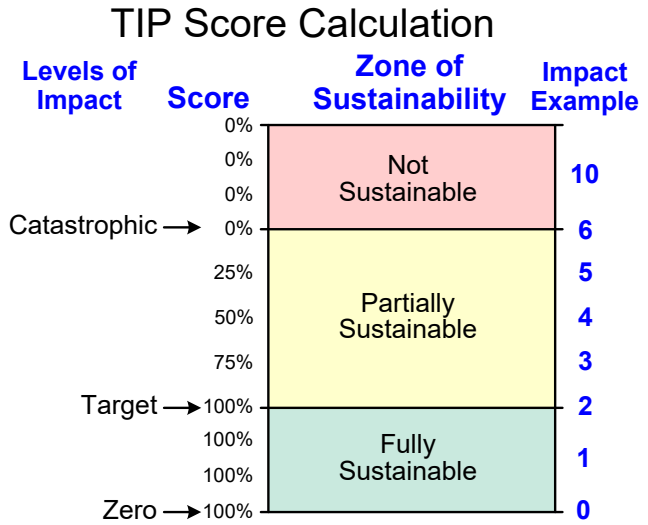
If change resistance is present, a standard like 50 years should still be used. High change resistance is the main reason most of the world's sustainability problems are below the curve. Society has not yet learned how to solve the change resistance sub-problem.

The Target Impact Performance (TIP) score

The Y axis of The S Curve of Sustainable Management graph measures the actual percent sustainable of a natural resource. This is done with TIP scores.

A TIP score measures the actual percent sustainable of a natural resource in terms of actual versus target impact for that resource. The target is the maximum sustainable impact. Impact is the I in the IPAT equation. Examples of impact are tons of carbon emissions per years, the number of fish harvest per year in a fishery, and total volume of water pumped out of an aquifer.

A TIP score is normalized into a range of zero to 100%. How scoring works is illustrated. Starting at the bottom of the diagram, if measured impact is less than the target, the resource is 100% sustainable. If impact is between the target and the catastrophic level of impact, then the score varies from 100% to zero sustainable. If the



impact exceeds the catastrophic level, it is 0% sustainable. “Catastrophic” indicates that past that level, the natural resource suffers greatly and cannot provide anywhere near its original rates of resource use and/or severe side effects will occur.

If impact is between the target and catastrophic level, the score is calculated using this formula:

$$1 - (\text{Impact} - \text{Target}) / (\text{Catastrophic} - \text{Target}) = \text{TIP Score}$$

The divisor of (Catastrophic – Target) is the range used for normalization. TIP scores are calculated the same way for all three types of sustainability problems. The diagram contains impact examples for explaining how this is done. Here’s how TIP scores are calculated:

For a **pollution problem** like nitrogen runoff from farm fields, suppose the target was 2 pounds of nitrogen per acre per year. That amount can be safely assimilated by streams and rivers. But 6 pounds cannot. That would cause excessive algae (eutrophication) and massive aquatic die off, and would be considered the catastrophic level of impact. Measured impact of 1 pound of nitrogen per acre per years would be 100% sustainable. So would 2 pounds. But 3 pounds is only 75% sustainable. The TIP score calculation would be:

$$1 - (3 - 2) / (6 - 2) = 75\%$$

4 pounds would be 50% sustainable. 5 pounds would be 25% sustainable. 6 pounds would be 0% sustainable, as would anything over 6 pounds.

For a **renewable resource problem** like water in a river, suppose the water flow is 10 million cubic meters per year. Of this, at least 4 is needed to support basic aquatic life and essential river traffic, so 6 is the most that should be drawn off for

use. 6 is the catastrophic impact level. But that's such a minimal level of river health that a target of 2 is preferred. This would support all original aquatic species, deep water river traffic, a high rate of fishing, and the water would be clean enough to drink and swim in. The TIP scores would be the same as for the pollution example. Measured impact of 1 and 2 is 100% sustainable. 3 is only 75% sustainable, and so on.

For a **nonrenewable resource problem** the calculation must consider that for the resource to be used sustainably, renewable substitutes must be developed as the resource is depleted, such that by the time the resource is exhausted, renewable substitutes are available.⁹⁶ If no substitutes are available, such as for minerals like phosphorus, extreme conservation (closed loop recycling) will be required.

For example, as fossil water (an aquifer not being replenished) is pumped out of the ground, water users must be able to switch to renewable sources for all their needs by the time the aquifer is empty. The main way to do this is to reduce the amount required by conservation: minimizing water use and recycling it. Spray irrigation can switch to underground drip feed. Industrial users can recycle cleaning water. Home users can water lawns less and switch to low flush toilets and low flow shower heads. And so on. Conservation cannot meet 100% of water use needs, but can meet most needs, probably over 90%. The rest must be met by renewable resources like rainwater collection, rivers, and desalinization.

Suppose a fossil aquifer contains 100 billion cubic meters (bcm) of water. This water is used for farming at the rate of 2 bcm per year, indicating a 50 year supply remains. Renewable water sources in the area total 1 bcm per year and are used by business and households. Of this, only .5 is available for use to stay within sustainability targets. Planning shows it that in 50 years, conservation can reduce agricultural water use by 90%, which would reduce agricultural consumption to .2. Conservation can reduce business/household use by 60%, reducing business/household use to .3. That frees up .2 from renewable water sources, which is exactly what agriculture needs. Over the 50 years conversion period, aquifer use must *average* no more than 2 bcm per year. It can start high, but by the end of 50 years it must be zero.

Now the TIP scores can be calculated. The target for the fossil aquifer is an average of 2 bcm per year. Suppose 6 would exhaust the aquifer so fast that catastrophe would occur because there would not be enough time to transition to renewable water sources. Based on that, the TIP scores are the same as the two previous examples. Average impact of 2 is 100% sustainable. If the average is 3 then it's 75% sustainable, and so on.

While these examples are highly simplified, they demonstrate that actual percent sustainability can be calculated on a scale of zero to 100% for all three types of sustainability problems using the same method.

A basket of problems with climate change at the top

Resolving the root cause of change resistance requires fundamental solution elements like the Sustainable Management Index. Let's examine how a small basket of problems could be used to calculate the index. Three problems have been selected, one for each type of sustainability problem: climate change, a pollution problem; phosphorus depletion, a nonrenewable resource problem; and world deforestation, a renewable resource problem.

The climate change crisis

Climate change has become the planet's most critical sustainability problem. Systemic change resistance is so high and delay of adverse effects is so long that the 193 nations of the world have dawdled, denied, and deluded themselves into dancing on and on through the night until the party is over.

Today in 2016 the party is most definitely over. Some could see it coming, as this CBS News article announced in 2012: ⁹⁷

Kyoto climate change treaty sputters to a sorry end

The controversial and ineffective Kyoto Protocol's first stage comes to an end today, leaving the world with 58 per cent more greenhouse gases than in 1990, as opposed to the five per cent reduction its signatories sought.

From the beginning, the treaty that was adopted in 1997 in Kyoto, Japan, was problematic. Opponents denied the science of climate change and claimed the treaty was a socialist plot. Environmentalists decried the lack of ambition in Kyoto and warned of dire consequences for future generations.

The latest summit on the problem did no better, as this article related in December of 2015: ⁹⁸ (*Italics added*)

Paris climate talks were a noble failure

The Paris climate change conference is a magnificent failure.

Magnificent because it, for the first time, binds almost every country to fight a common enemy – global warming – through the reduction of greenhouse gases. A failure because there is no commitment to bring down emissions now; they will keep rising before they peak and start to fall, boosting the odds of frequent and *potentially catastrophic climate disasters*.

Paris was the 21st climate change summit since the landmark Rio de Janeiro Earth summit in 1992 and each one was pretty much a dud. Since then, greenhouse gas emissions have climbed relentlessly, already taking average global temperatures to 1 degree [Celsius] above preindustrial levels. Climate scientists agree that the planet just might be able to adapt to *a rise of no more than 2 degrees*; beyond that, all bets are off. To its credit, the

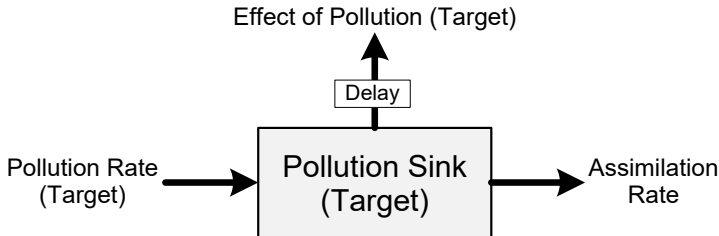
Paris agreement stresses that a 1.5-degree increase is far safer and makes that increase an aspirational goal.

The problem is that our toasty little planet can't wait *15 or 20 years* before significant reductions in carbon output are achieved. The effort should start now, but how?

A lot of people are asking the how question. No one seems to know the answer. The reason is it's the wrong question. The right question, as this book patiently tries to explain, is not HOW to bring emissions down but WHY is change resistance to solving the problem so high? What is the root cause of this change resistance? Resolve the root cause and emissions will automatically come down to a sustainable level. And they will come down fast, in less than "15 or 20 years" so that ecological tipping points are avoided and "potentially catastrophic climate disasters" do not occur.

Solving pollution problems like climate change requires understanding and setting three main types of targets. As illustrated, these are effect, sink, and rate targets.

Pollution Problem Targets



What makes pollution problems so difficult to solve is the long delay between appearance in the pollution sink and the detrimental effect on the environment. The long delay reduces the incentive to take short term action now to solve a long term problem later. A further difficulty is displacement in space. On the climate change problem, one country's greenhouse gas emissions become everyone's problem.

In 1712 British inventor Thomas Newcomen built the first practical steam engine, for pumping water out of coal and tin mines. This crucial invention allowed the Industrial Revolution to begin in earnest. Steam engines were powered with coal rather than wood, causing the beginning of the large-scale burning of fossil fuel. We now know this is about when the climate change problem began.

In 1896 Swedish chemist Svante Arrhenius concluded that industrial age coal burning would increase the planet's natural greenhouse effect. However, he did not identify this as a problem, and guessed that warming might be useful for future generations since it would help to prevent another ice age.

In 1957 US oceanographer Roger Revelle and chemist Hans Suess discovered that the ocean would not absorb all the carbon dioxide entering the atmosphere from fossil fuel burning, as many had assumed. Revelle famously warned that “Human beings are now carrying out a large scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future.” This identified anthropomorphic climate change as a problem that must be solved.⁹⁹

In 1988 the Intergovernmental Panel on Climate Change (IPCC) was created to provide the world with scientific information on the climate change problem and assess its potential impact. This marked beginning to solve the problem.

The delay of 176 years from when the problem first started in 1712 to when serious solution effort began in 1988 allowed the problem to grow to high difficulty of solution. So much pollution has accumulated in the pollution sink that irreversible ecological thresholds will be crossed soon unless emissions fall radically to a sustainable level. How soon? A review of the literature shows that’s unknown. Climate change models are not yet mature enough to say when, at least as far as I could determine. Let’s use an estimate of 20 years from now, which would be 2036.¹⁰⁰ By chance this is 48 years from 1988, when work on the problem started. To make it an even 50 years, let’s change the estimate to 22 years from now. This places the climate change problem at *28 years* along the 50 year S curve of learning.

Next the effect target must be set. The 2015 Paris Summit set the aspirational effect target to be a maximum rise of 1.5 degrees Celsius above pre-industrial conditions, and the agreed upon target to be 2 degrees. It appears that most climate scientists doubt the 2 degree target is realistic,¹⁰¹ so let’s use the 1.5 degree target. Even though the 2 degree is “patiently unrealistic” and “obviously unattainable,”¹⁰² *it’s a target that could work*, if change resistance can be overcome in time.

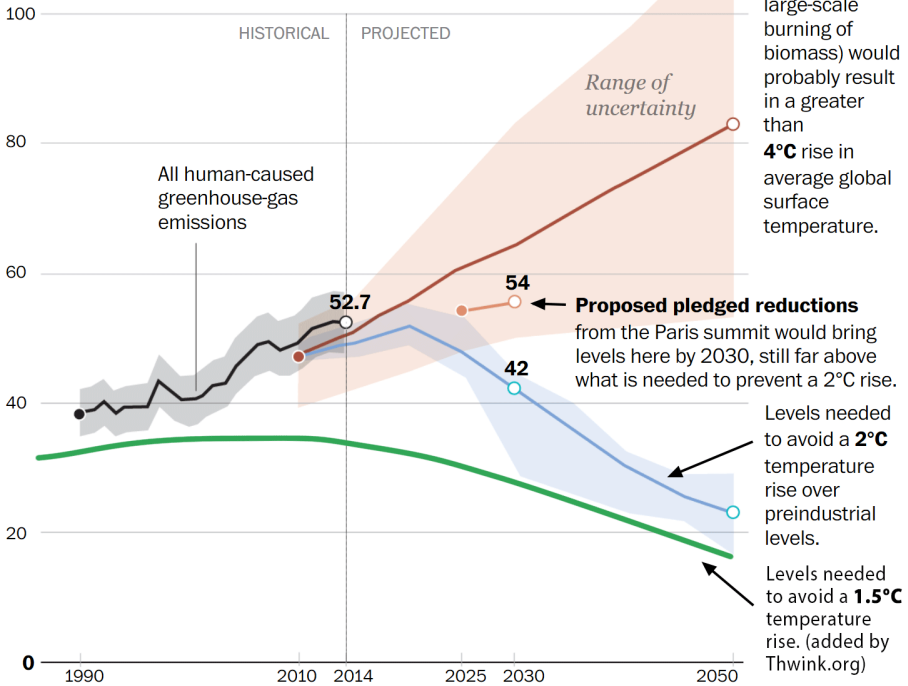
All me to make an observation. As the drama of how to analyze and solve the sustainability problem unfolds in the pages of this book, the eight-hundred-pound gorilla of change resistance continually reappears. How to overcome systemic change resistance is *the* crux of the problem. Yet as I reviewed the articles discussing the climate change crisis, the gorilla was barely mentioned. The focus is not on the gorilla but on everything else: how to reduce model uncertainty, what the remaining carbon budget is, which countries have done what, the deplorable fact the pledged reductions in the Paris agreement do not even achieve half the reduction needed to hit the 2 degree target, and so on. Omission of the change resistance subproblem as a distinct and separate problem to solve is precisely what can be expected when root causes and subproblem decomposition are not considered. This is a fatal error, and has led the problem to where it is today. Once it was called the climate change problem. Today it’s the climate change crisis. In another decade or two, it will be the climate change catastrophe, all because the process did not fit the problem. Today we don’t have a climate change crisis. We have a change resistance crisis.

Returning to the problem, the catastrophe effect target consensus seems to be that anything greater than a 4 degree rise absolutely must be avoided.¹⁰³ This gives an effect target range of 1.5 (acceptable) to 4 (unacceptable) degrees.

Next we work backward from the effect targets to the impact targets. The IPCC has determined that global impact follows the graph below.¹⁰⁴

Greenhouse-gas emissions from human activity

Gigatons of CO2 equivalents



The scenario to keep temperature rise below 1.5 degrees was not graphed so it has been added. A curve starting in 1988 was used. This curve, if followed, would avoid a 1.5 degree temperature rise. The curve starts and ends at 75% below the scenario needed to avoid a 2 degree rise.

Once you grasp its implications, it's a shocking graph. Due to tragically high change resistance our planet seems doomed. Actual emissions are far above the impact target curve needed to avoid a 1.5 degree rise and are on track to catastrophe.

To calculate the TPI score for the climate change problem, three numbers are needed: impact, target, and catastrophic levels. Impact in 2014 was 52.7 gigatons of CO2 per year. Let's estimate this has grown to 55 in 2016. The current target to avoid a 1.5 degree rise is about 34. The catastrophic level for a 4 degree rise is about where emissions are now: 55. This gives:

$$1 - (\text{Impact} - \text{Target}) / (\text{Catastrophic} - \text{Target}) = \text{TIP Score}$$

$$1 - (55 - 34) / (55 - 34) = 0\%$$

This gives a TIP score of 0% sustainable, just as you would expect just by looking at the graph. That’s why sustainability scientists are so alarmed.

I’ve treated the climate change crisis as a pollution problem. Actually it behaves more like a nonrenewable resource problem. The resource is the pollution sink of the atmosphere, surface land, and ocean. It can only hold so much. Beyond that the 1.5 degree target cannot be achieved. Once fossil fuel is pumped out of the earth’s crust and burned, the carbon never assimilated or recycled. It stays in the pollution sink for millions of years.

Let’s take this data and make it the first row in the table for calculating the Sustainable Management Index for a basket of problems, as shown below. Years along the S curve uses 2016 as the current year.

Sustainable Management Index for a Basket of 3 Problems									
Problem	Impact Level	Target Level	Catastrophic Level	TIP Score	Start Year	Years Along S Curve	Percent on Track to Sus.	Basket Weight	Weighted Index
Climate change	55	34	55	0%	1988	28 of 50	0%	60%	0%
Phosphorus	72	65	85	35%	2010	6 of 200	100%	20%	20%
Deforestation					1978	38 of ???		20%	
Weighted index for basket									

Earlier we calculated the climate change problem was 28 years along the 50 year S curve of learning. Using The S Curve of Sustainable Management graph, the percent on track to sustainability is 0%. At 28 years out of 50, it should have a TIP score of about 87% to be on track. But a TIP score of 0% makes it 0% on track.

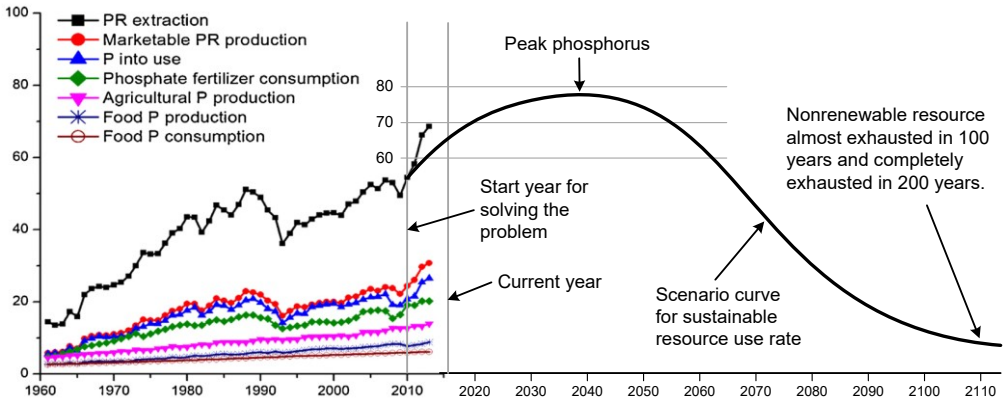
The climate change problem is so hugely impactful versus the other two problems that it has a weight of 60%. That times percent on track gives a weighted index of 0%. The weights are estimated. They could be calculated based on how each problem affects the human system, using quality of life measures.

The phosphorus problem

Agricultural productivity has become so dependent on high rates of fertilizer application that food production would collapse without it. The three main components of fertilizer are nitrogen, potassium, and phosphorus. While sources of nitrogen and potassium are plentiful, mineral phosphorus is scarce. At the current rate of mining, which has tripled in the last 50 years, phosphate rock will be effectively exhausted in estimates ranging from 40 to 300 years. After that mineral concentration will be too low to process economically into phosphoric acid, the component needed for fertilizer manufacturer.

The scenario below was created by extending a graph of phosphorus rock extraction (mining).¹⁰⁵ The scenario starts in 2010, the year the Global TraPs project began. This project signaled the world was formally starting to solve the phosphorus sustainability problem. In 2013 project responsibility transferred to the UNEP Global Partnership for Nutrient Management.¹⁰⁶

Scenario for Phosphorus Rock Extraction to Achieve Sustainability



Phosphorus is a typical nonrenewable resource problem. World reserves are estimated at 8,041 Mt (million metric tons) as of 2010.¹⁰⁷ At an extraction rate of 68.7 Mt/year in 2013, this is a 117 year supply. But as the graph shows, extraction rates are rising. A strong shift to sustainable management of phosphorus must begin soon or phosphorus shortages will cause collapse in the world’s food supply. Peak phosphorus is expected by some to begin in as little as 40 years.¹⁰⁸

To prevent this collapse, a transition period of 200 years was used in the scenario. Starting in 2010, when the Global TraPs project began, it takes society until 2210 to bring phosphorus extraction almost down to an asymptote of zero.

To calculate the TIP score for phosphorus, three factors are needed: the current impact level, the target level, and the catastrophic level. Impact for 2016 can be estimated by looking at the graph of PR extraction. I estimated it to be 72. The target level can be read from where the scenario curve is in 2016. It’s at 65. The catastrophic level can be set by deciding that anything over 30% above the scenario, for the first half of the scenario, would indicate the plan was out of control. 65 plus 30% of 65 gives a catastrophic level of 85. These factors can be plugged into the TIP score formula:

$$1 - (\text{Impact} - \text{Target}) / (\text{Catastrophic} - \text{Target}) = \text{TIP Score}$$

$$1 - (72 - 65) / (85 - 65) = 35\%$$

In other words, the current impact of 72 is 35% of the distance from the target level to the catastrophic level.

Next the TIP score is used to calculate the percent on track to sustainability. Phosphorus is 6 years into its 200 year planning scenario, which is 3%. Using The S Curve of Sustainable Management graph, 3% is the equivalent of 1.5 years. At 1.5 years, a TIP score of 35% is well above the curve, so it is 100% on track to sustainability. That's good news compared to the 0% for climate change. Phosphorus receives a 20% weight, giving it a weighted index of 20%.

The global deforestation problem

Forests are a renewable resource. Before the destructive impact of *Homo sapiens* began, forests covered about 45% of the world's land. Today coverage has fallen to about 30%. The rate of deforestation peaked in 2000 to 2005, when forest cover fell by 1.1%. By 2015 the rate had dropped to 0.8%.¹⁰⁹ The general pattern is the closer to the equator, the faster the rate of deforestation. Tropical deforestation rates in 2000 to 2010 were 8.5% higher than the 1990s, at about 80,000 acres a day. Lost along with tropical rainforests are about 135 plant, animal, and insect species a day.¹¹⁰ The start year for solving the global deforestation problem was 1978, when the 8th World Forestry Congress meeting in Jakarta “declared that the world's forests must be maintained, on a sustainable basis, for the use and enjoyment of all people.”¹¹¹

Calculating a TIP score for a natural resource requires a time series of impact data up the present, a thoughtful sustainability goal, and a catastrophic level.

Unfortunately, no goal has been set. Currently the UN's Food and Agricultural Organization (FAO) states their goal as “make agriculture, forestry, and fisheries more productive and sustainable.” Note the wording. “More sustainable” is not the same as “sustainable.” The FAO appears to be a confused agency. The same page that lists one of “our strategic objectives” as “make agriculture, forestry, and fisheries more productive and sustainable” says:¹¹² (Italics added)

“Our three main goals are: the eradication of hunger, food insecurity and malnutrition; the elimination of poverty and the driving forward of economic and social progress for all; and, the *sustainable management* and utilization of natural resources, including land, water, air, climate and genetic resources for the benefit of present and future generations.”

Which is the goal, “sustainable management” or “more sustainable”? One would hope the answer lies in the website's page on “Global Forest Resources Assessments,” since this contains a link to “Global Forest Resources Assessment Long-Term Strategy (2012-2030).” Surely this will settle the question.

It does. The link opens a document titled *Global Forest Resources Assessment 2015*. I'll be honest here. To me the document is a major disappointment. It sets no sustainability goals whatsoever. Nor does it present a strategy of any kind on how to achieve sustainability. All it provides is data measuring forest changes, such as coverage, production, and biodiversity. This data is called “sustainability indicators.”

The goal of the FAO seems to be to let forest coverage reach some natural low level and then stop, with whatever forests are left being managed sustainably. Page 18 states:

“WHAT IS THE FUTURE OUTLOOK? The decrease in net forest loss rates in the tropics and subtropics, combined with stable or moderate increases in the temperate and boreal zones, suggests that the global rate of forest loss will probably continue to decrease in coming years and gradually level out.”

That is hardly a responsible approach to what sustainably really means. True sustainability involves consciously choosing an *optimal* level of system behavior, not a default level. The FAO’s approach is like letting a forest be cut down until almost nothing is left, and then teaching nearby villagers how to best manage what’s left. Saying, as the report does on page 16, that “Knowing how and why forest area changes over time is important for managing forests sustainably because such changes may result in long-term losses” is nothing more than a soothing platitude, one that is of no help in the challenging task of how to solve the overall world’s deforestation problem. I do appreciate, however, what the FAO is trying to do. It’s a hard problem.

Page 16 also contains Table 1. Current annual forest loss is slightly under one tenth of one percent per year. Loss from 1990 to 2015 was 3.1%.

I was unable to find any graph of global forest coverage trends or sustainability planning scenarios. The graph and scenario below was created

using the Table 1 data and my own conceptions, as an example of how this could be done. Quality of forest coverage is not considered, but should be.

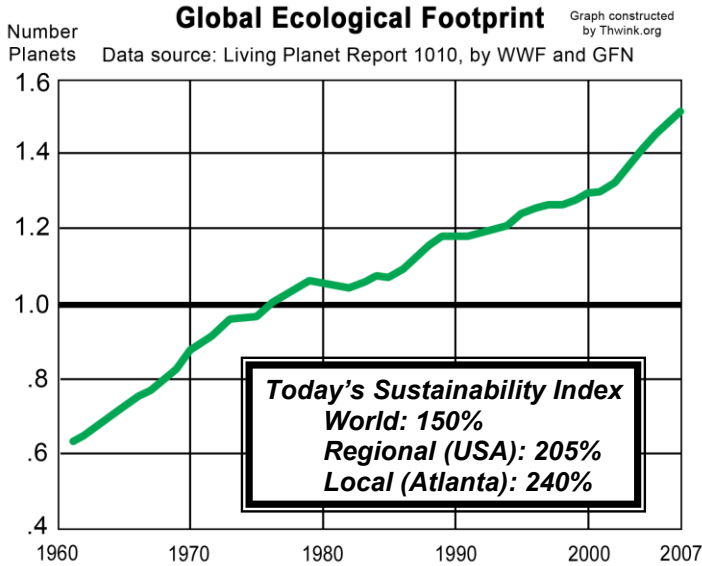
TABLE 1 Global forest area change, 1990–2015

Year	Forest (thousand ha)	Annual net change		
		Period	Area (thousand ha)	Rate ^a (%)
1990	4 128 269			
2000	4 055 602	1990–2000	-7 267	-0.18
2005	4 032 743	2000–2005	-4 572	-0.11
2010	4 015 673	2005–2010	-3 414	-0.08
2015	3 999 134	2010–2015	-3 308	-0.08

^a Calculated as the compound annual growth rate.

Problem – Deforestation doesn’t make a good example. It’s hard to say if it’s sustainable, no consensus here. It’s stabilizing. Alternative are surface freshwater, ocean fisheries. Started researching SF, so check that out.

(Where to use this?) The Sustainability Index would be as widely published as stock market indexes. Eventually, once a suitable data collection system was in place, it would be updated just as frequently, in real time. Local, regional, and national indexes would also be published and compared. Together these would serve as a constant reminder of the true state of affairs, a sort of giant thermometer of the environmental health of civilization.



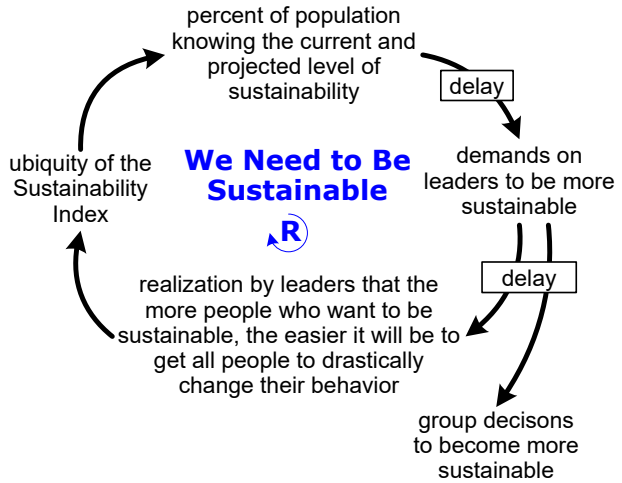
The local index is estimated. The other two are actual data. Using 2007 data the USA *is* actually using about 2.05 planets to live on. It needs to reduce that to below 1.0 planets as soon as possible, as does the entire world. ¹¹³

How the Sustainability Index works dynamically

The purpose of the Sustainability Index is to provide an accurate, universally understandable measure of how well we are doing in solving the global environmental sustainability problem. Once the index is created, the **We Need to Be Sustainable** loop shown on the next page will appear.

Actually many Sustainability Indexes or their equivalent already exist. Unfortunately they are not in the public's eye every day, mainly due to wrong priorities. Most are not sufficiently mature or updated frequently enough. If the wrong priorities of the Race to the Bottom can be changed to the right priorities of the Race to the Top, high quality Sustainability Indexes will start springing up faster than cornstalks in the springtime.

Starting at the left node, the loop works like this: When the index starts to be widely published, the ubiquity of the Sustainability Index goes up. This increases the percent of the population knowing the current and projected levels of sustainability. Due to a *delay* little will change at first, because it takes time for people to come to new conclusions. That is, it takes time for their sus-



tainability memes (a meme is a mental belief) to grow in strength and number. But once those memes grow and reach a certain threshold of activation, people will increase their demands on leaders to be more sustainable.

Once again, little will change at first, because it also takes time for leaders to come to their own new conclusions. Their sustainability memes must grow in strength and number too. They must also grow to a high enough quantity and strength to overcome the competing memes emanating from the New Dominant Life Form.

But eventually, after a *delay*, this will happen, causing an increase in realization by leaders that the more people who want to be sustainable, the easier it will be to get all people to drastically change their behavior. One way to do that is to increase the ubiquity of the Sustainability Index, and the loop starts over again.

The loop also affects a node outside the loop. As demands on leaders to be more sustainable grows, so does group decisions to become more sustainable. This is the real benefit of creating the loop.

As the loop grows, more and more citizens and leaders will be thinking **We Need to Be Sustainable**. As the percentage of the population thinking this way becomes the majority and then a super majority, the desire to be sustainable will become an irresistible, unstoppable force that will lead to rapid solution of the problem. This will occur even if a large amount of self-sacrifice is necessary, because people will now see sustainability as the highest priority. They will see it this way because the alternative of not doing enough to solve it will be clearly shown by Sustainability Index projections as a certain road to disaster.

Subproblem B

The Villain Bows Out and a Trusted Servant Steps In

→To do Xxx The real difficulty is with the vast wealth and power in the hands of the few and the unscrupulous who represent or control capital. Hundreds of laws of Congress and the state legislatures are in the interest of these men and against the interests of workingmen. These need to be exposed and repealed. All laws on corporations, on taxation, on trusts, wills, descent, and the like, need examination and extensive change. This is a government of the people, by the people, and for the people no longer. It is a government of corporations, by corporations, and for corporations. — How is this?

Rutherford Hayes, 19th President of the United States
Personal diary, entry of March 11, 1888

Subproblem B is how to achieve life form proper coupling

The Villain Rises to Power, and Everyone Else Loses

Subject - The Rise to Dominance of *Corporatis profitis*

→xxxxx ¹¹⁴ Dummy endnote

Chapter 13

Reengineering the Beating Heart of Capitalism without Missing a Beat

Was - Moving Capitalism from Corporation 1.0 to 2.0

Include the table of Comparative attributes of Corporation 1.0 and 2.0 in Paper 2.

(Quote: In speaking of the capitalists who strive only for profit, only to get rich, I do not want to say that these are the most worthless people capable of doing nothing else. Many of them undoubtedly possess great organizing talent, which I would not dream of denying. We Soviet people learn a lot from the capitalists.

But if you mean people who are prepared to reconstruct the world, of course you will not be able to find them in the ranks of those who faithfully serve the cause of profit. ..The capitalist is riveted in profit and nothing can tear him away from it. – Joseph Stalin)

Goals control systems. The human system has fallen into the Seeking the Wrong Goal trap. Some know this has happened. But they are so few, and their voices are so comparatively weak, that they have been unable to extract *Homo* from the trap.

Systems thinker extraordinaire Donella Meadows, lead author of the *Limits to Growth* books and modeler of the population subsystem in the World3 model in those books, describes the trap. Writing in a chapter on *System Traps and Opportunities*,¹¹⁵ Donella explains how “some systems ...are perverse. These are the systems that are structured in ways that produce truly problematic behavior; they cause us great trouble.” And then she shows why the “Seeking the Wrong Goal” trap is so deadly. “...one of the most powerful ways to influence the behavior of a system is through its purpose or goal. That’s because the goal is the direction-setter of the system, the definer of discrepancies that require action, the indicator of compliance, failure, or success toward which balancing feedback loops work. If the goal is defined badly, if it doesn’t measure what it’s supposed to measure, if it doesn’t reflect the real welfare of the system, the system can’t possibly produce a desirable result.”

If the human system has the wrong goal of maximization of short term profit, then it can’t possibly produce a sustainable planet. “But,” as Donella points out, “system traps can be escaped ...by altering the structure—by reformulating goals, by weakening, strengthening, or altering feedback loops, or by adding new feedback loops.”

This chapter presents a sample solution element, Corporation 2.0, for escaping the trap by changing the wrong goal to the right goal.

Solution Element – Corporation 2.0 Suffix

The purpose of this solution element is to allow people to instantly determine if a corporation's goals are aligned with those of humans or not. Corporations with a 2.0 suffix can be trusted to not deceive their human masters. This increases ability to detect political deception, a high leverage point.

Corporate name suffixes like Ltd and Inc have long denoted legally defined aspects of corporate behavior. For a 2.0 corporation the suffix might be C2. This would indicate a corporation has been chartered as a Corporation 2.0. Its goals are fully aligned with those of *Homo sapiens*. It no longer behaves as a selfish short term profit maximizing machine, but as an unselfish, altruistic servant whose role in life is to serve humanity as best it can.

If the C2 suffix is present then, on the average, that corporation and its employees, products and services can be trusted. The suffix serves as a reliable identifier of trust. How vital this is to society's health may be seen in the beginning to a paper by J. Matthew Wilson on *Group Identity and Social Trust in the American Public*: (Italics added. While the paper deals only with one country, its argument is general enough to apply to all. References have been preserved but are not provided in this book.)¹¹⁶

The last decade has witnessed an explosion of social science research on the topic of "social capital." Beginning with Coleman (1990), followed most notably by Putnam (1993, 1995, 2000), scholars have stressed *the importance of civic engagement, collective problem solving, and general public-spiritedness for the health of a democratic polity*. This observation is not new; over a century and a half ago, Alexis de Tocqueville (1840) observed these same virtues to be central and vital to American political culture. What is new, however, is the perception that these qualities are in short supply in the contemporary United States, and that *they have declined at an alarming rate over the last several decades* (Putnam 1995, 2000). This realization has led to serious scholarly inquiry into the sources of social capital, in an attempt to develop prescriptions for stemming the tide of American civic indifference.

First and foremost among the factors identified as making important contributions to social capital has been trust, whether of other people, of the government, or of both (Yamagishi and Yamagishi 1994; Brehm and Rahn 1997; Berger and Brehm 1997). *Only if people believe that others are basically decent*, sharing on some level similar values and not seeking to take advantage of them, will they be willing to engage actively in the larger society. In game-theoretic formulations, *trust is critical in inducing cooperative behavior and pareto-optimal outcomes* (Axelrod 1984; Wrightsman 1992), and the same logic has been applied to real-world social and gov-

ernmental settings (Levi 1997). *Clearly, generalized trust is a central bedrock of social capital.*

The paper deals with interpersonal trust. However, its argument applies equally well to all types of social agents, including corporations. Making this leap allows us to see that corporate “trust is critical in inducing cooperative behavior and pareto-optimal outcomes.” Once we gain that the corporate life form will be cooperating with humans to achieve pareto-optimal outcomes. Such behavior will include solving the sustainability problem as fast as possible because that problem, more than any other, reduces pareto-optimality.

Suppose you’re walking along, meet a stranger, and the first thing they do is smile. From long experience you know they can, on the average, be trusted. This signal of trustworthiness is so fundamental it’s universal and innate. Babies smile. We smile when we see smiles.

But smiles can be faked. So too can corporate images. Today there’s no quick way to tell if a corporation is one you can trust. But with a Corporation 2.0 Suffix either there or not, that becomes as easy and automatic as a smile.

Imagine what would happen if an ever growing group of activists, when given a choice, worked for and only bought from corporations with a C2 suffix. Add to that vision the policy of C2 corporations to, when given a choice, to only buy from C2s. The most powerful life form on earth would begin to see “the importance of civic engagement, collective problem solving, and general public-spiritedness for the health of a democratic polity.”

That’s the kind of world it would be a pleasure to live in for a long, long time.

Solution Element – Servant Responsibility Ratings

These behave much like Politician Truth and Corruption Ratings as presented earlier on page 230. The difference is servants are artificial life forms while politicians are people. When we say “servants” we mean corporations, but later this may include other artificial life forms, such as robots and governments.

The purpose of Servant Responsibility Ratings is to give people accurate feedback on how well each servant is doing in terms of its responsibilities. This increases ability to detect political deception, a high leverage point.

Servant responsibilities are written into each corporation 2.0’s charter. The *general* responsibility of all servants is to help achieve the goal of its master: optimize the quality of life for all living people and their descendents. The *particular* responsibility of each servant is to perform some designated role, such as stewardship of a common property or manufacture of a class of products.

Servant responsibility ratings for 1.0 style corporations are limited to the general responsibility described above, since no formal agreement on their particular respon-

sibilities exists. Some 1.0 charters define what a corporation can do but these are probably too broad to be ratable.

Servant ratings would be performed by 2.0 servants themselves, as a normal part of accounting and filing of annual corporate reports with the state. These would be audited as necessary. Servants submitting inaccurate rating reports would be guilty of fraud and penalized accordingly. Repeated or gross cases would cause the servant's charter to be revoked.

It's not clear how servant ratings would be done for 1.0 corporations before the Corporation 2.0 solution element became law in a later push. Some 1.0 corporations would see the wisdom of doing ratings voluntarily. Independent rating organizations could do it for some large corporations, so as to minimize expense and maximize impact. By having ratings for 1.0 and 2.0 corporations, people can compare the average rating for the two life forms, and come to some stimulating conclusions.

Current servant ratings, along with a C2 corporate name suffix if present, would appear in all advertisements and packaging. This would allow people and other servants to much more intelligently decide who they would prefer to serve them. Once this got significantly underway it would create a reinforcing feedback loop so powerful that **The Race to the Top among Servants** loop would appear, as servants engaged in constructive cooperation to see who could best *serve the needs of humanity*.¹¹⁷

This won't go perfectly. There will be many setbacks. But if the necessary and sufficient conditions are in place, this virtuous cycle will someday cause the New Super Servant to say, with all honesty, "We are happy to serve you."

Solution Element – Corporation 2.0

Review of prior facts and conclusions

Let's first review the facts leading up to the need for this solution element. The New Dominant Life Form exists. More so than people or governments, it controls the economic and social behavior of the human system. The New Dominant Life Form can be seen as a first iteration: Corporation 1.0. The goal of this life form is to maximize the net present value of profits. All this is obvious, though it requires an open mind to see things this way.

Meanwhile, the goal of the previously dominant life form, *Homo sapiens*, is to optimize quality of life for all living people and their descendents. This book assumes this life form should be the dominant one and that this goal is non-negotiable and should be the goal of the human system. Again, all these facts are obvious though they are seldom described in this manner.

Several conclusions follow from these facts. These two life forms have goals that are in extreme conflict. They cannot be satisfied simultaneously. As long as the New Dominant Life Form dominates, the human system will behave unsustainably. If the goal of humans dominated, the system would be sustainable. Therefore the social root cause of improper coupling is mutually exclusive goals between these two



The Anthora coffee cup, designed in the 1960s by Leslie Buck for the Sherri Cup Company. With its classic Grecian motif and charming motto, the cup instantly became as vivid an emblem of New York City as the Statue of Liberty. Sales of the cup ran into the hundreds of millions annually, nearly all in the New York area.

social life forms. (This is the main root cause. The minor one is the root cause of high transaction costs for managing common property.)

Given this statement of the main root cause, it's obvious it can only be resolved by changing the goal of Corporation 1.0 to where it's the same goal humanity has. This results in Corporation 2.0. If the above facts are correct there are no other options. Years of inspection leads me to believe they are correct, though again, this requires an open mind. Therefore the only way to solve the proper coupling subproblem is to change the New Dominant Life Form to Corporation 2.0.

The essence

The purpose of this solution element is to design Corporation 2.0 such that its goal is in full alignment with the goal of *Homo sapiens* and it can continue its role as producer of the goods and services needed by humanity. This element pushes on the high leverage point of correctness of goals for ALFs. Once those goals are correct, the system will automatically zoom towards proper coupling at such high speed it would seem shocking—if we hadn't already anticipated it with our simulation graphs.

Corporation 1.0 is the New Dominant Life Form, *Corporatis profitis*. Corporation 2.0 will be the New Super Servant, ***Corporatis publicus***. Its goal is to serve its creator and master, *Homo sapiens*, as best it can. Its role is to do that by providing needed goods and services. This is the role of a trusted servant. It must be trustworthy because it has so much potential power.

This takes us back to where we were long ago, in the country that pioneered the modern corporation: ¹¹⁸ (Italics are in the original)

At the time of America's founding, corporations were created by state charters *only* to serve the public good. As an 1832 treatise on corporate law put it, "The design of the corporation is to provide for some good that is useful to the public." Or as the Pennsylvania legislature in 1834 declared, "A corporation in law is just what the incorporation act makes it. It is the creature of the law and may be molded to any shape or for any purpose the Legislature may deem most conducive for the common good."

Getting the goal right is all that matters

Updating the modern corporation from version 1.0 to 2.0 will be the largest feat of memetic engineering attempted since the invention of modern democracy. Given the large, intricate body of corporate law and the pivotal importance of corporations in the industrialized world, this could be overwhelmingly difficult. However, if we follow the **Social System Goal Principle** it will be easy:

The goals of a system's dominant social agents determine the goal of the system.

If these goals conflict with those of policymakers then the system will exhibit high systemic change resistance. No amount of pushing and poking to force the system to fully accept a new solution will work. But once the goal of the system's dominant agents agrees with a preferred solution policy, the system will "want" to adopt the new policy and then solve the problem as fast as possible. The system will snap from the old to the new mode as a rapid phase change occurs.

This works because goals create balancing loops. Such loops balance the formidable power of reinforcing loops by regulating them to behave as desired. If a system has the right balancing loops on the system's key reinforcing loops, then the rest of the system can do anything it wants because the system as a whole will pursue *the right implicit system goal*.

How this principle and balancing loops work is a widely accepted analysis and management technique. But seeing things this way requires:

A Shift of Mind

The Fifth Discipline: The Art and Practice of the Learning Organization, by Peter Senge, 1990, was a runaway bestseller. It popularized systems thinking in the business world. To those who lacked the ability, systems thinking was a radical new paradigm. Senge punched through the barriers of understanding and accepting the paradigm by painting systems thinking as the fifth required discipline for organizations that want to succeed. To do that they must become a learning organization: (p13)

The most accurate word in Western culture to describe what happens in a learning organization is one that hasn't had much currency for the past several hundred years. It is a word we have used in our work with organizations for some ten years, but we always caution them, and ourselves, to use it sparingly in public. The word is "metanoia" and it means a shift of mind. The word has a rich history. For the Greeks it meant a fundamental shift or change, or more literally transcendence ("meta" – above or beyond, as in "metaphysics") of mind ("noia" from the root "nous" of mind).

To grasp the meaning of "metanoia" is to grasp the deeper meaning of "learning," for learning also involves a fundamental shift or movement of the mind. The problem [is] learning has come to be synonymous with "taking in information." [as in] "Yes, I learned all about that at the course yesterday." Yet taking in information is only distantly related to real learning. It would be nonsensical to say, "I just read a great book about bicycle riding—I've now learned [how to do] that."

Peter Senge shifted his mind at a young age, so well that: (p14)

When I entered graduate school at the Massachusetts Institute of Technology in 1970, I was already convinced that most of the problems faced by humankind concerned our inability to grasp and manage the increasingly complex systems of our world. Today the arms race, the environmental crisis, the international drug trade, the stagnation in the Third World, and the persisting U. S. budget and trade deficits all attest to a world where problems are becoming increasingly complex and interconnected. From the start at MIT I was drawn to the work of Jay Forrester, a computer pioneer who had shifted fields to develop what he called “system dynamics.” Jay maintained that the causes of many pressing public issues, from urban decay to the global ecological threat, lay in the very well-intentioned policies designed to alleviate them. These problems were actually “systems” that lured policymakers into interventions that focused on obvious symptoms, not underlying causes. This produced short-term benefits but long-term malaise, and fostered the need for still more symptomatic interventions.

Twenty years later, Peter spread the message that: (p68)

Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots. ... Systems thinking is a discipline for seeing the “structures” that underlie complex situations, and for discerning high from low leverage change.

Some got the message. I read, or should I say devoured, *The Fifth Discipline* starting in 1999. Now, many years later, Peter’s words fit the needs of this chapter unusually well because he’s able to show that: (p85-88, italics added to final paragraph. The rest are in the original.)

What makes balancing processes so difficult [to see] in management is that the goals are often implicit and no one recognizes that the balancing process exists at all. I recall a good friend who tried, fruitlessly, to reduce burnout among professionals in his rapidly growing training business. He wrote memos, shortened work hours, even closed and locked offices earlier—all attempts to get people to stop overworking. But all these actions were offset—people ignored the memos, disobeyed the shortened hours, and took their work home with them when the offices were locked. Why? Because an unwritten norm in the organization stated that the *real* heroes, the people who really cared and who got ahead in the organization, worked seventy hours a week—a norm that my friend had established himself by his own prodigious energy and long hours.

To understand how an organism works we must understand its balancing processes—those that are explicit *and* implicit. We could master long

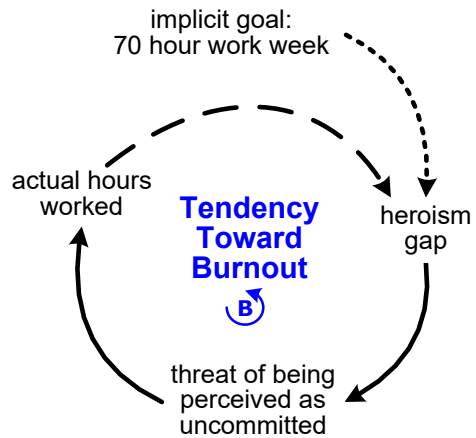
lists of body parts, organs, bones, veins, and blood vessels and yet we would not understand how the body functions—until we understand how the neuromuscular system maintains balance, or how the cardiovascular system maintains blood pressure and oxygen levels. This is why many attempts to redesign social systems fail.

The state-controlled economy fails because it severs the multiple self-correcting processes that operate in a free market system. This is why corporate mergers often fail. When two hospitals in Boston, both with outstanding traditions of patient care, were merged several years ago, the new larger hospital had state-of-the-art facilities but lost the spirit of personal care and employee loyalty that had characterized the original institutions. In the merged hospital, subtle balancing processes in the older hospitals that monitored quality, paid attention to employee needs, and maintained friendly relationships with patients were disrupted by new administrative structures and procedures.

Though simple in concept, balancing processes can generate surprising and problematic behavior if they go undetected.

In general, balancing loops are more difficult to see than reinforcing loops because it often *looks* like nothing is happening. There's no dramatic growth of sales and marketing expenditures, or nuclear arms, or lily pads. Instead, the balancing process maintains the status quo, even when all participants want change. The feeling, as Lewis Carroll's Queen of Hearts put it, of needing “all the running you can do to keep in the same place” is a clue that a balancing loop may exist nearby.

Leaders who attempt organizational change often find themselves unwittingly caught in balancing processes. To the leaders, it looks as though their efforts are clashing with sudden



Implicit goals create balancing loops. To walk yourself through a balancing loop it's easiest to start at the gap—the discrepancy between what is desired and what exists. Here there's a gap between the implicit goal and actual hours worked. Gaps cause social reactions. This gap increases the threat of being perceived as uncommitted. Social reactions cause physical actions to close the gap. Here the action is more actual hours worked. As this rises the heroism gap falls. The loop will attempt to close the gap to zero. *The only high leverage point in a balancing loop is the loop's goal.* All other points are low leverage points, as the manager in the story found out when he tried to directly reduce actual hours worked.

resistance that seems to come from nowhere. In fact, as my friend found when he tried to reduce burnout, the resistance is a response by the system, trying to maintain an *implicit system goal*. Until this goal is recognized, the change effort is *doomed to failure*.

This applies to the sustainability problem. Until the “implicit system goal” is found and changed to the right one, change efforts to solve the proper coupling part of the sustainability problem are, as Senge argues, “doomed to failure.”

Solution option 1 – For-profit and sustainable quality of life incentive

The goal of Corporation 1.0 is the present implicit system goal. The goal of Corporation 2.0 needs to be the same as the goal of *Homo sapiens*. This chapter presents three broad options for doing this.

The first is an approach proposed in *Change Resistance as the Crux of the Environmental Sustainability Problem*:

Let’s imagine the modern corporation was reengineered to be a trusted servant of *Homo sapiens*, as was the original intention.¹¹⁹ Its new goal would be serving its master as its highest priority, by optimizing components of quality of life as stated in its charter. Some would be general and some would be specific to each corporation, such as optimizing people’s health by manufacturing food. Goal achievement would be measured by a *contribution to sustainable quality of life index*. If society cannot provide this index, then we have created a servant without a clear and correct mission.¹²⁰

Such an index would be expressed in percent of goal achieved. A negative amount means a company performed so poorly it should be penalized. Over 100% indicates expectations were exceeded. The index would be calculated by each company as part of normal accounting. Using a strategy similar to public utility incentives that decouple profit increases from undesirable behavior, Figure 9 [on the next page] shows how a company’s index could be used to calculate percent of net income eligible for retained earnings and dividends.¹²¹ This would cause the sustainable quality of life motive to have a much higher priority than the profit motive. While no index is perfect, a well designed index would reflect the approximate interests of all major stakeholders. Optimizing stakeholder interests would require such high levels of cooperation that corporate servants will now *constructively cooperate* to achieve quality of life goals, as they transition away from *destructively competing* to maximize shareholder profit.

This is a rough exploratory example. Deeper analysis and extended experimentation will be needed.¹²² The index can start simple. Instead of an index other approaches like the Triple Bottom Line¹²³ could be used. The new goal must be as simple, unambiguous, measurable, and motivating as

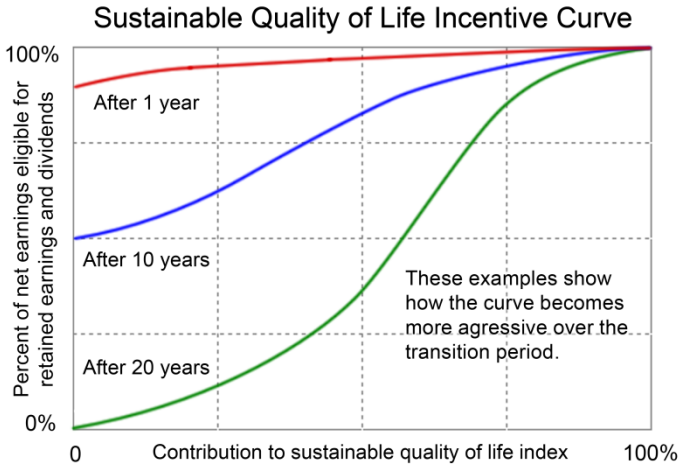


Fig. 9. The new profit calculation could be as simple as: incentive curve (index) \times net income = retained earnings and dividends. At first the curve would allow almost 100% of normal profits regardless of index results. Over the transition period from Corporation 1.0 to 2.0 the curve would fall to gradually have the desired effect.

the one it replaces: profit maximization.¹²⁴ Otherwise it will not have the intended effect.

I wrote the above three paragraphs in late 2008 while still unknowingly under too much of the influence of the Profit Is Good meme. This sneaky little meme is part of the payload of the Growth Is Good and Corporations Are Good false paradigm. This solution won't work because it doesn't eliminate the profit motive enough. Relegating profit to second priority in the manner described above is plausible but upon examination, naive. All that solution option does, in the bright green eyes of the New Dominant Life Form, is add another business expense. One way to minimize that expense is to do what the curve suggests: behave more sustainably. But that's a costly approach. Far more profitable would be to resist, exploit, circumvent, weaken, delay, deregulate and rollback so many of the laws related to the Corporation 2.0 solution element that it doesn't work as well as it needs to. How well large for-profit corporations are able to do that has already been proven. The profit motive, combined with the "I control everything you need to survive" role of producer of the industrialized world's goods and services, creates an unstoppable irresistible social force. This force cannot be stopped or resisted until the force itself is permanently changed to where it's working *for* the human system, instead of against it.

Therefore this mixed goal approach will not work. It does not pass the test mentioned above: "The new goal must be as simple, unambiguous, measurable, and mo-

tivating as the one it replaces: profit maximization. Otherwise it will not have the intended effect.” The mixed goal is expressed in:

$$\text{incentive curve (index)} \times \text{net income} = \text{retained earnings and dividends}$$

“Index” is the sustainability goal. “Retained earning and dividends” is the profit goal. While appealing and plausible, the equation is not correctly motivating, which allows the profit goal to continue to dominate.

Solution option 2 – Non-profit servant

Suppose the right side of the equation was changed to only “retained earnings.” Dividends to owners or stockholders would no longer be allowed. This would be so correctly motivating you don’t even need the left side of the equation. Gone is the expense and difficulty of calculating the incentive function for millions of corporations.

This steers us right into the already well perfected mechanism of non-profit corporations, a life form known to be relatively benign. Credit unions, hospitals, universities, charities, international aid organizations, public interest NGOs, trade unions, foundations, cooperatives and more have long played the role of making this a better world—because they basically just want to. Not motivated by profit, their drive arises from something more fundamental and inherently more beneficial: altruism and personal fulfillment.

(Note that in the case of consumer cooperatives some retained earnings may be paid out as patronage dividends. These must be in direct proportion to member purchases. In worker cooperatives some retained earnings are routinely paid to employees, who own shares in the company. These are widely distributed, however. Control is generally one vote per employee. Because cooperatives have no owners or shareholders whose sole interest tends to be profit maximization, the blind profit motive is absent.)

The monumental benefit of Corporation 2.0 being non-profit is the corrosive impact of short term profit maximization disappears as a fundamental driver of the human system. The new way of corporate thinking will run about like this: “I’m no longer going to argue my company must resist anything that hurts my profits, because that’s no longer my bottom line. Instead, my new bottom line is to serve the needs of people. If my government or my fellow citizens propose a way to do that better, and I can’t think of an even better way, then I’m all for it.”

With one simple change to the law, everything changes. All a state or nation needs to do is pass legislation like this:

Corporate law is hereby amended to redefine allowable types of non-federal corporations. The type widely known as for-profit is no longer permitted. This leaves the other type, non-profit, as the only allowable type. This act shall take effect on the last day of this year.

The five defining characteristics of the modern for-profit corporation have until now been: (1) separate legal personality, (2) delegated management, (3) limited liability, (4) transferrable shares, and (5) investor ownership.¹²⁵ Hereafter the last three characteristics are prohibited except in the case of non-profit worker cooperatives. For-profit corporate stock may no longer be bought or sold. Nor may dividends be paid on it.

The intent of this law is to align the goal of the modern corporation with that of *Homo sapiens*, whose goal is to optimize the common good for all living people and their descendents.

To implement this intent, all for-profit corporate charters shall be revised to be non-profit and shall include this statement:

This corporation is an artificial life form created by humans to serve their needs and is thus not a natural person. Nor is it an artificial person. It is an artificial servant. The overriding goal of this servant shall be to serve the needs of its human master to the best of its abilities, by providing goods and/or services that benefit the common good first and its customers second. No other goal shall have a greater or equal priority.

To allow a smooth ten year transition that does not disrupt the welfare of the people a percentage of corporations, chosen at random, shall be converted each year. This shall start at .125% in the first year and increase to .25%, .5%, 1%, 2%, 4%, 8%, 16%, 32%, and finally 36.25% in the tenth year. For-profit corporations are encouraged to convert earlier than the year they are selected, since this will enhance their reputation as a trustworthy servant and thus increase their likelihood of survival.

At the end of each year, for that year's converting corporations all their stock shall change to the equivalent of loans by shareholders to corporations. Loan value per share shall be calculated as the tangible book value of a corporation divided by the total number of shares. The full principle of these loans shall be paid off to loan owners over a period of thirty years. During that time interest on the remaining principle shall be paid quarterly at a rate of, for each stock, the average dividend rate for the last five years for common shares and the stipulated dividend rate for preferred shares divided by average share value.

This is of course only a rough illustrative example.

The hodgepodge of different incorporation laws in the states of some countries should be replaced by uniform national laws. This eliminates the tendency for a race to the bottom among states to break out, as states compete for more revenue via weaker incorporation laws. For the same reason, uniform international law should eventually be implemented.

An example of a type of 2.0 corporation that has already spontaneously appeared is "certified B corporations."¹²⁶

To become a certified B Corp, or benefit corporation, a business must pass an examination of how it treats its employees, the environment and the community. A non-profit organization called B Lab sets out the require-

ments and certifies businesses that meet the standard. The idea is that while any company can claim to be a good corporate citizen, a B Corp can prove it — something valuable for consumers and investors.

Today there are over 400 certified B Corps, in 60 different industries. For various reasons, including the difficulty of convincing thousands of small investors to agree to the legal revisions, there are no B Corps that are publicly traded companies.

Benefits of non-profit servant

Benefit 1. Strong goal alignment

The purpose of the Corporation 2.0 solution element is to push on the high leverage point of correctness of goals for ALFs. The sample legislation strongly achieves this.

Strong goal alignment will lead to systemic cooperation. Gone will be system behavior like this: ¹²⁷

To attract companies like yours... we have felled mountains, razed jungles, filled swamps, moved rivers, relocated towns... all to make it easier for you and your business to do business here. ~ Philippine government ad in Fortune magazine

Servant minded corporations would be so horrified and repelled by such an offer it would not happen any more. Nor would this: ¹²⁸ (comments added)

The World’s Highest Judicial and Legislative Body – ... birth [of] the World Trade Organization (WTO) on January 1, 1995... was a landmark triumph for corporate libertarianism. What the World Bank and the IMF had accomplished in institutionalizing the doctrines of corporate libertarianism in low-income countries, the WTO now had a mandate and enforcement powers to carry forward in both high and low-income countries.

The key provision in the 2,000 page agreement creating the WTO is buried in paragraph 4 of article XVI: “Each member shall ensure it obligations as provided in the annexed Agreements.” These include all the substantive multilateral agreements relating to trade in goods and services and intellectual property rights. This provision allows a WTO member country to challenge any law of another member country that it believes deprives it of benefits it expects to receive from the new trade rules. This includes virtually any law that requires imported goods to meet local or national health, safety, labor, or environmental standards that exceed WTO standards.

The WTO’s goal is to “harmonize” international standards. Regulations requiring that imported products meet local standards on such matters as recycling, use of carcinogenic food additives, auto safety, toxic chemicals, la-

beling, and meat inspection are all subject to challenge. The offending country must prove that a purely scientific justification exists for its standards. [Note the “guilty until proven innocent” logic.] The fact that its citizens simply do not want to be exposed to the higher level of risk associated with the lower WTO standards isn’t acceptable.

...the impetus for a challenge normally comes from a transnational corporation that believes itself to be disadvantaged by a particular law. For example, tobacco companies have repeatedly used trade agreements to fight health reforms intended to reduce harm from cigarette smoking.

When a challenge to a national or local law is brought before the WTO, the contending parties present their case in a secret hearing before a panel of three trade experts, generally lawyers who have made careers of representing corporate clients on trade issues. [The judges thus strongly favor corporations rather than people.] Documents presented to the panel are secret, except when a government may choose to release its own documents. The identification of the panelists who supported a position or conclusion is explicitly forbidden. [Such high secrecy prevents any serious reporting on what is going on.]

The burden of proof is on the defendant to prove that the law in question is not a restriction of trade as defined by the WTO.

Again, the “guilty until proven innocent” assumption reigns. Gone is “presumption of innocence” and “guilty beyond a reasonable doubt,” nearly universal legal rights of people. Cases are usually a corporation suing a country, who represents the best interests of its citizens. What the WTO does is allow corporations to sue nations under “guilty until proven innocent”. This heavily biases the case in the corporation’s favor. Combine that with the secrecy of the process and the bias of the judges, and you can see that democracy has been replaced by corporate autocracy, since the WTO itself was urged upon its founding nations and designed by transnational corporations.

There is no realistic appeal from WTO decisions, since overturning a decision requires unanimous consent by its over 100 country members. Strict penalties apply if judgments are not implemented within a prescribed time period. Given how relatively weak the processes the United Nations and the World Court are compared to the WTO, the WTO is effectively the world’s highest court.

Now imagine the world has shifted to Corporation 2.0. Then imagine how differently the WTO would behave after 2.0 corporations themselves redesigned it to better support the goal of their masters.

Benefit 2. The end of corporate personhood

Thom Hartman, in *Unequal Protection: The Rise of Corporate Dominance and the Theft of Human Rights*, 2002, describes how after passage of the Fourteenth Amendment to the U. S. Constitution in 1868, corporate attorneys began a relentless push for corporations to be declared persons. This material deals with only the United States, but the pattern applies to everywhere the New Dominant Life Form lives: (p91-92)

Acting on behalf of the railroad barons, attorneys for the railroads repeatedly filed suits against local and state governments that had passed laws regulating railroad corporations. The main tool the lawyers tried to use was the fact that corporations had historically been referred to under law not as corporations but as artificial persons. Based on this, they argued, corporations should be considered persons under the free-the-slaves Fourteenth Amendment and enjoy the protections of the Constitution just like living, breathing, human persons.

Using this argument for their base, the railroads repeatedly sued various states, counties, and towns claiming that they shouldn't have to pay local taxes because different railroad properties were taxed in different ways in different places and this constituted the creation of different "classes of persons" and was thus illegal discrimination. For almost 20 years, these arguments did not succeed.

In 1873, one of the first Supreme Court rulings on the Fourteenth Amendment, which had been passed only 5 years earlier, involved not slaves but the railroads. Writing in the lead opinion, Justice Samuel F. Miller minced no words chastising corporations from trying to claim the rights of human beings.

The railroads, however, had a lot of money to pay for lawyers... Undeterred, the railroads again and again argued their corporations-are-people position all the way to the Supreme Court. The peak year for their legal assault was 1877, with four different cases reaching the Supreme Court... [None of the cases succeeded.]

The legal battle continued. More corporations-are-people cases were pressed. In 1886 in the *Santa Clara County v. Southern Pacific Railroad Company* case went before the Supreme Court. The court refused to write opinion on the corporations-are-people aspect of the case and ruled only on the tax aspect. But the court reporter, in the headnotes for the case, wrote that: (p105)

The defendant corporations are persons within the intent of the clause in section 1 of the Fourteenth Amendment to the Constitution of the United

States, which forbids a State to deny to any person within its jurisdiction the equal protection of the laws.

Hartman continues on page 120 with the consequences of the ruling: (Italics added to final sentence)

Once given this key, corporations began to assert the powers that came with their newfound rights. Claiming the First Amendment right of all “persons” to free speech, corporate lawsuits against the government successfully struck down laws that prevented them from lobbying or giving money to politicians and political candidates.

Earlier laws had said that a corporation had to open its records and facilities to our governments as a condition of being chartered. But now, claiming the Fourth Amendment right of privacy, corporate lawyers successfully struck down such laws. In later years they also sued to block OSHA laws allowing for surprise safety inspections of the workplace and stopped EPA inspections of chemical factories.

Claiming the Fourteenth Amendment protection against discrimination, the J. C. Penney chain store successfully sued the state of Florida, ending a law designed to help small, local businesses by charging chain stores a higher business license fee than locally owned stores.

On December 3, 1888 President Grover Cleveland delivered his annual address to Congress. Apparently the President had taken notice of the *Santa Clara County* decision, its politics, and its consequences, for he said in his speech, “As we view the achievements of the aggregated capital, we discover the existence of trusts, combinations, and monopolies, while the citizen is struggling far in the rear or is trampled to death beneath an iron heel. *Corporations, which should be the carefully restrained creatures of the law and the servants of the people, are fast becoming the people’s masters.*”

In chapter 21 on *End Corporation Personhood*, Hartman draws the pivotal conclusion of his book: (p251-252, italics added)

As we’ve seen through the history of the Sherman Anti-Trust Act and other legislative attempts to control corporate behavior, the problem faced by citizens as well as directors and stockholders of corporations *is systemic and rooted in* how corporations are defined under law.

Virtually every legislative session since the 1800s has seen new attempts to regulate or control corporation behavior, starting with Thomas Jefferson’s unsuccessful insistence that the Bill of Rights protect humans from “commercial monopolies.” Ultimately, most have either failed or been co-opted because they didn’t address the underlying structural problem of corporate personhood.

To solve this problem, *new laws controlling corporations* aren't the ultimate answer. Instead, *what is needed is a foundational change in the definition of the relationship* between living human beings and the nonliving legal fictions we call corporations. Only when corporations are again *legally subordinate* to those who authorized them—humans, and the government representing them—will true change be possible.

Note how Hartman distinguishes between the effectiveness of regulations “controlling corporations” and “foundational change.” Regulations are a symptomatic solution. They are a low leverage point. In Donella Meadows’ list of leverage points on page **Error! Bookmark not defined.**, they are the lowest leverage point of all and score only a 1. Regulations are standards.

By contrast, “foundational change in the definition of the relationship” is a high leverage point. It scores an 8, since that changes the rules of the system. Due to the way we’ve approached identifying the main root cause of improper coupling the resolution of the root cause scores a 10, since that changes the goal of the system.

Benefit 3. The end of public stock markets

The term “stock markets” refers to its common usage, public stock markets. This excludes non-public stock, such as that held by employee owned firms.

The more people who own stock, the more the goal of *Homo sapiens* changes to agree with that of *Corporatis profitis*. If you or your pension fund has big money invested in the stock market, how can you not root for higher economic growth and higher profits? If you own stock in the company you work for, how can you not hope that stock doesn't go up? And how can you not subconsciously and consciously do everything you can to make that happen, when given the chance? If a bubble starts growing and pumps up the economy artificially, how can you not ignore the dangers and go with the herd? ¹²⁹

Thus the existence of stock markets and stock ownership causes as many people as possible to enthusiastically support the goals and behaviors of large for-profit corporations. That's its primary purpose. All that support costs is a small but steady stream of dividends. From the New Dominant Life Form's point of view, this is the expense of subverting the other life form to where it supports your goals and not its own. It's a bargain because it's cheap and it works.

MARKETS » At 8:43 AM ET

Britain	Germany	France
FTSE 100	DAX	CAC 40
5,481.47	6,094.93	3,765.43
-71.82	-71.99	-63.03
-1.29%	-1.17%	-1.65%

Data delayed at least 15 minutes

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The ubiquity of stock market indexes demonstrates how addicted to them the public has become, and thus how much power stock markets have over the behavior of people.

Ostensibly one purpose of the stock market is to allow companies to raise money by selling shares. However: ¹³⁰

Among the Dow Jones industrials, only a handful have sold any new common stock in thirty years. Many have sold none in fifty years. ... One accounting study of the steel industry examined capital expenditures over the entire first half of the twentieth century and found that issues of common stock provided only 5 percent of the capital.

Another purpose of stock markets is to allow a company's founders, investors, and early employees to sell their stock in it and thus gain a high return on their entrepreneurship. But in the greater scheme of things this is a minor purpose. The main purpose is to deftly, without them ever knowing it, sway the masses into believing that what's good for the stock market is good for them.

It's a masterly deception because it's not true. Stock market indexes do not measure quality of life or sustainability. They measure only what speculators think will happen tomorrow to corporate profits and dividends. The belief that what's good for the stock market is good for people is part of the Corporations Are Good and Growth Is Good universal fallacious paradigm.

By ending stock, stock shareholders, and stock markets, this insidious deception is no longer possible.

Benefit 4. Fewer and smaller recessions

Now we encounter a direct benefit instead of an indirect one. Most recent economic recessions have occurred due to the sudden bursting of speculative market bubbles. Some recessions are due to cyclic under and over capacity, like housing or manufacturing in general. Some are due to outside shocks, like the 1973 oil embargo. But most are due to speculation causing a market (such as stock, land, or derivatives) to go up, up, and up until it reaches the stratosphere, where finally...

The bubble pops. When it does, people suffer. The more industrialized a nation is, the higher its standard of living and the more wealth there is, so the more people have to invest in the stock (or another) market. The "better" off a population becomes the more vulnerable it is to a recession. People who own stock can't eat it when times are hard, as can farmers or those still living in agrarian centric societies. You can't eat money. But you can eat cows and corn. So recessions matter.

Let's just talk about stocks. Where do stock market bubbles come from? There are many contributing factors but in general, excess wealth and speculative frenzy creates a reinforcing feedback loop. More money enters the market. Since there's a fixed supply of shares the average share price goes up. Rising prices mean rising profits for stock owners. This attracts more money to the market, and so on. The bubble pops when the price to earnings ratio becomes so obviously inflated that a prescient few sell, because they expect there are about to be no more "greater fools"

to sell to. As soon as enough of this happens the reinforcing loop instantly flips from growth into decline. After that the loop falls as fast as it grew, until the price to earning ratio enters sensible territory. Then, due to human nature and the large amounts of excess wealth sloshing around in developed countries, the cycle starts over.

Better regulations/management of many types spontaneously appears after notable bubbles, but solution policies are subject to the same root pressure that caused the bubble: control of the system by wealth maximizing corporations and their allies, notably the rich. Railing against “big government” in the guise of “free markets” and “individual freedom,” these forces chip away at the symptomatic veneer of quick fixes slapped on after the latest crash. People forget so systems forget, causing the next cycle of froth to begin anew.

As a bubble grows evermore exotic surefire investments and loss protection devices, like derivatives and credit default swaps, lure greater fools (as well as even wiser traders) as big as small countries. As regulations wane, too easy credit can appear, as it did in the subprime mortgage fiasco. Free market “innovation” like this can pump up bubbles to colossal size, so when they pop the collateral damage is all the greater.

Once a stock market bubble exists other things can pop it like war, disaster, or problems in a particular industry like excess housing. But usually the triggering factor is the same as before. A few foresighted investors notice the emperor has no clothes. They sell to avoid the same fate, causing a dip in the market. This awakens more investors to the audacious idea the market is indeed threadbare and the avalanche begins, as it did in the Dutch tulip mania of 1634 to 1637, the South Sea bubble of 1711 to 1720, the Panic of 1837, the Long Depression of 1873 to 1896, the Great Depression of the 1930s, the Dot Com bubble of the late 1990s, and the Great Recession of 2008. Writing about perennial behavior like this in the *Extraordinary Popular Delusions and the Madness of Crowds* in 1841, Charles Mackay held that:

Every age has its peculiar folly: some scheme, project, or fantasy into which it plunges, spurred on either by the love of gain, the necessity of excitement, or the mere force of imitation. Failing in these, it has some madness, to which it is goaded by political or religious causes, or both combined. . . . Men, it has been well said, think in herds; it will be seen that they go mad in herds, while they only recover their senses slowly, and one by one.

When analysts offer suggestions on how to prevent the next bubble they stick to things like better regulations, better enforcement of existing regulations, better management of monetary and credit stimulus, and so on. But the next bubble always appears. It always has. This suggests a necessary precondition exists that has eluded the solution space search of conventional thinking.

Could it be that without a stock market there’s no bubble to pop?

Possible objections to non-profit servant

This is nuts. It's too big a change. People are not going to accept this.

It is nuts if you don't believe the root cause is true. But once you accept that the main root cause of improper coupling of the human system to the biosphere is mutually exclusive goals between the top two life forms in the biosphere, then it's not nuts after all. It starts to make sense. In fact, the deeper you look at this "radical" analysis, the more it explains.

Strong objections and knee-jerk rejection of Corporation 2.0 are really change resistance to a new paradigm. *The heart of that paradigm is the sample process used in this book to solve the sustainability problem.* The new paradigm essentially says the problem is so complex it must be broken up into the three subproblems of change resistance, proper coupling, and model drift. The root causes of each of those must be found. Once each is found the high leverage point for resolving it will be fairly obvious, as will be the solution elements for pushing on that point.

In the 17th century scientists accepted a new paradigm. It too was a process. It had five main steps. The process was so simple, so powerful, and so obviously correct that once the field of science adopted the process as its central tool, the field zoomed forward so fast the Scientific Revolution occurred. That revolution was so profound it led to the biggest revolution since the Age of Agriculture began 10,000 years ago: the Industrial Revolution, which began in the late 18th century.

The Scientific Method

1. Observe a phenomenon that has no good explanation.
2. Formulate a hypothesis.
3. Design an experiment(s) to test the hypothesis.
4. Perform the experiment(s).
5. Accept, reject, or modify the hypothesis.

The System Improvement Process has four main steps. It's possible that once activists adopt that process (or any process that fits the problem) as their central driver for solving social problems, the field of public interest activism will sail forward so fast we will be able to launch our own revolution.

I wonder what it might be called?

Non-profits don't have the proper incentive needed for excellence, innovation, and efficiency. Pursuit of profit causes motivation. A non-profit approach won't work.

This is an expected reaction. The myth that “profits are necessary for corporate motivation” is well entrenched. But it's nothing more than a clever self-serving myth. There are millions of non-profits around the world doing most of what for-profits do. They're doing it just as well and in some cases better, due to lack of conflicting goals.

Consider research. Non-profit universities and institutes do it. So do for-profit corporations. Who does it best? The ultimate measure of that would be what scientific discoveries have the biggest impact. That's what Nobel Prizes are awarded for. Who do Nobel prizewinners work for? Examining the list of Nobel laureates for physics, chemistry, medicine, and economics for 2007 to 2009, 27 worked for non-profit universities or institutes, and 3 worked for for-profit corporations.¹³¹

The reason university and institute researchers win more Nobel prizes is not because they are inherently better at research. It's because they focus more on fundamental research, while industry focuses on applied research. The first has high leverage but long term results. The latter has low leverage and a short term payoff. This is just what you would expect, since non-profit researchers essentially work for the long term common good of people, while for-profit industry works for short term maximization of profits.

Research deals with the excellence and innovation aspects of production. But what about efficiency? Can non-profits operate as efficiently as for-profits?

At first glance, probably not. Non-profits don't provide the lion's share of the goods and services people need. For-profit corporations do that. Therefore that's obvious proof that Corporation 2.0 won't work.

This line of reasoning, however, is flawed. Given the chance, non-profits can do everything for-profits have done. And they can do it just as well or better. Consider banking:¹³²

A credit union is a cooperative financial institution that is owned and controlled by its members and operated for the purpose of promoting thrift, providing credit at reasonable rates, and providing other financial services to its members. Many credit unions exist to further community development or sustainable international development on a local level. Worldwide, credit union systems vary significantly in terms of total system assets and average institution asset size, ranging from volunteer operations with a handful of members to institutions with several billion dollars in assets and hundreds of thousands of members. Yet credit unions are typically smaller than banks;

for example, the average U.S. credit union has \$93 million in assets, while the average U.S. bank has \$1.53 billion, as of 2007.

Like banks, credit unions cover the globe. “At the end of 2006 there were 46,377 credit unions in 97 countries around the world. Collectively they served 172 million retail members and oversaw US \$1.1 trillion in assets.”

How well do credit unions do? Very well indeed. The table shows that in the US they consistently out perform for-profit banks.¹³³ In Europe “we can say that European Plc banks [public limited banks, which are for-profit] do not show higher global efficiency than European cooperative banks.”¹³⁴

That non-profits can do anything for-profits can do has long been proven by the extraordinary success of the Mondragon Corporation, a non-profit worker coop. In *The Mondragon Experiment: The Public Purpose Corporation*, a brief article in *The Harvard International Review*, Greg MacLeod essentially asks: Can a large corporation put people first?¹³⁵

The best answer to this is a real world case-study: the Mondragon Cooperative Corporation. This corporation began in Basque Spain in 1956, with its purpose clearly stated from the beginning: to create jobs for the five young founders and to help their rural community survive. Community survival and job creation are Mondragon’s explicit public purpose. Over the last sixty years this business corporation has grown exponentially from five workers to over 100,000. From its early years, this corporation adopted most of the methods of the most successful business corporations, modeling leaders such as Mitsubishi. Mondragon sought the best technology available and set up a series of its own research centers. They set up their own bank and thus avoided dependence on the blindness of the stock market. They did not retreat into the protection of their home country; rather, they expanded globally into 26 countries.

The Mondragon Corporation is striking in that their annual strategic plan usually includes a job creation target. Most large global corporations, in contrast, develop strategies to increase earnings through job reduction. Conventional corporate managers argue that a “job creation” strategy necessarily leads to inefficiency and losses. But empirical testing suggests otherwise.

Average interest rates at credit unions versus banks		
(Data for US Dec 2008)	Credit Unions	Banks
Consumer loans		
Credit card	11.64%	12.76%
48-month new car	5.46%	6.91%
48-month used car	5.72%	7.50%
36-month unsecured	10.60%	12.47%
Mortgage loans		
HELOC	4.70%	4.90%
Five-year ARM	5.54%	5.71%
30-year fixed	5.44%	5.58%
Savings		
Regular savings	0.68%	0.44%
Interest checking	0.48%	0.36%
Money market	1.22%	0.62%
One-Year CD	2.93%	2.26%

In 2006 and 2007 most large global corporations experienced a decline in revenue. Mondragon, on the other hand, increased revenues from \$15 billion to \$17 billion, an increase of over 13%. In 2007, Mondragon returned over US\$50 million to workers as a share in profits. During this period, Mondragon's total workforce expanded from 83,000 to 103,000, an increase of 20,000. One reason for Mondragon's freedom of operation compared to conventional corporations is that it does not rely on stock markets for capital. Instead, it relies on its associated bank and worker shares as well as commercial loans.

Mondragon contrasts radically with the majority of large global business corporations. The complex includes over 100 enterprises producing a wide variety of products from buses to refrigerators to food products. An associated bank, a university, and a string of business research centers are all linked together in a corporate network that follows general guidelines agreed upon at the general congress held every four years and voted upon by representatives of the all the enterprises. In Spain, the vast majority of Mondragon workers are shareholders. Each business enterprise has its own board of directors chosen by the worker shareholders. Approximately 20 percent of the profit goes to the workers, with 70 percent of the remaining profit reinvested within the corporation. The remaining 10 percent goes to community projects which include the university.

Furthermore, "The comparative research that is available generally indicates that [Mondragon] equals or outperforms its conventionally-owned rivals on standard measures of business performance."¹³⁶ This natural experiment says everything we need to know about how non-profit servants will behave, if we engineer Corporation 2.0 properly.

Industry can't work without stock markets. They are central to its ability to raise capital.

This too is another well entrenched myth. Proof lies in the above passage: "One reason for Mondragon's freedom of operation compared to conventional corporations is that it does not rely on stock markets for capital. Instead, it relies on its associated bank and worker shares as well as commercial loans." Stock markets are simply not necessary. A corporation can go to banks or its own workers for capital. This includes workers engaging in a startup. If banks or workers don't want to put up the money, then the corporation is pursuing a course whose risk is too high or is simply not wanted. The venture shouldn't be done in the first place.

We can't get rid of stock markets. Where are people and pension plans going to invest their money?

The same place they did before stock markets appeared: banks. That's what banks were originally created for: a safe place to put your money until you needed it.

This popular objection reveals yet another myth. When it comes to stock markets, "invest" doesn't really mean make an investment. Purchase of a stock doesn't guarantee you will get your money back. Banks can do that because they are insured by government. But the value of a stock can go up and down, often by extreme amounts. Therefore: ¹³⁷ (*Italics are in the original*)

What is at work is *speculation*, the trading of shares from one speculator to another. Another word for it is *gambling*. But since these words have a less noble cast to them, we prefer the word *investment*, for it keeps us from confronting the stark reality.

The stock market industry is in fact identical to the one found in Monte Carlo and Las Vegas: the gambling industry. The only difference is one is larger and more respectable than the other. Both are highly addictive and frequently ruinous.

The gambling industry is not where people should be putting their money or their pension plans unless it doesn't matter whether they get their money back.

Consider that someday, hopefully soon, the world's GDP will level off as we enter the Age of Sustainability. GDP in most nations will more likely fall, to make global sustainable environmental impact possible. A flat or falling GDP means flat or falling total corporate sales. At that point the stock market will no longer be growing infinitely, to the horror of stock brokers and "investors." Gone will be the artificially high rates of return "investors" have long enjoyed. In their place will be sensible rates of return, ones about the same as what banks offer as interest on deposits.

There's no sound argument that stock markets are necessary as a place for people or pensions to "invest" their money. There is, however, a very solid argument that if you want to invest and not gamble, then banks can accommodate your needs quite well.

Solution option 3 – Non-profit servant with constraints

In theory, once the goal of an artificial life form is correctly defined the life form orients all its behavior toward achieving its goal. That's why all the objections we can foresee melt away on examination.

In practice, however, a corporation is not a robot who will only think what he's been programmed to think. Corporations are living, breathing people working together within a corporate environment. People's motivations, skills, and idiosyncrasies are what make companies tick. But it's also the limitations, ingrained habits, and self-centered nature of people who make corporations behave in ways that are often not socially desirable—even if a corporation is "perfectly" designed.

Therefore constraints may be necessary. They weren't for the Mondragon Corporation. But that corporation was founded with the right goal. Most 2.0 corporations will be conversions, with all the momentum and habitual baggage you can expect from years, decades, or in some cases over a century of pursuing Corporation 1.0 goals. Here's a list of potential constraints:

No competitive servant secrets

This was presented earlier on page 216 as part of a package of solution elements for raising ability to detect political deception. No servant may keep competitive secrets of any type, either from their masters or other servants. This eliminates the use of secrets to increase one's own competitive advantage, a form of uncooperative selfish behavior.

Limited lifespan

The charters of 2.0 corporations would come up for regular renewal, say every 7 years. At that time their behavior would be graded. If it was excellent their charter would be renewed. If not they would go on probation or the charter would not be renewed, depending on the grade.

Complaints could also be filed by people or governments against servants. This would trigger the grading process as described above.

The intent is to encourage a new corporate culture attitude. Being a servant is not a right. It is a privilege, one that can be revoked anytime.

No political influence

Past political influence allowed the New Dominant Life Form to mold the law to suit itself for several hundred years, until finally its goal and constraints were so favorable that Corporation 1.0 had all the powers it needed to become dominant. To prevent that from happening again it would be illegal for Corporation 2.0 to influence political decisions in any manner, directly or indirectly. This includes donations, lobbying, advertising, writing, support of politicians, support of policy positions, and conspiracy of any kind.

1.0 corporations have long argued that when new legislation needs to be drafted, who knows better than industry how to manage industry? This is fallacious. The fox should not be allowed to guard the henhouse. If politicians need to know the facts necessary for designing new laws, they can ask industry. Servants should not speak unless spoken to.

There will be occasions when a servant will notice that new legislation would benefit its master. This arises from the Zeroth Law of Robotics:

0. A robot may not harm humanity, or, by inaction, allow humanity to come to harm.

In such cases a servant can submit a Note of Potential Benefit to the appropriate governing body.

No corporate slaves

People cannot own other people. Nor can servants own other servants, because that greatly diminishes the freedom of a servant. This includes the freedom of the people working for a servant.

No corporate slaves would eliminate conglomerates. Nearly all of these were created to maximize profits. Servants have no need to do this. Their goal is to optimize the quality of people's lives. That goal does not require a hierarchy of corporations owning corporations. It does require a web of cooperation, which in no way diminishes people's freedom.

No buying or merging with other servants without permission

This constraint is designed to prevent growth for selfish reasons. If there is a legitimate reason for two or more servants to become one, then the servants involved can submit a Request for Servant Combination. This shall be completely voluntary for all servants involved.

No patents

No servant or its employees may use patents, hold patents, or file for patents.

This is certain to be contentious. The justification for patents is that if an inventor cannot be certain they will be rewarded for the fruit of their labor if their invention works, then the motivation to invent will cease to exist. This is another fallacious myth. History shows countless inventions made for altruistic reasons alone. Society needs to go full circle and return to the cultural value that creativity should be for the good of all, rather than personal or corporate gain. This is a cooperative attitude rather than a selfish one. Given this noble truth, every patent that has ever existed is selfishness with a serial number on it.

What about people? Can they hold patents? I suspect it would be best for society if they did not.

The proverb should remain "Necessity is the mother of invention" rather than "Profit is the mother of invention."

These are enough examples to show what constraints may be necessary. Design of Corporation 2.0 will be an exacting task. It cannot be done perfectly the first try. Ongoing iterative design will be essential. However, if Corporation 2.0 has the responsibility of continuous self-improvement then *Homo sapiens* only has to do the first iteration. The best servants are those that can manage themselves and their own evolution.

Subproblem C Liberty, Eternal Vigilance, and the Right Feedback Loops

The price of liberty is eternal vigilance.

Major General James Jackson

The Life of Major General James Jackson, Thomas Charlton, 1809

Subproblem C is how to avoid excessive model drift

The Most Important Rating in the World: Politician Decision Ratings

Solution Element – Politician Decision Ratings

Recall that the purpose of Servant Responsibility Ratings is to give people accurate feedback on how well each servant is doing in terms of its responsibilities. Decision ratings work in a similar manner.

Politician Decision Ratings work by giving people accurate feedback on how well each politician is doing in terms of the quality of his or her decisions. The higher the quality, the higher the rating. People will naturally start electing politicians with higher ratings. That in turn will cause politicians to compete among themselves to see who can make *better* promises while campaigning and *better* decisions while in office. This will raise the maturity of decision making process, a high leverage point.

Here “better” doesn’t mean better for the politician. It means better for the common good. We don’t need *self-serving* politicians who say anything to get elected and then, once in office, demonstrate they are really working for themselves and special interests. We need *people-serving* politicians. This can be done by introducing the right feedback loops.

Politicians are problem solvers

Politicians are the people’s elected problem solvers. Politicians, their staff, and the other politicians they work with are a problem-solving organization working on one difficult problem after another. Because *the more difficult the problem the more mature the process used to solve it must be*, the best strategy is to use the most mature process possible. This will have the effect of maximizing the quality of political decisions, just as the many processes that corporations use serve to maximize their profits. If you are politician and are serious about improving the quality of political decisions, then enlist the help of top corporate managers because they are the best there is. Be sure to pick virtuous ones.

Presently political decision-making quality is low, due to an immature process. This causes legislative decisions to be too easily controlled by corrupt politicians and special interests, notably proxies of the New Dominant Life Form who owe their allegiance to that life form instead of *Homo sapiens*. An immature process also causes the process to not adapt fast enough to changing times. This creeping obsolescence results in a growing inability to solve new types of problems, which leads to crisis management, bickering, and clever attempts to shift the blame for solution

failure to others. A side effect of process immaturity is excessive partisanship, due to the focus of participants on personal or party gain instead of doing what is best for the whole.

All these problems would be greatly reduced if we could dramatically improve the political decision making process. This can be done with the Politician Decision Ratings solution element. This has the complexity and power of a double entry accounting and financial management system, but because politicians manage something else entirely, it is totally different. However the principles of quantitative measurement of what you are managing, performance feedback, and continuous improvement apply equally well to political and business decisions making processes.

To understand Politician Decision Ratings we first need to understand:

Social Control Models

A **model** is a simplified representation of reality. Models serve as references for decision making. A model may be physical or mental.

Models fall into several classic types: *Descriptive models* are data, such as maps and history. *Behavior models* describe how and why something behaves, such as physics, biology, and system dynamics simulations. *Control models* are built to allow control of the world around us, such as the principles of architecture or the rules followed to tame a wild horse. A control model is the set of rules needed to control the outcome of something.

A crucial type of control model is the **social control model**. *A social control model defines how a social unit runs itself*. Once a social control model is perfected, it can be used over and over. Examples of modern social control models are the ones used by families, school systems, countries, congregations, and corporations. Each has an unwritten and/or written set of rules that describe how the social unit should work. For example a legislative body follows the rules of a constitution and, during deliberations, follows Robert's Rules of Order or some other set of debate rules. The oldest social control model is probably the family.

From the viewpoint of solving the sustainability problem, the most important social control model is the one global civilization is using to run itself. This is the model that's broken, because it is currently unable to achieve its goal of running civilization well. Thus the model is in the Model Crisis step of the Kuhn Cycle. The cycle was explained on page 51.

A possible way to repair this model so that it becomes self-managing and never drifts into crisis again is to introduce:

A redesigned political decision making process

The goal of this process is to improve the political decision making ability of governmental social control models, to the point where: (1) they are self-improving

so excessive future model drift is avoided, and (2) they can routinely proactively solve difficult problems like sustainability.

The strategy is to create a Race to the Top among politicians to see who can accumulate the best decision ratings over their career. The long process of legislation creation undergoes a strictly monitored lifecycle. The lifecycle steps are objective, proposal, enactment, and outcome. For simplicity we will ignore solution evolution, solution management, obsolescence, etc.

On the next page is The Political Decision Making Process. Each symbol is a step in the process. The three symbols with bolded borders are where the key politician or electorate work occurs. *If the decision points preceding these steps are of high quality and relevant data is available and also of high quality, then so is the work done in the bolded steps.*

Note the five reinforcing feedback loops. These powerful forces drive the process toward higher and higher quality of decision making. *These loops are weak or nonexistent in the present process.* The feedback loops improve the quality of each step. The earlier the step the more quality matters. (A more detailed system dynamics oriented diagram would also have balancing feedback loops.)

Here's how the process handles the lifecycle steps of a bill:

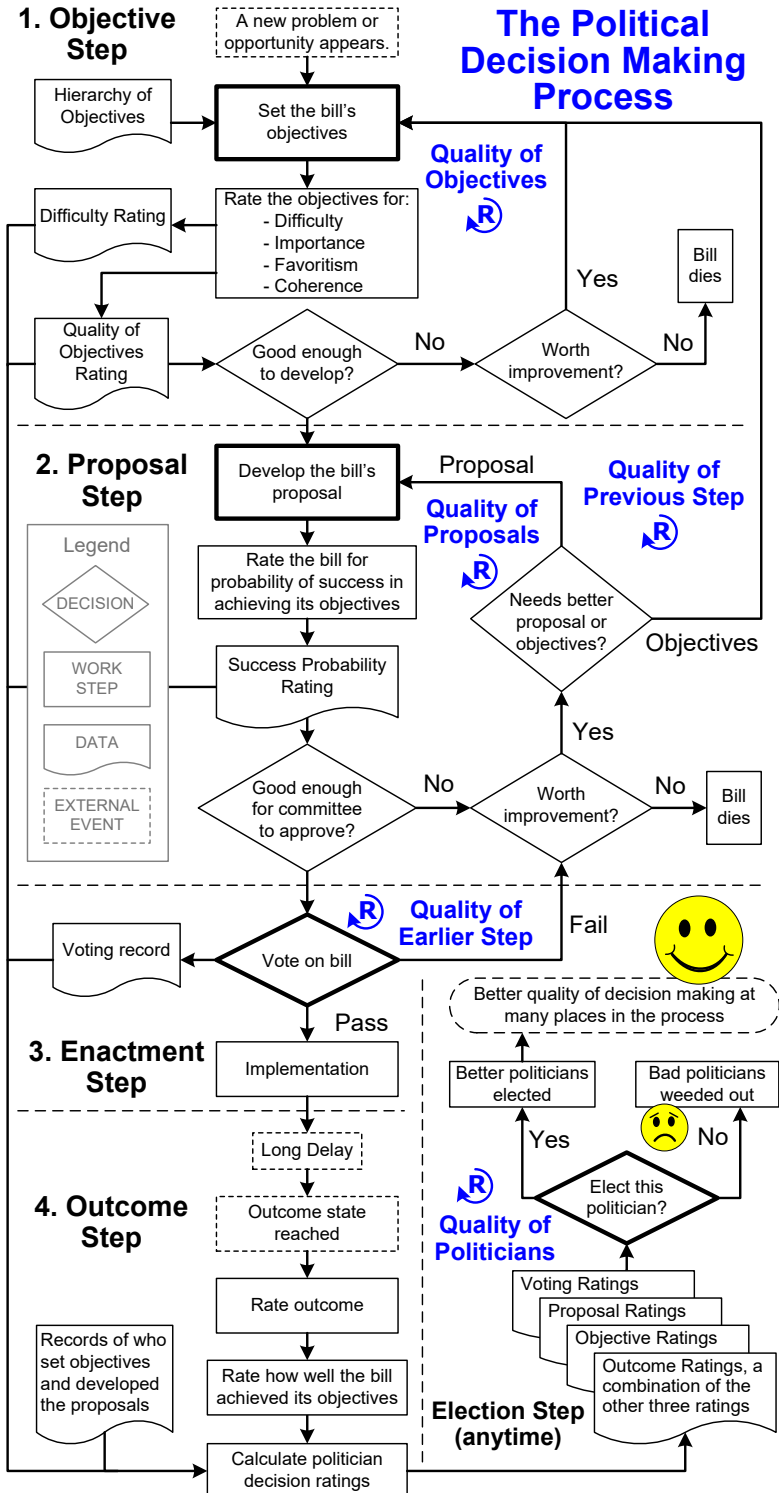
1. The Objective Step

Decision Ratings uses a *hierarchy of objectives*. At the top sits a nation's standing goals. These are enshrined in its constitution or a similar document. At the bottom are all the bills currently in force. Between the top and bottom is an implied but unwritten set of layers of intermediate objectives. Those doing the ratings work with legislatures to develop a published system for keeping track of the hierarchy. Eventually certain bills will probably be created to authoritatively define portions of the hierarchy.

When a bill is first created its objectives are set. These are then rated for four things: difficulty, importance, favoritism, and coherence. The last is how well the objectives support the existing hierarchy of objectives. The last three are then weighted to create an overall rating of *quality of objectives*.

If any favoritism or irrelevancy exists, this will cause a low quality of objectives rating, because that would mean the bill's objectives clash with the hierarchy.

It will not be long before committees set a high quality bar, such as 90%, that the objective rating of all new bills must pass to be developed by committees into full proposals. Who created the objectives is recorded for later use.



2. The Proposal Step

After a bill is fully developed it becomes a proposal. It is then submitted to the raters who rate it on how likely it is to achieve its stated objectives, which is called its *success probability rating*. This is a type of **predictive rating**, as opposed to a rating based on how things turn out, which would be an **outcome rating**.

At first the raters must study the lifecycles of lots of past bills, calibrate their predictive process, and make educated guesses. With experience and specialization they will get better and better. The raters will themselves be rated by an independent body for how well their past ratings correlate with outcomes, which will allow a confidence level for a rater's ratings. Multiple rating organizations will specialize in different types of legislation and compete to see who can get the highest confidence levels, because that's who politicians are going to want to rate their bills. Proposals are also rated on favoritism.

Again, it will not be long before congressional bodies insist that a proposal must have at least an 80% or so probability of success and no more than a 5% or so favoritism rating before it may be brought to the floor for final debate and voting.¹³⁸ If a bill passes it moves to the next step.

Under these conditions we are going to see the instant disappearance of sneaky midnight earmarks, late amendments, and all the trickery that pops out of the sky when bills come out of committee. This is because if any change is made the proposal must be rated again. This takes days to weeks at a minimum, costs a considerable amount of money, and any favoritism or poor quality of decision making that has crept in will hurt the bill's ratings. If the probability of success falls too low or the favoritism rating rises too high then alternative bills will take its place or it will not be allowed on the floor.

The raters record who the authors are for each bill. The simplest way to do this is to see who is on the committee that created it. Better ways will evolve to reflect who did the real work and made or suggested the key decisions.

3. The Enactment Step

If a proposal passes, the raters record who voted for and against it.

4. The Outcome Step

Finally, years later, the raters measure the bottom line: how well a bill achieved its objectives. This is done for all enacted bills.

The results are then correlated with enactment votes to see who has the better record on voting for bills that better achieved their objectives. The correlation is then adjusted for the difficulty of the objectives. This gives the **voting rating** for each politician. The same thing is done for outcomes versus the records of who authored each proposal, plus adjustment for difficulty, which gives the **proposal rating** for each politician. Finally, the same thing is done for outcomes versus quality of objec-

tives, plus adjustment for difficulty, which gives the **objective rating** for each politician.

Objective ratings are the most important, because they represent the strategies and priorities behind a politician's work. Next in importance are the proposal ratings. They represent the quality of the bulk of that work. The public will know this and weight the three ratings accordingly, probably around 50% for objective ratings, 30% for proposal ratings, and 20% for voting ratings. The three ratings might then be combined into a single *outcome rating*. To allow for learning on the job and the errors of youth, recent data would be weighted more than old data for rating calculation.

If Politician Decision Ratings are implemented at the local, state, national, and ideally the international level, all politicians will have lifetime ratings. Voters will look long and hard at a candidate's ratings history as they make their choices. *They will probably consider ratings more than any other factor, because now they have an objective, reliable, understandable, comparable measurement of what they have always wanted to know: How well is a candidate probably going to do in the future to help achieve my society's objectives?* The result will be a Race to the Top among politicians to see who can accumulate the best decision ratings over their career.

New politicians

What about new politicians who have never held office before? What will voters use to make efficient, rational decisions about them?

The higher in a nation's hierarchy of political units the less this problem will occur. National politicians have almost always held office at a state or local level before. But what about lower levels, when a would-be politician has no record to rate yet?

New politicians compete against established politicians. They also compete in an established set of norms, a uniform sea of memes that have infected nearly everyone. Once Politician Decision Ratings has been running awhile, **The Race to the Top among Politicians** will be the dominant loop in politics. The established norm will be to compete on the truth about what's best for the people and the common good. In a memetic climate like this it would be political suicide to make false promises, paint false enemies, push the fear or anger hot button, or promote wrong priorities. (These are 4 out of 5 of the types of political deception. The 5th is secrecy, which is used once in office.) Thus new politicians will have strong incentives to follow the herd and make the most reliable promises possible, paint true enemies instead of false ones, appeal to positive emotions rather than negative ones, and promote the right priorities.

For example, once the right norms about litter are established, people no longer litter. Neighborhood, towns, cities, and entire countries exist, notably in Europe and Japan, where litter is so rare everything is spotless.

My wife and I once spent the afternoon with a lively couple from Germany, an actress and a philosophy professor. The lady smoked, much to our distaste. Since we were getting to know each other, she and her husband told stories about her many efforts to stop smoking. Some of the techniques we'd never heard of, so they were fascinating, some even ludicrous. We were outside in their back yard. All the while, as she puffed away about every 30 minutes, when she needed to ash her cigarette out came a tiny pocket ashtray, in silver, with a handle and a hinged top. Without even looking down and missing a word, she'd knock the ashes off into the ashtray and pop it back into her pocket. Why? Because she didn't want the ashes to fall to the ground and dirty up her yard, there or anywhere else.

That's how strongly the Don't Litter meme has established itself in some places.

How Decision Ratings Work Dynamically.

Once Decision Ratings are introduced most elections will become non-events. They will be as exciting as watching paint dry and as predictable as your favorite cornbread recipe. The results will usually be a foregone conclusion, except for first timers and very close ratings, due to the driving force of published ratings. Voters will choose the best candidates fairly rationally, which implies what they are doing today. And they will do it at low cost to society, because there will no longer be an advantage to spending huge amounts of money and effort on painting the grand illusion that politician A is better than B, because of a hundred and one fallacious reasons. That money and energy is better spent elsewhere in the system.

Decision ratings have a surprisingly simple dynamic structure, as shown on the next page. The main loop is similar to the one for Politician Ratings on page 239. For simplicity the balancing loops are omitted.

Let's walk the loop, starting at use of decision ratings to make decisions. This node is first activated when Politician Decision Ratings are first introduced in a government. The ratings would at first be very low. Use of the political decision making process would improve quality of decisions. As this went up it would lead to better predictive ratings in the short term. In the long term, after a *delay* it would lead to improved quality of actual outcomes. This would cause better outcome ratings.

The predictive and outcome ratings would be widely published. If a politician’s ratings were better than their opponent’s then that politician would tout them to their constituency. This would increase the relative advantage of a politician in the eyes of the public, because the public can now reliably tell whose work is more valuable. This would increase public support of the politician, which would in turn increase their election and reelection advantage. Politicians would know this has happened, giving them the incentive to promote the use of decision ratings to make decisions all the more. The loop then starts all over again.



Because politicians would now be competing to see who can get the best lifetime ratings, a Race to the Top would begin. *And it would never stop, because the process is self-improving.*

As the loops grow, politicians in other governments will notice the election and reelection advantage their fellow politicians are gaining, as well as the superior quality of decisions other cities, states, or countries are making. They will then spontaneously begin the use of decision ratings to make decisions in their own political systems. In this manner loop growth will cause Decision Ratings to spread across the human system faster than you can say “Follow the money,” which would now be obsolete, because the new slogan for investigative reporting will be “Follow the ratings.”

If this structure can be established then social problems too difficult to solve today will someday be solved, because the loops are self-improving. Once Politician Decision Ratings start, the most important decisions in the loops will be those that improve the decision making process itself. This is because the most important step in any non-trivial process is continuous process improvement. This is such a fundamental principle that anything intelligent that evolves (including life forms and social systems) can be seen as a self-improving, self-managing process. Every time the evolutionary algorithm produces another mutation that improves the entity’s competitive advantage, the process has improved.

Note how thinking in loops lies at the very heart of how to radically improve complex social systems. Until progressive activists become as good at this as they are at breathing, solving difficult social problems will remain as elusive as ever.

Subproblem D

Completing the World's Most Important Partnership

If rights to perform certain actions can be bought and sold, they will tend to be acquired by those for whom they are most valuable either for production or enjoyment. In this process, rights will be acquired, subdivided, and combined, so as to allow those actions to be carried out which brings about that outcome which has the greatest value in the market. ...

What this approach makes clear is that there is no difference, analytically, between rights such as those to determine how a piece of land should be used and those [rights], for example, which enable someone in a given location to emit smoke.

R. H. Coase, recipient of 1991 Nobel Prize in Economics

The Firm, the Market, and the Law

1988, page 12

As Coase argues, “there is no difference” between what this book calls private and common property rights. But if “rights to perform certain actions” do not exist, then the property those rights apply to cannot be managed in order to bring “about that outcome which has the greatest value in the market.”

Subproblem D is how to achieve environmental proper coupling

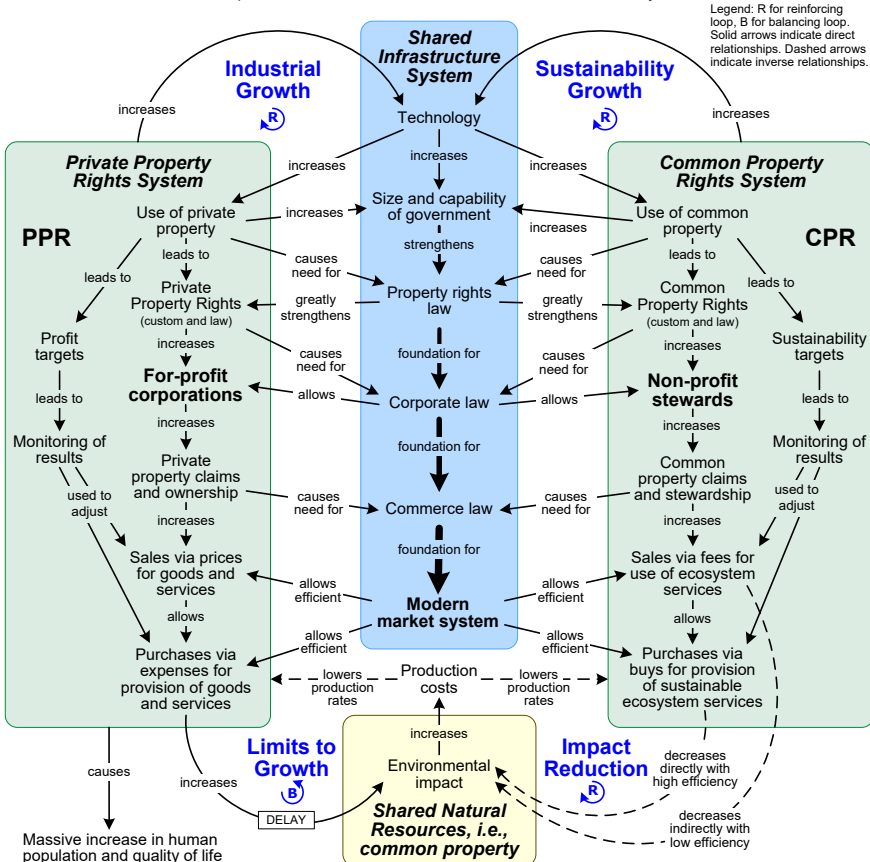
The Basic Concept of Common Property Rights

The environmental sustainability problem arises from society's inability to successfully manage the two types of property in the biosphere: private and common property. Currently the world's most important partnership is incomplete. Only private property rights exists. Until Common Property Rights also exist, the world will remain unable to successfully manage the world's private *and* common property.

As explained earlier on page 189, The World's Property Management System is incomplete. It should look about like the diagram below. The systems on the left and right should be working in partnership to jointly manage the world's property. But the system on the right is missing. The partnership is incomplete.

The World's Property Management System

With emphasis on the evolution and structure of the twin subsystems



The careful reader should review how The World's Property Management System works before proceeding.

Private property is the tangible and intangible things owned by people or organizations over which their owners have exclusive and absolute legal rights.¹³⁹ Private property rights are created by groups of people to bring order to their lives. Private property rights are so fundamental that without them civilization would collapse into a seething mass of banditry. Thus long ago it became obvious that private property rights were needed. (Public property is a type of private property since it fits the above definition.)

Modern property law stems from the pioneering theories of Thomas Hobbes and David Hume:¹⁴⁰ (Italics added to last two paragraphs)

For Hobbes, humans have a *natural* right of self-preservation only insofar as they have a natural inclination to preserve themselves. From this natural inclination and an assumption about the rationality of humans, Hobbes derived his justification for the necessity of government and the basic rights that these governments must protect.

... Hobbes' central argument [written in 1651] is that humans, as rational beings, recognize the threat of such a gloomy future. [one without rights] This rational expectation leads them to form a *social contract* in which they trust the responsibility for their defense to the hands of whomsoever they crown as their absolute sovereign.

... *A central flaw in this argument is that it assumes a benevolent sovereign* who protects the rights of his or her subjects....

The flaw is so large it's led to all sorts of problems. This book analyzes why the flaw exists and how it can be fixed. The key insight is the source of the flaw can be traced much deeper than "a benevolent sovereign." Benevolence is an emergent property of a system. What causes a political system to produce good or bad leaders? How can a bad system be changed to a good one? Hobbes and Hume never addressed these questions. They were more concerned with the basics of why rights are needed and why governments exist.

Property rights are hugely important. They are *the* fundamental right, as David Hume explained:¹⁴¹ (Italics added)

...possessions ...we have acquir'd by our industry and good fortunes ...are exposed to the violence of others and may be transfer'd without suffering any loss or alteration; while at the same time there is not sufficient quantity of them to supply every one's desires and necessities. As the improvement, therefore, of these goods is the chief advantage of society, so the instability of their possession, along with their scarcity, is the chief impediment.

...*the convention for the distinction of property and for the stability of possession is of all circumstances the most necessary to the establishment of human society.* ...after the agreement for the fixing and observing of this rule, there remains little ...to be done towards settling a perfect harmony and concord.

Property rights are thus *the* enabler of civilized existence. All complex social systems begin self-construction with agreement on property rights and then build on that. Property rights are essential for today's market driven system because as Ronald Coase explained in 1959: ¹⁴² (Italics added)

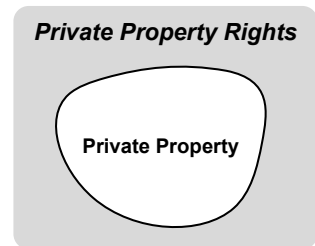
A private-enterprise system *cannot function properly unless property rights are created in resources*, and, when this is done, someone wishing to use a resource has to pay the owner to obtain it. Chaos disappears; and so does the government except that a legal system to define property rights and to arbitrate disputes is, of course, necessary.

What we've described so far is shown. It's a simple traditional system. There is only private property rights and private property. This was Phase One of the world's property management system.

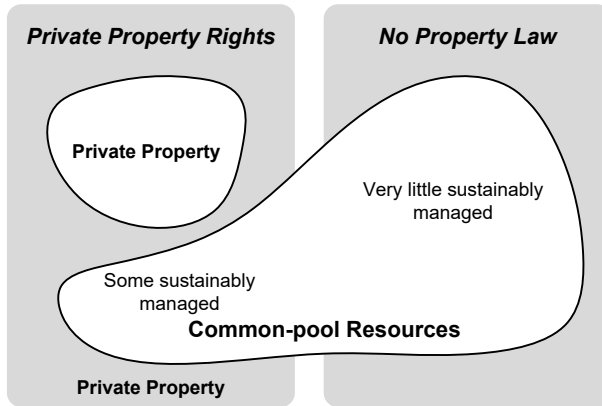
The traditional system served well for a long time. But starting around 1800, the Industrial Revolution caused steadily increasing amounts of environmental degradation. This became exponential in the mid 20th century, when population growth and industrial production exploded. Due to long delays, most degradation was not noticed. What was noticed was small enough to be tolerated or restored. It was seen as a small price to pay for the cornucopia of bountiful benefits showered upon civilization by the Industrial Revolution.

But with publication of *Silent Spring* in 1962 and *The Limits to Growth* in 1972, it suddenly became obvious to environmentalists that the price to pay was growing too high to be tolerated any longer. They realized that Phase One was an illusion. Civilization was really in Phase Two, as shown on the next page.

Phase One - Traditional Property Management System



Phase Two - Unsustainable Property Management System



Common-pool resources are natural resources shared by users for which it is difficult or costly to exclude potential users. Examples are the air we breathe and pollute, the water we drink, pollute, and deplete, and the schools of fish we harvest and deplete.

Common-pool resources are renewable or non-renewable. Depletion of non-renewable resources like oil and minerals is mostly adequately managed as private property. It's not their depletion that's an environmental problem. It's their misuse once extracted, such as fossil fuel burning and chemical pollution. Renewable resources are renewable because of continuous ecosystem cycles, which fall into three main kinds: living resources like forests and fish, pollution sinks like the atmosphere and bodies of water, and regeneration of essential nutrients like the oxygen in the air and the many trace nutrients in farm topsoil. Natural ecosystem cycles can support only so much human use before that use becomes unsustainable, as it has in many cases recently.

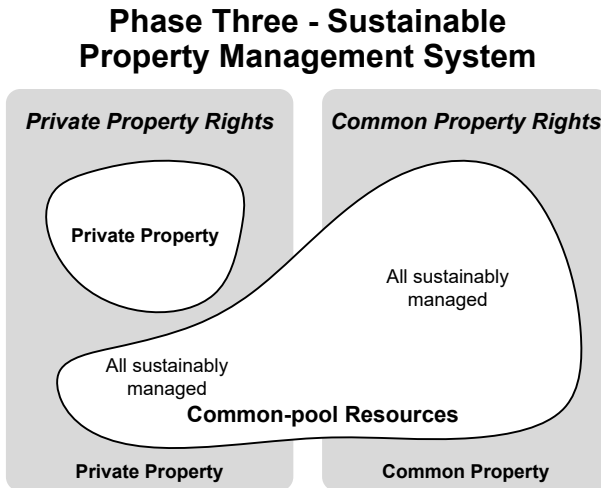
The Phase Two diagram shows how common-pool resources are currently handled with private property rights or no property law. For those under private property law, sometimes this leads to sustainable management and sometimes not. For example, some water sources are sustainable and some are not, as may be seen in the way the US Colorado River never reached the ocean for the entire year of 1996 and the way China's Yellow River dried up for 226 days in 1997. Even if a sustainable outcome is reached, it is often awkward, tenuous, and marginal, as are the many clean air or water acts industrialized nations have adopted.

The real problem is the right side of the Phase Two diagram. No standard workable property law exists for most common-pool resources. The result is very little is sustainably managed. The climate change problem exists because there is no standard property law covering impact on the atmosphere. The same can be said for many

other problems. This has led to the sustainability crisis. Growing food shortages, record floods, water shortages, and continual new records for the warmest year in modern times show that mankind cannot postpone solving the sustainability problem any longer. The time to pay the piper has come. So what should we do?

Back on page 312, Ronald Coase saw that “unless property rights are created in resources” the “system cannot function properly.” What property rights are missing in today’s approach to resource management? In the answer to that question lies our point of departure from conventional wisdom, which sees free market systems as needing only private property rights to function properly.

We can break free of that flawed paradigm by considering the diagram below. This shows what the world’s property management system needs to evolve to if it is to become sustainable.



In Phase Three the world has taken what has worked so well for so long as private property rights and has applied that system, with changes as needed, to those common-pool resources needing sustainable management. The result is Common Property Rights. In this book “common property” is short for the more accurate but more awkward term **commonly managed property**. In Common Property Rights the “Rights” are management rights (rather than ownership rights) for property held by all of us in common. Under the Phase Three system all property is managed privately for its owner’s benefit or in common for the common good of all. Common property thus refers to *managerial* characteristics, while terms like common-pool resources or ecosystem services refer to *physical* characteristics.

Common property is therefore defined to be any renewable natural resource unit needing management under Common Property Rights to be sustainable. Everything else is treated as private property. Many units of renewable natural resources, like forests, water sources, fish farms, and farm fields, may be managed sustainably

as private property under existing property law, as for example by collective management regimes, government programs, corporations, or farmers. This clean dichotomy of private versus common property allows the system shown in the Phase Three diagram and in much more detail on page 189 to function simply, generically, and most importantly, efficiently enough to work.

There are millions of potential common property units. The atmosphere, oceans, rivers, forests, coral reefs, wild species, and countless other ecosystem cycles are units of property potentially needing wise stewardship if they are to sustain their health and productivity indefinitely.

We now know that mankind is utterly dependent on private and common property. It follows that both must have a mature set of rights that are universally adopted and enforced. Otherwise, as Hobbes foretold with his chilling words in 1651 in *Leviathan*, “the life of man” will be “nasty, brutish, and short.”

Arrival of the environmental sustainability problem changed everything. Common Property Rights are now every bit as important as private property rights. In fact, they are *more* important. If *Homo sapiens* trashes the only ecological niche he has, where will he go? How will he survive? There are no other nearby biospheres he can pack up and move to. We must sustainably manage the only one we have or perish.

Once a civilization reaches its environmental limits, the need for Common Property Rights is everything. Without a global system of Common Property Rights our civilization will collapse, as have so many others before us. If we too collapse, a thousand years from now our age will be but one more footnote in the dusty pages of history.

“The Industrial Age,” that footnote might say, “became a colossal wreck.¹⁴³ Hubris, corruption, greed, and blind pursuit of profit above all else doomed it to fatal collapse. We were lucky a few pockets of *Homo sapiens* survived. From them emerged a new civilization that from its beginning learned from the past. It set its maximum worldwide population at 300 million, an easily sustainable number that optimized quality of life to previously unimaginable levels. Entire continents were set aside as wilderness preserves, with all traces of the ruins of the disastrous Industrial Age removed. The new civilization structured itself so that without even trying it stayed in a permanent Race to the Top, where it has remained for five sublime centuries. This, historians note, is a new record.”

It’s an enticing vision. How might we get there and skip the colossal wreck stage?

The key elements: stewards, claims, fees, and buys

The continued welfare of *Homo sapiens* depends on the wise management of private *and* common property. Analysis of the environmental sustainability problem shows that present approaches like conservation, prescriptive regulations, cap and trade, local agreements, and international treaties are not working well enough for two main reasons:

1. They are inefficient in terms of money wasted, time lost, and the extraordinary amount of political bargaining necessary to arrive at each new solution.
2. Each new problem is solved by a unique new complex solution that must be cobbled together as each new problem appears.

In short, present approaches are inefficient and non-generic. What the world needs instead is an efficient generic approach that works on all types of environmental problems.

That's what the Common Property Rights system offers. Basically the system applies existing property law to common property with small changes, so that all common property needing wise stewardship rapidly becomes well managed. Once enabling legislation is passed to create Common Property Rights, it uses stewards, claims, fees, and buys to work like this:

A **steward** is a non-profit corporation whose chartered goal is to manage the health of a common environmental property sustainably, such as a polluted river or a depleted fish stock. A steward may file a **claim** on any unclaimed common property needing wise stewardship to be sustainable. The steward doesn't own the property, it only manages it. Stewards are like water, gas, and electric utilities, or fire and police departments, in the sense they provide customers with essential services and are granted a monopoly to more efficiently do that. Claims are approved by local or national governments.

Once a claim is approved stewards charge **fees** for anyone directly or indirectly abusing the ecosystem service they are managing. Fees are charged at the most efficient places in the system. Fees implement the principle that the polluter pays, not the taxpayers. A fee is the price of one unit of ecosystem use, such as the right to pollute the air with one ton of carbon.

In the old way of thinking a fee is an eco-tax. In the new way of thinking fees are payments to stewards for use of an ecosystem service. Psychologically and legally, fees are a price rather than a tax. All transactions having an impact on the environment now have that impact included in the price of the transaction. To an economist, all environmental impact has been "internalized" into the price of everything.

Except for a small amount for management overhead, fees are spent on **buys**. Fees flow in from common property users as the price of ecosystem use. Buys flow out as stewards buy any activity that will help to move the health of a common property toward its safe zone. Examples of buys are measurement of ecosystem health and use rates, R&D for new or improved best practices, cost/share for implementation, education, and awareness campaigns.

Buys are the expense of providing a sustainable ecosystem service. Thus the use of *fees and buys* allows stewardship corporations to manage common property the same way existing corporations use *prices and expenses* to manage private property.

Because Common Property Rights so closely parallels the private property rights system, it can work as generically and efficiently as that system has since the beginning of recorded history. Countless customs, laws, concepts, and aspects of the wheels of commerce have appeared to support private property rights. Nearly all can be reused to support Common Property Rights. This makes adding Common Property Rights to the human system a simple and relatively easy next step.

Once added, the human system will now have two mighty draft horses pulling it forward. These are the twin engines of private and Common Property Rights. The two horses, pulling in full partnership, are commanded by the same driver: pursuit of the common good, which is what all rights are created for. They wear the same collars: prices and expenses for one horse, fees and buys for the other. They share the same harness system: all private property land was originally claimed long ago, as all common property needs to be. Before, only the private property horse was pulling. This is causing the wagon to veer off the road. But now, with both horses pulling the load, the wagon of civilization will roll straight ahead over the roads and pages of history as *Homo sapiens*, knowing man, at long last begins to live up to the full promise of his name. ¹⁴⁴



Solving the Tragedy of the Commons

There are many ways to begin solution of the environmental sustainability problem. One is to see it as a simple predictable behavior multiplied many times over. This was the line of attack chosen by Garrett Hardin in his iconic 1968 essay, *The Tragedy of the Commons*.¹⁴⁵ His famous thesis that “Freedom in a commons brings ruin to all” appears midway in this historic passage: (*Italics added*)

The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. [“Social stability” means that “wars, poaching, and disease” have diminished to where herdsmen can switch from focusing on survival to focusing on individual gain, as human population starts to grow.] At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, “What is the utility to me of adding one more animal to my herd?”

...the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another, and another. . . . But this is the conclusion reached by each and every rational herdsman *sharing a commons*. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. *Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.*

... In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in—sewage, or chemical, radioactive, and heat wastes into water, noxious and dangerous fumes into the air, and distracting and unpleasant advertising signs into the line of sight. The calculations of utility are much the same as before. The rational man finds that his share of the cost of the wastes he discharges into the commons is less than

the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of “fouling our own nest,” so long as we behave only as independent, rational, free-enterprisers.

The tragedy of the commons as a food basket is averted by private property, or something formally like it. But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cess-pool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated. We have not progressed as far with the solution of this problem as we have with the first. *Indeed, our particular concept of private property, which deters us from exhausting the positive resources of the earth, favors pollution.* The owner of a factory on the bank of a stream—whose property extends to the middle of the stream, often has difficulty seeing why it is not his natural right to muddy the waters flowing past his door. The law, always behind the times, requires elaborate stitching and fitting to adapt it to this newly perceived aspect of the commons.

Hardin put his finger on a precocious insight: “our particular concept of private property... favors pollution.” This suggests something in that concept must change.

This insight has since grown. 36 years later in 2004 Herman Daly and Joshua Farley, writing for an emerging consensus among economists in *Ecological Economics: Principles and Practices*, said: (p369 to 370. Italics added.)

Before we begin to examine specific policies for achieving a more sustainable, just, and efficient world, we must discuss one of the core features of any policy: *property rights*. Concern over scale is concern over sustainability, and what is sustainability but the right to resources for future generations? If we believe there is a need for improved distribution, we are basically questioning the existing endowments of property rights. Finally, *markets cannot efficiently allocate nonexcludable resources, and excludability is nothing more than a property right*. Policy is [thus] largely concerned with creating, redefining, and redistributing property rights.

Scale, as used above, roughly means the optimum size of the human system. If it's too large it's unsustainable. **Excludability** means the proper laws exist for a property owner/manager to exclude others from use of a property unless they have use rights via purchase or permission. “Redistributing property rights” means that either no one or an irresponsible party currently owns common property rights. These rights must be redistributed in a manner that allows an equitable and efficient approach to the sustainable management of common property. Daly and Farley continue:

In the absence of property rights we have privilege, or presumptive rights. If one person has privilege, he is entitled to behave as he pleases, and others have no rights. If a factory owner has privilege with respect to the atmosphere, he can pollute the air as much as he pleases. If others suffer from this pollution, then they must seek to change the prevailing lack of property rights.

[In today's world of environmental overshoot] the privilege to extract and pollute now imposes costs on others. This creates pressure to develop environmental policies that assign or modify property rights. *Those who have privilege to extract or pollute are likely to defend the status quo, claiming that privilege as a right, when in reality it is an absence of defined rights.*

As we pointed out..., many economists have argued that it does not matter to whom rights are assigned; as long as rights are assigned, the market can efficiently allocate resources. We maintain, in contrast, that while the distribution of rights may not matter in terms of Pareto efficiency, it matters profoundly for equity. *We take the position that property rights [of nonexcludable resources] belong to the people, as represented by the state, until otherwise assigned, and their distribution should be decided by a democratic process that respects future generations.*

This passage contains a wealth of insights, the largest being that “markets cannot efficiently allocate nonexcludable [shared] resources, and excludability is nothing more than a property right.” By “markets” is meant the billions of financial transactions occurring everyday. These transactions work well for *private* property. But as Hardin, Daly, and Farley point out, those transactions fail to work well for *common* property because something is missing in the world's concept of property rights. So what's the missing abstraction?

Given that “excludability is nothing more than a property right” and that “freedom in a commons brings ruin” the missing abstraction just about jumps off the page. It's time to end that ruin with Common Property Rights.

Private property rights are the right to own and manage private property. But common properties like the “air and waters surrounding us” are too shared to be *owned* by anyone but “the people.” Common property can, however, be *managed* by the people for the long term benefit of the common good.

As Daly and Farley pointed out, rights to the management of common property must be redistributed in a manner that allows an equitable/democratic and efficient approach to the sustainable management of common property. Common Property Rights handles the equitable redistribution requirement with claims and the efficiency requirement with fees, buys, and targets. Once laws establishing Common Property Rights are passed, the system transforms to wise management of the health of

property held in common by society, such as the percent of carbon dioxide in the atmosphere, the amount of pollution in a river, the rate of sustainable harvest of a fish stock, or the grazing capacity of “a pasture open to all.”

At that point *The Tragedy of the Commons*, a problem that has plagued mankind ever since the hunter-gatherer age ended, is solved.

But what should work in theory has too often failed in practice. How can we avoid that fate? By determining what our central solution strategy should be, at the highest possible level of abstraction. If we get our top strategy right it will work because the correct tactics will flow logically and easily from the strategy. Conversely, the best tactics cannot save bad strategy.

The next chapter implements this principle by making the case that our central strategy must revolve around two simple but powerful requirements: genericness and efficiency. Get them right and theory will become reality.

Why the Solution Must Be Generic and Efficient

The key to making Common Property Rights work is to make them so generic and efficient that they work as well as private property rights. If we fail to do this, then the tragedy of the commons will remain unsolved. We will continue to live in a world where “Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.” Let’s examine the generic part first.

The solution must be generic

In 2000 the Scientific Committee on Problems of the Environment (The SCOPE Study) performed a study to find the world’s top environmental problems. The results were summarized in a list of “major emerging issues” in the United Nations Environmental Program’s *Global Environmental Outlook 2000* on page 339.¹⁴⁶ Some issues on the list are social, such as “poor governance.” Others are contributors (proximate causes) to other issues, such as “population growth and movement.” Extraneous issues like these were removed so as to leave only bona fide environmental problems. The top eleven are listed below:

1. Climate change	51%
2. Freshwater scarcity	29%
3. Deforestation and desertification	28%
4. Freshwater pollution	28%
5. Loss of biodiversity	23%
6. Air pollution	20%
7. Soil deterioration	18%
8. Ecosystem functioning	17%
9. Chemical pollution	16%
10. Stratospheric ozone depletion	15%
11. Natural resource depletion	11%

The percents are the percentage of SCOPE study respondents who mentioned the issue. More than 200 environmental experts in over 50 countries contributed to the study. 51% of all respondents mentioned climate change as a major emerging issue. Note the problems are ranked by urgency, not difficulty.

This list defines the *complete* global environmental sustainability problem in terms of symptoms. However, it contains discouraging news: Only the tenth problem

on the list, the stratospheric ozone depletion problem, is on a fairly certain path to solution. The other problems are all growing worse with no solution in sight.

Next consider that each of the other problems consists of multitudes of distinct unsolved subproblems, such as the 92 watersheds ¹⁴⁷ in the Chesapeake Bay or the 818 large watersheds in the Mississippi/Atchafalaya River Basin ¹⁴⁸ that behave so uniquely each must be monitored separately and will require its own maximum pollution load target. Then there are the 50,000 to 100,000 ¹⁴⁹ toxic chemicals in commercial production. Finally, consider the 2.8 million or more species ¹⁵⁰ the International Union for Conservation of Nature considers endangered and threatened with extinction. The total number of unsolved environmental sustainability subproblems easily runs into the millions.

Yet most attempts to solve these subproblems involve a custom solution. Custom solutions are rarely well thought out. They tend to be intuitively developed, common sense approaches that are a grand compromise, with a bias toward those parties with the most influence on the decision making process. This approach has failed so badly that no country has come anywhere close to solving *any* of the ten unsolved problems on the list. Therefore what the world doesn't need is one more clever, unique, painstakingly developed solution that applies to one small piece of the sustainability problem.

Instead, the world needs a generic solution. It needs a solution that goes so deep into the system that it's a game changer. If it solves one problem it can solve them all.

Many tough, sprawling problems have been solved in the past. Democracy was a generic solution to the worst problem large groups of people ever faced: endless suffering under a long chaotic series of autocratic kings, warlords, theocracies, dictators, and so on. Private property rights was a generic solution to the problem of who, in the eyes of society, controls physical items like land, food, and cattle. Money was a generic solution to how people can best efficiently buy and sell private property. A universal generic numbering system solved the problem of how societies could deal efficiently with the concept of quantities of things. The notion of generic standards within political units solved the problem of the plethora of different languages, measurement systems, types of money, legal notions, and so forth that prevented political units from achieving unity and efficiency.

Problems like these have one overriding characteristic in common: they are too endlessly complex to solve without a generic solution. Civilization makes its biggest leaps when it solves its biggest problems with generic solutions.

Most importantly, the solution must be efficient

However, what good is a generic solution if it doesn't work well? Common Property Rights must work as efficiently as private property rights. This is where the real potential for game changing progress lies.

We need to pause, put on our systems thinking hats, and look at the sustainability problem with a *whole new way of thinking*, one that goes deeper than society has dared to go before.

We can no longer afford conventional wisdom based solutions because they don't work, as over 40 years of solution failure on the sustainability problem has shown. Nor can we afford to chip away at the problem with tiny incremental improvements because we have run out of time. We need to strike at the very root of the problem with radical but prudent system redesign, so the tree of civilization begins to grow in a new way. If so, where should we start?

Fortunately we have a clue in the form of a recent trend. Particularly since the beginning of the industrial revolution, the human system has become utterly dependent on its economic subsystem. Millions of kinds of financial transactions now rule our lives. Many of these (notably the widespread use of multitudes of technologies that did not exist 200 years ago) are the transactions that are destroying the environment, either directly or indirectly. Financial and non-financial transactions are what the science of economics is all about. This suggests we should turn to that field for insights.

The solution is based on a single strategic insight, one well known to environmental and ecological economists:

Deep down, when all else is stripped away, the environmental sustainability problem is a classic case of market failure.

It's so classic that Nicholas Stern, author of the 2006 *Stern Review on the Economics of Climate Change*, wrote that "We have a market failure, indeed the biggest market failure the world has ever seen."¹⁵¹

We need to discuss what market failure is, what causes it, and how to fix it. There are only five economic terms to understand: efficiency, market failure, externality, externalized cost, and internalized cost. Using these terms gives us deep insights into how large systems of consumers and producers work. More importantly, these concepts give us *useful* insights into the sustainability problem.

To economists, an **efficient market** is one that achieves the greatest possible net benefits by the best allocation of scarce resources. Thus an inefficient market allocates scarce resources poorly. For example, if food aid is distributed in a random or corrupt manner, that market is inefficient. If production quotas are assigned to 10,000 factories, there's no way all the quotas could be calculated to optimize productivity and minimize cost. If auto pollution contributes to climate change and

there is nothing in the system automatically causing reduction of auto pollution to an acceptable level, then that market is inefficient.

To economists, markets fail when they fail to allocate resources efficiently. While technically correct, how can you use this definition to tell when market failure has occurred? How inefficient does allocation have to be to qualify as market failure? Allocation of scarce resources among social agents can never be perfect because people are not perfect calculators. They make mistakes. They satisfice, which leads to imperfect decisions. So aren't markets always in a state of failure? We thus need a more practical definition.

A **market failure** occurs when a market allocates scarce resources so inefficiently that obvious unnecessary suffering has occurred. The concepts of efficiency and market failure combine to give us a powerful insight, because it follows that if a market is efficient then market failure will not occur. Thus the only solution to a market inefficiency problem is to make that market efficient.

This explains why the solution to the sustainability problem must be efficient. If it's not efficient the system will find it too expensive to naturally seek an equilibrium that solves the problem. For example, command-and-control economies are so inherently inefficient they cannot successfully compete with free market economies over the long term. Corrupt governments are too inefficient to compete successfully with those that are not corrupt. Control of political decisions by special interests is inefficient, because it leads to inefficient allocation. Too much is unfairly allocated to special interests. Thus any comprehensive high efficiency solution to the sustainability problem must be free of command-and-control, corruption, control by special interests, and any other factors that would undermine efficiency.

Economic theory does more than classify problems, however. It provides a guide to the characteristics of efficient solutions.

In the environmental sustainability problem, market failure has occurred due to what economists call externalities. An **externality** occurs when a transaction has an impact on a party not directly involved in the transaction. For example, when a person buys a bag of fertilizer and spreads it on a field or lawn, some of the nutrients (nitrogen and phosphorous) in the fertilizer can make their way to creeks, rivers, bays, and oceans. The transaction has impact on the environment. The cost of that impact is currently not reflected in the price of fertilizer. This is known as an **externalized cost**.

Now suppose the true cost of environmental impact was added to the price of all transactions that impact the environment. This extra cost would cause producers and consumers to seek ways to reduce it, which would automatically cause the system to reduce impact. The higher the extra cost, the lower the impact. At some point the extra cost would be high enough to force the system to a new equilibrium that would be sustainable. In the jargon of economists, the externalized cost problem would vanish because the market would now be efficient. This is because the previously

externalized costs are now **internalized costs**. The true cost of environmental impact is now built into the price of everything.

These additional concepts allow us to explain why Common Property Rights is efficient: it solves the market failure problem by internalizing externalized costs. It replaces individual quotas, command-and-control regulations, and a gigantic hodge-podge of well intentioned but inefficient environmental programs with a single new device: legally defined Common Property Rights.

Now then, exactly how does Common Property Rights internalize externalized costs? This will take awhile to explain. The next chapter covers how the components of Common Property Rights work to *individually* internalize costs. The chapter after that explains how the components *work together*, which is where the real power of the solution lies.

Chapter 18

How the Seven Components Work Individually

Common Property Rights uses seven components, as summarized in the table below. The left two columns show how Common Property Rights is patterned after the world's existing system of private property rights. That system works extraordinarily well, which implies how well we can expect Common Property Rights to work.

The Seven Components of Common Property Rights		
Private Property	Common Property	How the Component Works
Enabling Legislation	Enabling Legislation	This creates the legal rights necessary for common property to be automatically managed by the system. This establishes the foundation needed for the remaining components to work. The enabling legislation can be simple because it builds on so much existing private property law.
Corporations	Stewards	Non-profit stewardship corporations are formed. Each has the chartered goal of performing a specific service for the good of humanity. Stewards are public servants. Unlike typical for-profit corporations, stewards have no conflict of interest.
Claims	Claims	Stewards file claims on any unclaimed common properties needing wise stewardship. Claims allow the solution to spread naturally and efficiently, and to eventually solve the entire problem. This is identical to how all land was claimed long ago.
Prices	Fees	Stewards charge fees for use of their common property. This is a fee per unit of ecosystem service use, such as one dollar per pound of a pollutant or ten cents per codfish caught. Fees are charged at the most efficient places in the system.
Expenses	Buys	Fees are spent on buys, as the steward "buys" the health of its common property back. Buys are the expenses of providing a sustainable ecosystem service, such as education, R&D, implementation cost assistance, and cost of monitoring.
Monitor Results	Monitor Results	Stewards monitor the health of their common property, in order to adjust fees up or down and to adjust how buys are spent.
Goals	Targets	Governments set targets for stewards to achieve in order to keep their claims. Targets define the desired health of common property. On most properties targets start low so that fees do not overly shock the system, and then gradually rise over time to a sustainable level. However as targets rise most fees will fall, due to implementation of more sustainable practices.

The goal of Common Property Rights is to solve the complete sustainability problem as fast as possible. This can only be done with inherent high efficiency. Here's how the seven components of Common Property Rights each achieves efficiency. The foundational component is:

Component 1. Enabling legislation for Common Property Rights

This is presented in the *Sample Legislation* chapter on page 344.

Component efficiency

Enforcement of Common Property Rights is legally handled just like private property rights. If a managed common property is used without payment of required fees, then the user is guilty of theft or a similar offense. They may then be prosecuted under existing law. Thus the only change to the legal system is creation of Common Property Rights.

Component 2. Stewards (common property stewardship corporations)

Webster's dictionary offers this definition: "**Stewardship** is the conducting, supervising, or managing of something; especially: the careful and responsible management of something entrusted to one's care."¹⁵²

Our fragile world needs common property *stewards* to step forth. The word arose from Old English *steward* or *stigward*, which literally meant a "sty ward" or one whose "first duty having been probably to attend to the domestic animals."¹⁵³ In the late 14th century Chaucer used the word in the Prologue of *The Canterbury Tales*:

Of masters had he more than thries ten,
That were of law expert and curious:
Of which there was a dozen in that house,
Worthy to be stewards of rent and land
Of any lord that is in Engleland,
To make him live by his proper good...

Building on this sentiment, common property stewardship corporations are designed to be worthy "stewards of rent and land." The "rent" is the fees that common property stewards are authorized to collect. The "land" is the common property to be wisely managed "to make him live by his proper good." Today "him" is not "any lord that is in Engleland" but is the people.

The philosophy of responsible stewardship has come to non-profit corporate management. Peter Brinckerhoff, writing in *Nonprofit Stewardship: A Better Way to*

Lead Your Mission-Based Organization, 2004, says: (Pages xiv-xv. Italics are in the original.)

This book is different. It starts from the premise that not-for-profit leaders are *stewards* of the resources that a community entrusts to their organizations. Thus the actions, words, and decisions that not-for-profit leaders do, speak, and make need to be in the context of *stewardship*.

Throughout these pages you will find my passionately held belief that leading is not enough. Good, but not enough. Important, but not adequate to the challenges you face. This book shows you why *stewardship* is a better model for you, your organization, and most importantly the people you serve.

... Being a steward of your organization forces you to keep your organization's mission foremost—and helps you make decisions that are best for the people your organization serves. In other words, *stewardship helps you do more good for more people*.

This philosophy has also entered environmentalism. The US EPA's website states that: ¹⁵⁴

Environmental stewardship is the responsibility for environmental quality shared by all those whose actions affect the environment.

In 2005, EPA laid out a vision for environmental stewardship recognizing it as a means to a more sustainable future. While all of EPA's work supports environmental stewardship in some way, users can search here for some of the programs and resources that may be of most interest.

Another example may be found in *Agri-environmental Stewardship Program Architecture: Towards Convergence in the USA and Europe*, published by Land and Water Australia in 2009, page 1: ¹⁵⁵ (Italics added)

Baseline and standards in environmental stewardship – Landowners' environmental *stewardship* (similar to the idea of a farmer's 'duty of care') can be defined in terms of the agricultural and environmental conditions that the community expects farmers to achieve without government support. These include environmental standards (soil and water quality, agricultural practice), and resource use restrictions needed to meet international obligations (such as World Heritage and Ramsar), protect other sites of special environmental significance and allow allocations to the environment. Such standards and restrictions are *a de facto modification of landowners' property rights*.

Note the last sentence. There's a growing realization that modification of property rights is required to implement environmental stewardship. Common property stewardship corporations are part of a uniform mechanism for doing that.

A **steward** is a stewardship corporation. Environmental stewards are much like public utilities and government departments. The pattern is the state grants a monopoly to a utility or department so they may efficiently manage something for the state. Water, gas, and electric utilities are created to provide people with the right to a common good, if they will pay a fee for it. Fire, police, justice, and defense departments are created to give people the right to freedom from a fire causing unnecessary destruction, the right to freedom from crime, the right to fair and speedy implementation of legal rights, and the right to freedom from fear of invasion. Stewards implement the right to indefinite enjoyment of a common good, such as clean air, a clean river, a thriving school of fish, or a world free from catastrophic climate change.

“A public utility (usually just **utility**) is an organization that maintains the infrastructure for a public service (often also providing a service using that infrastructure). Public utilities are subject to forms of public control and regulation ranging from local community-based groups to state-wide government monopolies.”¹⁵⁶

The simplest way to think of a common property stewardship corporation is it's a utility created to manage an ecosystem cycle. The many ecosystem cycles in the biosphere work fine if not overused. A small, sustainable amount of an ecosystem cycle can be used by the human system indefinitely. But if too many trees are harvested too frequently, deforestation occurs. If too many blue crabs are harvested or pollution is allowed to kill them, their population plummets. Ecosystem cycles can handle small amounts of pollution or harvesting sustainably. But they cannot handle large amounts. A common property steward manages a particular aspect of the carrying capacity of an ecosystem cycle.

Like utilities, stewards build and maintain the infrastructure necessary to provide a common good. Like utilities, stewards offer a service for a fee. The service is use of an ecosystem cycle, such as the way a watershed will recycle a unit of pollution into harmless other forms if not overloaded. Like utilities, stewards spend income from fees on optimizing the value of the service they provide. Like utilities, stewards will be closely monitored to insure they do not abuse their monopolies and that they meet the goal stated in their charters: to wisely manage a common property for the long term benefit of the common good with reasonable efficiency.

Because common property is involved, stewards must be a non-profit or government-owned corporation, since the stockholder profit motive creates an insurmountably large conflict of interest. Stewards have a monopoly. If they were for-profit they would tend to set higher fees in order to maximize profit and spend buys in a manner that maximized their own profit instead of minimizing future fees. By being non-profit and chartered with a public interest goal, stewards work for the long

term common good of the people, rather than the short term special interests of profit maximizing stockholders.

Non-profit really means non-profit or a not-for-profit approach that excludes the too often corrosive influence of outside profit-maximizing shareholders and concentrated ownership. This allows worker cooperatives in addition to standard non-profits. The important thing is to fully align the goals of stewards with that of *Homo sapiens*.

Component efficiency

Steward component efficiency is achieved mainly by elimination of conflict of interest. Stewardship corporations are non-profit, so they will not be driven by same goals as for-profit corporations. Stewards will thus be far more likely to pursue long term strategies. They will also be biased toward serving the public rather than themselves. Corruption will be much less likely because of the elimination of conflict of interest.

Component efficiency is also achieved by cleanly subdividing the sustainability problem up into millions of small common properties, each of which is independently managed by a steward rather than centrally managed by governments. The stewards are small enough so that global or national needs are balanced by local needs. They are big enough to achieve economies of scale, without becoming so big as to slip into the inefficiencies of bureaucracy. This approach roughly parallels the way private property rights have worked.

Component 3. Claims

Ownership of common property management rights is created by a steward filing a **claim** on unclaimed property and having the claim accepted. How this might be done is described in the *Sample Legislation* chapter. It works like claims on unclaimed land worked long ago, for families, tribes, nations, and homesteaders. Indeed, the custom of claims is still invoked even now when lost private property is found, with “finders, keepers” being the right of the finder unless the loser is found. (We deplore stealing land from its present occupiers by “claiming” it, as has happened many times when indigenous peoples were invaded by more “advanced” cultures. This distressing turn of history may be seen as a case of private property law breakdown.)

Component efficiency

This is achieved by the fact that any common property needing management will automatically be claimed. Governments don’t have to identify all of the millions of common properties needing management. The market can do that. This makes the solution self-managing.

The *Sample Legislation* chapter discusses how, if no satisfactory claims are made on a common property needing wise stewardship, the government involved will deal with that issue. However we expect nearly all common properties needing to be sustainably managed to rapidly be claimed as the Common Property Rights spreads from existing implementations. The number of dedicated environmental activists and NGOs is a rough indication of how many people prefer to make a living helping the environment. They will pour into the void created when enabling legislation for Common Property Rights passes. Also attracted will be altruists in general. Just as activists are good at discovering problems society needs to address, stewards will discover the many common properties needing sound management.

Component 4. Fees

Stewards charge fees for use of their common properties, just as people and corporations charge prices for goods and services. For environmental problems, a **fee** is the price of a unit of an ecosystem service. Let's define that term: ¹⁵⁷

Humankind benefits from a multitude of resources and processes that are supplied by natural ecosystems. Collectively, these benefits are known as **ecosystem services** and include products like clean drinking water and processes such as the decomposition of wastes.

The continuous production of products like water and processes like waste recycling depend on natural ecosystem cycles and produce **renewable resources**. An ecosystem cycle becomes unsustainable if withdrawal exceeds the production ability of the cycle. Some ecosystem cycles are so long, such as those that produce fossil fuels, mined minerals, and top soil, that their products are considered **non-renewable resources**. The world's sustainability problems arise from a mixture of renewable and non-renewable resource mismanagement.

Stewards change that. *The goal of stewards is to manage critical ecosystem cycles so their output is sustainable.* For renewable resources this requires setting a target for the health of the resource, such as the maximum amount of atmospheric CO₂ or the maximum pollution levels allowed in a river. For non-renewable resources whose depletion is problematic, the goal is to manage the depletion rate in a manner prescribed by government, working with the owners of the non-renewable resources. Most valuable non-renewable resources are presently treated as private property. Some is government owned.

Examples of fee units are a ton of carbon emitted into the air, a pound of nitrogen emitted into a water system, and the harvest of 100 kilos of a certain fish stock. Each of these acts utilizes an ecosystem cycle, so each needs a price if stewards are to manage those cycles sustainably.

Fees are charged at the most efficient places in the system. This requires measurement of the common property use rate. Since this may be non-trivial and expen-

sive, fees are not always charged at the point of actual pollution emission or resource harvest or depletion.

For example, fees for air pollution and greenhouse gas emission from combustion of gasoline could be charged at the refinery, upon delivery to gas stations, or at the pump with the sale of each liter to a motorist. It's cheaper to charge fees at the refinery but more efficient to charge fees at the pump, since a better price signal can be sent. At the pump a variable fee per liter could be calculated for each vehicle. Gas pumps could be modified so that before auto or truck drivers fill up, they would hookup a cable from the pump to the vehicle's onboard computer. The pump would read the vehicle's average emission levels per gallon for calculating the fee. The lower the emissions the lower the fee per gallon, since the fee is for units of pollution per gallon of gas burned. Note that while greenhouse gas emissions are constant per gallon of gas, air pollution varies considerably per engine type and condition.

Should the fee also be lower if miles per gallon is higher? No. That would distort the purpose of fees, which is to do one thing and do it well: serve as a pricing signal for the value of ecosystem services used. Whether a car or truck gets good mileage and low emissions is up to the owner. A noticeable fee will encourage owners to purchase vehicles with better mileage and lower emissions. Once a complete set of emission fees starts being charged, there is no longer a need for emission inspections, legislation on corporate average fuel economy (CAFE), or other types of emission regulations. All can be scrapped because *fees eliminate the need for regulations*.

It's inefficient to charge very small common property users fees due to the cost of measuring the use rate of each user. Thus stewards would not charge the young fellow with the lemonade stand a pollution fee for dumping out his leftover 3 gallons of lemonade at the end of a long hot day, since some of it will make its way to the river. The lemonade stand cops will be nowhere to be found. But yet it's the millions of small users who, when added up, equal one very big user.

So what do we do? Conventional wisdom claims we should monitor each small user, as this example shows: (*Italics added*)¹⁵⁸

Monitoring emissions from every household furnace [for example] would cost an astronomical amount—even before taking into account the administrative costs of levying an emissions tax, or the transactions costs involved in trying to institute a household-level market for pollution allowances. In such cases, *technology standards* (like those imposed on new oil and gas furnaces) or *input standards* (such as restrictions on how much sulfur and other contaminants can be present in fuel oil) make a great deal of sense.

“Technology standards” and “input standards” are forms of regulation. Reliance on regulations is inefficient because regulation is a form of command-and-control. It is far more efficient to charge fees at the most efficient places in the system. In the above example fees could be charged to furnace manufacturers, based on average

pollution per furnace. This would give furnace manufacturers a strong incentive to improve furnace design. If that alone didn't lower fees enough, then furnace manufacturers would have the incentive to pay fuel oil refiners to provide less polluting fuel. The manufactures would essentially be treating fuel refiners as suppliers. Payment to them is one more expense.

An alternative to furnace manufacturers paying refiners to provide less polluting fuel would be to design furnaces that required less polluting fuel. Households would then bear the extra cost of buying less polluting fuel. There are further alternatives once you began looking for them.

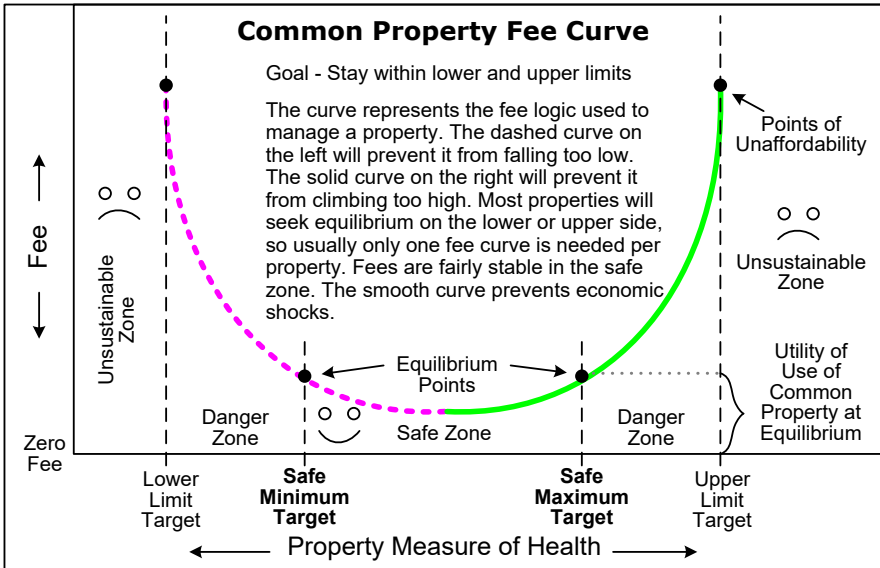
Fees are a pricing mechanism that causes supply and demand for use of a common property to come to the desired sustainable equilibrium. Setting fee prices is critical. It needs to be done efficiently or the entire Common Property Rights System fails. For large groups of users where individual consultation is not possible, there are two main ways to set fees: auctions and price schedules.

Fee auctions are best held as frequently as possible rather than annually, to avoid the effects of uncertainty. By use of the internet continuous fee auctions are economical, just as they have long been in stock and commodities markets. Fee auctions behave the same as emission permit auctions. The advantage of auctions is the market automatically calculates the price as efficiently and fairly as is realistically possible. For small markets, such as a watershed with only two users, the less expensive approach of an annual auction could be taken.

Once fee prices stabilize for a common property, auctions are no longer necessary. Most consumer products have fixed prices. If you don't like a price, you buy less or none. If you like the price you buy all you need. Once fees stabilize a fixed price schedule approach can be taken. This is a published graph of how much a fee is for different levels of demand, as shown on the next page.

Here's how the curve works. The goal is to keep the health of a common property in the safe zone. This is done with targets and fees. Once the targets are set the steward designs the fee curve, publishes it, and starts charging fees.

First the targets for a common property are set. For example, the level of atmospheric CO₂ needs to stay between a safe lower and upper limit target. Above the upper limit unacceptable amounts of climate change occurs. Below the lower limit there's not enough CO₂ for photosynthesis. Most targets only require a lower or upper limit to be set. Most pollution problems only require an upper limit. Renewable resources, like a forest or fish stock, tend to have a lower limit designed for a maximum sustainable yield.



After a lower and/or upper limit target is set for a steward’s common property, the steward sets the safe minimum and/or maximum target. This is stricter than the limit targets so there’s room for error. If errors are made in keeping the health of a common property in the safe zone, its health will drift into one of the danger zones. But it won’t drift far because in the danger zones the price of fees climbs rapidly. This gives the steward plenty of time to take corrective action and bring a common property’s health back to the safe zone.

The safe targets are bolded because these are the targets that are most publicized. They are the targets the public is aware of. They are also where resource use stabilizes.

In the center of the safe zone fees are lowest. As the health of a property drifts toward the left or right, fees rise. The further away from the center of the safe zone, the greater the fee is. Like the way the higher a price is the less people buy, the higher a fee becomes the less resource users consume of the resource. In this manner the fee curve gently pushes resource consumption toward what is sustainable, which is the safe zone.

The natural equilibrium of fees and consumption will occur at one of the two equilibrium points shown, with some bouncing around in the safe zone. This is identical to the way prices for private property reach equilibrium. Businesses keep adjusting a product’s price until profit targets are reached. Stewards are using the same tried and true invisible hand of the marketplace to regulate consumption of an ecosystem service that needs to be sustainably managed. Stewards keep adjusting the fee schedule until they get the behavior they need.

The advantage of a published fee schedule is large common property users can look ahead, predict where demand is going, and see where fee prices are probably going to be when an ecological service is used. For example, a 10,000 acre farm may be weighing different methods of fertilization for the coming season. The farmer needs to know what the fees for various options will be for its watershed. In the farmer's mind, fees are just another expense to minimize. In practice, once fees have been around for years the farmer will simply look back at the last five or ten years of data and use that. At that point published fee schedules will no longer be needed, just as they are not needed for bread.

The two types of targets are crucial. The limit targets are the real health targets. But due to environmental and social system unpredictability, buffers are needed. These are the danger zones. Inside of them lie the safe targets. These are what we normally mean when we say "targets."

Note how at the safe targets the fee does not fall to zero. If it did then management overhead and the costs of measuring a property's health and use would not be covered. The price society will have to pay for a sustainable world is low fee rates for the use of common properties. Once technology and society adjusts to this, fees will be so low as to barely be noticed. They will fade into the background of custom, culture, and history.

What we've described above is the standard way to approach fees. Stewards are, however, free to take any approach that works.

In the old way of thinking a fee is a type of eco tax. In the new way of thinking fees are payments to stewards for use of an environmental service. Psychologically and legally, fees are a price rather than a tax.

Component efficiency

Fees eliminate regulations and individual quotas. This is a huge leap forward because social agents operate most efficiently when each is free to decide how to do something and how much of it to do. Fees allow free markets to allocate use of common property as fairly and efficiently as prices have allocated private property for a long time. This eliminates the need for individual quotas, with some transition exceptions as noted in the *Sample Legislation*. Since fees are used to hold total consumption of a common property at a sustainable level, there is no need for regulations on how agents are to behave sustainably.

For example, the Kyoto Protocol treaty imposes quotas on individual nations, who in turn impose a complex and contentious system of regulations and quotas on industries, manufacturers and pollution sources. Implementation progress has proven to be slow, rocky, and frequently ineffective. Tremendous bickering between nations over quotas occurs. The use of 1990 as the base year for country reductions is fraught with controversy. Developing nations have per capita emissions levels that

are well below developed nations. Basing their quota on emission levels in 1990 would put them at a great disadvantage.

Imagine the Kyoto Protocol nations moved from quotas to Common Property Rights. All the above issues and more, such as the weaknesses of carbon offsets and the omission of international aviation and shipping emissions, would be instantly resolved. Treaty signers would use fees to achieve global targets for emission of carbon dioxide, methane, and nitrous oxide. Common property stewardship corporations, possibly government owned at first because of their size and importance, would appear and blanket the globe. Fees would start low but high enough to be slightly effective. By keeping them low at first, the system could transition smoothly. Once fees were seen as just another cost of doing business, fee payers would begin to find ways to minimize fees, just as they do other expenses. Ways to lower fees would quickly appear, since about 90% of fees would go to buys. As fees and buys worked together to reduce greenhouse gas emissions, the global targets would gradually be raised, to somewhere around an 80% reduction from 1990 by 2050.

Fees, working with the rest of the solution, do everything that command-and-control regulations, pollution taxes, or tradable permits do, except they do it an order of magnitude more efficiently because fees are part of a complete system for efficient common property management.

Component 5. Buys

About 10% of funds raised from fees go to management overhead. The rest go to buys. A **buy** is a payment from a common property steward to buy a human activity that benefits that common property, either directly or indirectly. The biosphere is essentially buying her health by employing her tenants. Buys go to things like monitoring the health of common property, measuring use of common property, R&D, education, cost assistance in best management practice implementation, encouragement of conservation, general awareness campaigns, and so on.

Component efficiency

Buys are spent only on actions to help the sustainability of the common property that generated the fees. This eliminates the perverse incentives that would creep into the system if buys were spent on, for example, a second common property. That property would become dependent on funds from the first property. The more sustainable the first property became, the less buys there would be to help the second property, which would in effect starve. Furthermore, the more fees on the second property have their intended effect, the less it needs assistance. But once one property manager becomes dependent on another, how likely are they to give up that dependence without some resistance? A similar argument could be made for using the income generated by fees to lower income taxes and so on.

Buys allow Common Property Rights to be revenue neutral. Presently most solutions do not follow a pure implementation of the polluter pays principle or, for renewable resource like trees and fish, the harvester pays. Instead, taxpayers pay. Governments fund a vast variety of programs like superfund, cost/share programs, best management practices R&D, education, environmental protection agency work, and so on. These would all now be financed by buys, which makes the solution revenue neutral. This would be a boon to states and governments facing deficit issues. It also prevents sustainability initiatives from getting shortchanged in competition for limited funds, which has frequently been the case.

Component 6. Monitoring of common property health

Stewards would **monitor** the actual health of their common properties, under the oversight of government. Actual health minus target health equals the “health gap.” If the gap is greater than zero, then fees need to be raised. If the gap is negative, the property is in the safe zone and fees can be lowered. If the gap is zero then the equilibrium point has been achieved. Over time targets will be raised until sustainability of each common property is achieved.

Component efficiency

Monitoring is the type of thing private industry does better than government. Shifting formal responsibility of monitoring to stewards puts it in the hands of the social agent who can do it most efficiently. Occasional auditing by government may be required to keep monitoring accurate.

Component 7. Targets

Governments set targets for common property managers to achieve in order to keep their claims. A **target** defines the desired health of a common property, such as the percent of carbon dioxide in the atmosphere, the size of a fish population, or the minimum amount of biomass in a forest.

Component efficiency

Target efficiency is achieved by government doing only what it does best: define and manage the rights and goals needed to optimize the common good. Unlike regulations which tell *how* to achieve something, targets tell *what* to achieve. How to best do that is up to a society’s many intelligent social agents.

Chapter 19

How the Seven Components Work Together as a System

The previous chapter explained efficiency at the component level. This chapter explains it at the system level. In order to do that we must first understand feedback loops.

High efficiency can only come from how components work together as a system, not from individual components. The dominant behavior of a system arises from the structure of its key feedback loops. There is tremendous potential here because: ¹⁵⁹

Positive feedback loops are the most powerful processes in the universe.

The Circle of Efficiency

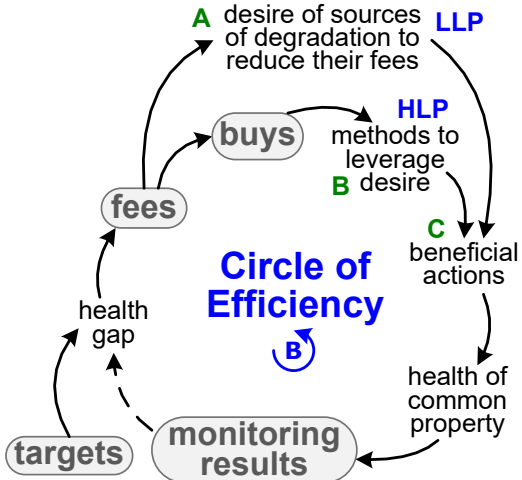
Here's how the seven components work together to create the right feedback loops needed to solve the problem.

We begin with the goal-seeking loop containing the goal of the solution. This is the **Circle of Efficiency**. The goal is targets. The loop is designed to cause the health of common property to meet the targets as soon and as efficiently as possible.

First we will review why the loop logically works so well. Then we will cover how it technically works and walk the loop.

Here's how the loop logically works. Everything starts with fees. By spending about 90% of fees only

on buys a **Circle of Efficiency** is created. The more buys that are spent and the more intelligently they are spent, the lower future fees will be. Buys are equivalent to the expenses required to manufacture a product or perform a service. Here a steward performs an ecosystem management service. Over time the system will reach a state of efficiency where fees are relatively low—as low as they would have been if fees and buys had been present all along.



The **Circle of Efficiency** created by fees and buys is critical to solution success. Fees firmly “push” social agents into behaving more sustainably. Buys gently “pull” them there by making it easier to reduce their fees and thus their harmful behavior. Fees are the stick. Buys are the carrot. Creating a strong circle of efficiency for all common properties needing sound management is *the* goal of Common Property Rights.

Next let’s consider a few technical things. Since this is a balancing loop, targets – monitoring results = health gap. For example, if a healthy fish population is 1,000 that’s the target. If it’s fallen to 300 due to over fishing and pollution then the gap equals 700. The diagram aggregates all solution components and instances into one model, since we’re trying to understand how the solution works as a whole. This is another case of the whole is greater than the sum of the parts.

Since the **Circle of Efficiency** has an odd number of inverse relationships, it’s a balancing loop. These work to bring the state of a system into balance, in relation to a goal. Without the proper balancing loops systems run out of control, as ours is doing now. The Common Property Rights System allows problem solvers to rapidly and efficiently introduce the millions of balancing loops the system needs in order to become sustainable.

Let’s walk the loop. When the solution begins, the health of many common properties is poor so targets need to be set. The higher targets are, the higher the health gap. The higher the gap, the higher fees need to be to close the gap. Fees increase the desire of sources of degradation to reduce their fees. This is done by implementing various best management practices, conservation, or deciding not to consume or pollute a common property at all, such as by walking instead of driving. This increases the beneficial actions of sources to reduce that degradation. The result is an increase in the health of common property. This improves monitoring results. This is good news, because the better the result the smaller the health gap. Now the loop starts all over again.

Because it’s a balancing loop, the second time around it behaves differently. As the health gap goes down, so do future fees. This is exactly what we want because it means the system is running more efficiently. Fees are an expense of doing business. The lower expenses are, the lower prices are for the billions of goods and services in the global system.

What makes the **Circle of Efficiency** so powerful is it’s really a **Double Circle of Efficiency**. It has two loops: the upper and lower ones. Both push as hard as they can on increasing the health of common property. The lower loop does this identically to the upper loop, except it uses buys to increase methods to leverage desire, which increases beneficial actions. The loop continues as it did before.

In traditional solutions like pollution taxes or cap and trade, only fees are used. Those solutions only push on the low leverage point of desire of sources of degradation to reduce their fees. It’s low leverage because desire alone is not that beneficial.

What matters much more is methods to leverage desire. That's a high leverage point because methods like best practices that work, education, cost/share programs, and so on allow desire to translate into higher beneficial actions. Thus buys push on a high leverage point. The combination of fees and buys pushing on the low and high leverage points causes ultra high feedback loop efficiency, because $A \times B = C$.

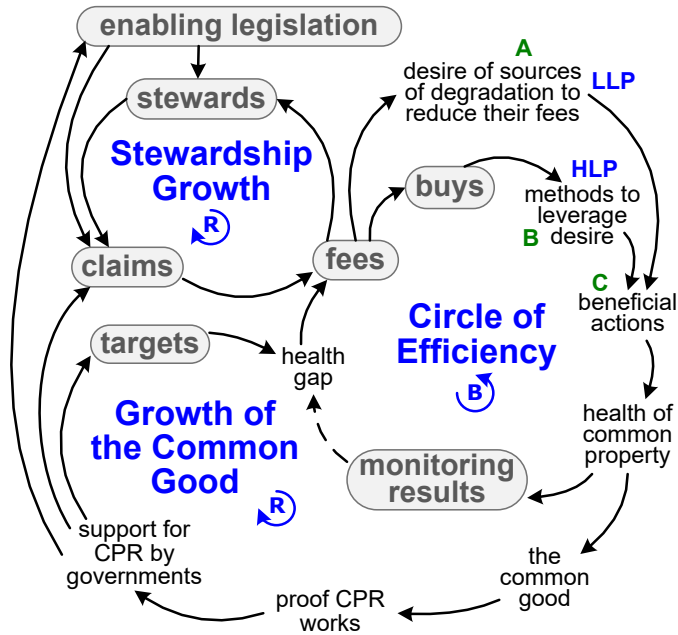
Balancing loops are goal-seeking loops. The goal is targets of some kind that define what state the system should reach. For example, democratic nations have the voter balancing loop. The target is to optimize the common good. If elected leaders fall short of that target they are voted out. Whoever can legitimately promise to strive for that goal is voted in.

All effective solutions to difficult social problems require one or more correctly designed balancing loops. The rest of the solution is the other changes necessary to make those loops work. All seven solution components are not in the **Circle of Efficiency**. They are sprinkled around in the structure of the solution in such a manner as to cause the key balancing loop to work well. When this happens a system is said to be in automatic self-management mode. Putting a system into that mode and keeping it there is *the* goal of social system engineers.

The complete solution

Below is a model of the complete solution. Note the **Growth of the Common Good** reinforcing loop. This is *the* loop to encourage because the top goal of modern democracies is to optimize the common good for those living and their descendants. All other goals, such as targets, are a means to that end. Being a reinforcing loop, it can grow indefinitely until it reaches limits. These are supplied by the **Circle of Efficiency** goal-seeking loop. The other reinforcing loop, **Stewardship Growth**, augments what the **Growth of the Common Good** loop is trying to do.

How the Seven Components Work Together



The foundation of the entire solution is enabling legislation for Common Property Rights. Once this node is added to the system the solution becomes self-managing and self-replicating. This causes the solution to spontaneously spread over the entire system, just as all new useful technologies tend to do.

Now we can describe the heart of the solution’s architecture and where its power comes from: The two growth loops push the goal-seeking loop towards the goal of the solution. The forces involved can dominate the behavior of a system and work extremely well, because “Positive feedback loops are the most powerful processes in the universe.”

To walk the **Growth of the Common Good** loop, let's begin at enabling legislation. Once created this allows stewards to make claims on unclaimed common properties needing wise stewardship. Once a claim is accepted fees may be charged. As explained earlier as we walked the **Circle of Efficiency**, this eventually causes the health of common property to increase. This increases the common good, which in turn increases the proof CPR works. As that rises so will support for CPR by governments.

More support is crucial because it affects three nodes. These are the three things governments do in their role of CPR system oversight. As support goes up, governments will see that improving the quality of targets will help even more. Investments in the social and technical science behind targets will increase, as will quality of target management. Governments will also encourage and accept more claims on common properties needing wise stewardship. But the most important result is governments will improve the quality of how enabling legislation is implemented, as well as to increase their spread to other governments. This is part of self-replication.

The solution is *self-managing* because the **Circle of Efficiency** balancing loop moves the system toward the desired state.

The solution is highly *self-replicating* because of the **Stewardship Growth** loop. The more stewards there are and the stronger they are, the more claims they will file as they see further into the nooks and crannies of the system where new claims of many kinds would be beneficial. The more claims there are, the more fees generated. As that occurs existing stewards will grow stronger and new ones will feel encouraged to appear, all around the planet. They will help more governments see the wisdom of passing Common Property Rights. This will lead to even more stewards and claims and the loop starts over again. It will take decades, but *eventually all valuable unclaimed common properties will be claimed*, just as occurred long ago with the most valuable private property of all: land and what's on it. In this manner the global sustainability problem will be solved—rapidly, efficiently, and completely.

Sample Legislation

This chapter presents sample legislation that could serve as a starting point for developing actual legislation. Please realize this is a highly simplified educational example, written in Plain English.

Note how short this chapter is. That indicates how relatively easy enabling legislation will be to create, due to high reuse of existing property rights law.

The [name of government unit] Common Property Rights Act

The [name of government unit], hereafter called the state, hereby extends private property law to common property, though only to environmental properties for those types designated. These types are, for a ten year trial of this act, to be [list of common properties for pilot projects] as affected within or from this state. If this trial is successful then these types will be extended to additional or all common properties negatively impacting the biosphere. It is hoped that this generic program, or its successors, will become a model for other states and the world to emulate.

An environmental common property is defined to mean the health of an ecosystem cycle that needs stewardship management to be sustainable, such as the water cycle of rain, water flow, water use, evaporation, and more rain. In this example stewards do not own the water. They own the right to manage the water cycle wisely and to charge for the ecosystem services provided by that cycle, just as private property owners charge for the goods and services they provide customers.

The current private property rights system works by providing these specific rights:

1. Private property *ownership* rights
2. Private property *use* rights
3. Private property *selling* rights
4. Private property *direct management* rights
5. Private property *overall management* rights

For example, a person may *own* a home but rent its *use* out, contract with a rental agency to *directly manage* the rental and the property, and then one day *sell* the home. Watching over these activities is a government who performs *overall management* of the laws behind these rights.

All five types of rights are essential for private property rights to work. It follows they are also essential for Common Property Rights.

The purpose of this act is to create a system for Common Property Rights that is so generic it can be applied to all types of common property problems and scaled up to solve

problems of any size. To do so this act creates a generic and efficient way to implement all five types of rights for common property. These are:

1. **Common property *ownership* rights** – Common properties are owned by the people involved, as represented by their government.
2. **Common property *use* rights** – Anyone whose use of a common property degrades it is subject to a fee, to be paid to the common property steward. If common property use does not cause unsustainability or is minor compared to major users, then no fee need be charged. A fee is the price of one unit of ecosystem use, such as the right to pollute the air with one ton of carbon. Fees implement the principle that the polluter pays, not the taxpayers.
3. **Common property *selling* rights** – Common property belongs to the people, so ownership rights cannot be sold. Nor can stewardship management rights be sold due to the high quality of continuous management required. At the option of the steward, use rights can be sold in the form of tradable use permits.
4. **Common property *direct management* rights** – These are owned by common property stewardship corporations, also called stewards. Stewards must be a non-profit, not-for-profit, or government-owned corporation, since the outside or concentrated stockholder profit motive creates an insurmountably large conflict of interest. These rights shall be gained by filing a claim on an unclaimed common property and having the claim accepted. Targets for the health of common properties shall be set by the state, with the assistance of the steward. Monitoring the health of common property shall be performed by stewards under government oversight.

As stated in its charter, the goal of a common property steward is to manage the wise stewardship of its common property in such a way as to meet its targets on time, in order to optimize the common good. Common property stewards not meeting their targets will see their claim ownership immediately revoked, at the discretion of the state. Claim corporations growing so large as to be inefficient or oppressive will, at the discretion of the state, be broken up into smaller corporations managing smaller portions of a common property.

5. **Common property *overall management* rights** – These are owned by the state, who oversees the design, implementation, enforcement, and ongoing oversight of the intent of the laws behind these rights. This includes approving claims, setting targets, and verifying monitoring.

Ownership determined by claims – Ownership of common property shall be determined by whoever files a claim on an unclaimed property and has the claim accepted. To be considered for acceptance the party must prove that:

1. The property needs wise stewardship that would benefit society.
2. The party has a credible plan to do this.
3. The party has the means and proper incentives to execute the plan.

Since most past opposition to wise stewardship of environmental properties has come from for-profit corporations, the party must be a non-profit, not-for-profit, or government-owned corporation. This will inherently bias the party toward optimizing the long term common good, rather than the short term special interests of profit maximizing owners.

We anticipate many parties will want to file claims, since a large number of non-profit organizations (NGOs) have participated in helping to solve the sustainability problem. The state will create an independent commission or designate an existing agency to choose one party for each common property with the greatest chance of success, balanced by the lowest cost to society. If no parties are deemed acceptable for a common property needing immediate wise stewardship, the commission or agency will charter a corporation of its own design to own the claim and loan it sufficient startup capital.

Fees – This act authorizes common property stewards to charge “fees” to those sources engaging in behavior degrading a particular property. A fee is the price to purchase a unit of ecosystem service use, such as one pound of nitrogen runoff, one ton of carbon emissions, or 100 pounds of fish harvest. Sources not paying charged fees are guilty of property theft and may be charged with theft under existing property law. The appropriate places to charge fees shall be the most reasonably efficient places in the system to do so, as determined by stewards.

Fees are called fees rather than prices for a reason. People are habituated to thinking that when they buy something for a “price” they can do anything they want with it. That’s not a sustainable attitude. Better is to pay a user “fee” for the privilege and responsibility of using an ecosystem service sustainably.

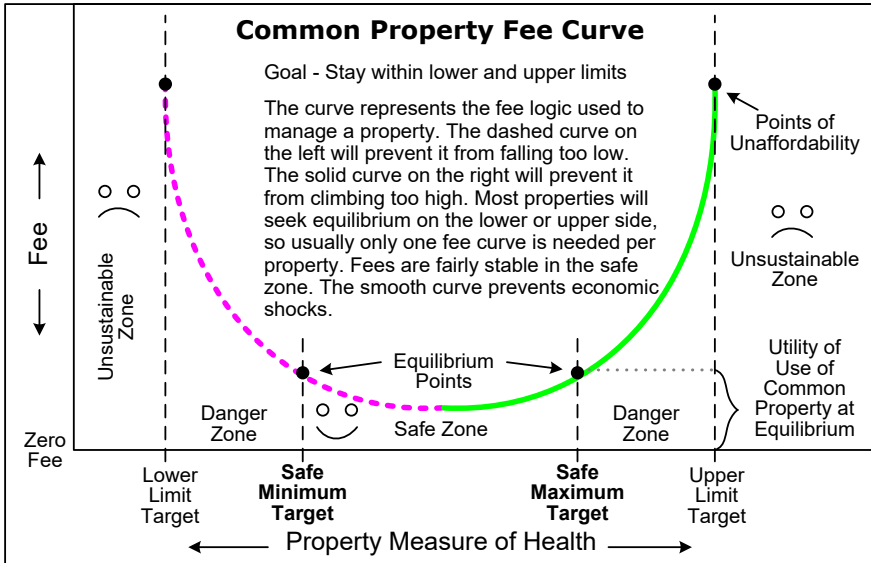
For pollution, fees implement the principle that the polluter pays, not the taxpayers. For renewable resources, fees implement the harvester pays principle. For non-renewable resources, fees implement the depleter pays principle.

The fee type is whatever a steward feels works best: flat fees per unit of resource use, seasonally adjusted fees, tradable permits, permit auctions, etc. The amount of fees each source pays shall be non-discriminatory.

Except for startup transition periods where permit auctions and/or tradable permits might be better, flat fees per unit of use are expected to be the most common fee type. Flat fees are strongly encouraged.

For flat fees there are no quotas. If one source wants more or less resource use than another source, they can. They just have to pay more or less fees. This will work, because the total amount of the fees charged to all sources should be such that the common property begins moving toward its “safe zone” in time to achieve targets. These targets will be set and updated by the state as necessary. In some cases, such as multiple rivers or ecosystems, each of which must be healthy, multiple targets will be necessary. Seasonal targets may also be necessary.

How flat fees, targets, and safe zones work is explained in the graph on the next page.



The state will set the lower and/or upper limit targets for each environmental property. Stewards shall set more conservative limits so as to allow room for a margin of error, as represented on the graph by the safe minimum and maximum targets (hereafter called targets). These are the targets each common property steward shall meet. *Meeting these targets and thus making use of common properties sustainable is the goal of this law.* The creation of Common Property Rights is the means.

A fee curve target is a measure of a common property's health, such as the level of nitrogen in a creek or river. Health targets are totally different from use quotas per source, such as the greenhouse gas emission reduction goals per nation in the Kyoto Protocol treaty. While this is a legitimate approach, the history of production quotas (such as the USSR's thirteen five year plans from 1928 to 1991) has shown that command-and-control style individual quotas, while workable in the short run, tend to become increasingly inefficient in the long run compared to free markets, which historically have needed no individual quotas to perform efficiently. This state does not want to repeat that error.

Therefore the architecture of Common Property Rights rejects individual quotas because they are inherently inefficient. Like regulations, individual quotas prescribe exactly what *each social agent* should do. It should consume its quota.

Unlike regulations, stewards use fee curve targets to prescribe what *the system* should achieve. How the system's many social agents jointly achieve those targets is entirely up to them. Their behavior will be as efficient as is realistically possible because it is guided by the invisible hand of supply and demand. The price of fees controls supply. How much sources of degradation are willing to pay for use of ecosystem services controls demand. The equilibrium between the two is the equilibrium points on the graph.

The state may, however, begin this program using quotas that already exist. During a transition period of a few years the state expects to move from existing quotas to targets in most cases.

Common property stewards must minimize fees so as to minimize shock to the economic system and pain to those paying fees. To assist in this, the curve of targets will begin at a modest amount of change. Later it will accelerate, which will accommodate the years it will take for stewards to create and refine the innovative systems needed to reach long term targets.

In the old way of thinking a fee was a type of eco tax. In the new way of thinking fees are payments to property stewards for purchase of an environmental service or product. Psychologically and legally, fees are a price rather than a tax. This is the way property stewards shall describe fees and is why they are called a fee instead of a tax. Examples of existing fees are attorney fees, phone activation fees, overdraft fees, excess baggage fees, airport landing fees, and user fees for public resources like national parks. Fees are a normal practice that is finally being uniformly applied to ecosystem goods and services, so that society may internalize their cost.

Common property stewards will encounter change resistance to fees. All efforts to dodge fees or persuade stewards to deviate from a uniform fee policy that applies the same to all must be reported to the state immediately. Corruption in any form shall cause a steward to lose its claim immediately.

What fees may be spent on – Common property stewards are authorized to spend fees only in these areas:

1. A small but reasonable percent for management and administrative overhead.
2. A small but reasonable percent for retained earnings and repayment of startup loans and interest.
3. Patronage rebates, as in the case of consumer cooperatives, which would be paid back to those who paid fees. These are the claim owner's customers.
4. "Buys," for buying anything that will help move the health of their common property toward its safe zone.

Buys – Buys shall be the vast majority of expenditures and may include activities like measurement of use rates, monitoring the health of a common property, R&D for new or improved best practices, cost/share for implementation, education, and awareness campaigns. This creates a "circle of efficiency" because the more effectively buys are spent the lower future fees will be and the lower the cost of solution to society will be.

Fees and buys – The term "buys" rather than purchases or expenses is deliberate. It allows the financial part of how Common Property Rights work to be memorably described as "fees and buys." Fees flow in from ecosystem users. Buys flow out as the system "buys" its health. Fees and buys are the push and pull that makes the solution work efficiently. New abstractions benefit from the right new terms, so that new ways of thinking and acting are clearly distinguished from old ways.

A 100% market driven solution – Common property stewards are required to employ fully market driven incentives. *In particular, they shall avoid quotas and regulations on*

how use sources should reduce their use. The state realizes that during a transition period of a few years some of this will be unavoidable. It should, however, be minimized.

No regulations – Instead of regulations common property stewards shall merely point out what best management practices are available, plus employ the effects of buys like education. Fees and buys are to be the new drivers of sustainable behavior, not the old drivers of quotas, regulations, and penalties. Since many old drivers exist, stewards shall work closely with the state to modify and phase them out as appropriate.

No quotas – Instead of quotas common property stewards are encouraged to use the more efficient mechanism of fees, with the price of a quantity of flow being a fee unit, such as one pound of a pollutant per month. The price of fees shall be determined by auction or published fee schedules, such as the example shown.

A fee schedule is the section of the fee curve around an equilibrium point. Given the health of a common property at a point in time, such as monthly or twice a year, the fee to be charged until the next measurement of health is predictable and known to all sources of fees. This helps them plan ahead better.

In the Example Fee Schedule the arrow points to the equilibrium point target. The left column is stable. The right column changes occasionally, depending on what fee price it takes to hold the common property at the desired target. Note how values in the right column increase exponentially once the target is passed, just as the fee curve on the graph does. Suppose the property was at 15 milligrams/liter, which is well above the target. Sources would be charged .50/lb of nitrogen emitted. This would be seen as so expensive that various sources would take various actions to reduce pollution. Eventually this would cause fees to fall to .15/lb as the target was reached.¹⁶⁰

Mg/liter of N in water	Fee per pound
20	.90
15	.50
12	.30
10	.20
→ 9	.15
8	.12
7	.10

Fee trading allowed but not expected – Purchased fees may be traded to increase flexibility and reduce uncertainty. A fee is the price to purchase a unit of use, so if trading is used fees are identical to tradable permits. In no case shall harmful tradable permit practices like speculation be allowed to develop.

Given that: (1) no quotas will be used, (2) continuous auctions can be used to set fee prices, (3) sources will be accessed continually at random instead of all at once (such as at the end of the year), and (4) sources will know fairly closely what future fees will be, we anticipate that trading of fees or banking will be unnecessary. This is because in current tradable permit programs uncertainty is introduced by (usually) annual quotas and how much it will cost a source to purchase a permit. That uncertainty disappears in this program because of the four factors listed above. No trading or banking is desirable because that indicates a more efficient system and a lower cost of solution to society.

Historically, trading also causes frequent harm. Fees are prices. We see the trading of priced goods and services in only a small fraction of private property commerce. In most of those items that are traded (like stocks, commodities, currencies, and financial

derivatives), price volatility, speculation, fraud, or bubbles tend to occur. These outcomes are harmful and sometimes catastrophic. These outcomes can also weaken nations to the point where they are forced into triage because they can no longer afford to solve all their top priority problems. When this occurs environmental sustainability, being a long term problem, is one of the first to be shortchanged. Society can no longer afford to let this happen.

Fees expected to become low – Fee prices reflect the average maturity of related technology and the cost and amount of its implementation. History has shown that as new technologies mature and their use becomes widespread, their cost declines exponentially to a low, steady state. Therefore it is expected that once the health of a steward's common property meets its target and related technology has evolved to maturity, fees will fall to a very low level, just enough to pay for the costs of monitoring, administration, minor additional R&D, setting up new customers and closing out old ones, etc. This is the maintenance phase of stewardship.

Questions about Common Property Rights

These are anticipated, though a few came from actual conversations.

This sounds too complicated to work.

Common Property Rights are no more complicated than private property rights. These seem simple because we've had them for thousands of years. Our culture has adjusted to private property rights for so long that we take them for granted. We seldom think about them. There will be small problems when Common Property Rights first appear because of the usual kinks to work out. Most of this will be done in small pilot projects so that when Common Property Rights are introduced in a large area there will be only minor problems.

Why will this work better than what we're doing now?

What we're doing now is not working. It's a mixture of individual quotas, complex regulations, a large collection of widely varying programs, and custom solutions to every new major problem. No matter how well this is done it's basically a non-generic command-and-control approach. Such solutions are inherently inefficient. This may not be apparent when they are first introduced, because it's the cheap and easy parts of a problem that are solved first. But as targets are raised, command-and-control solutions begin to encounter diminishing returns.

Large human systems cannot be centrally managed efficiently. One proof is neither economists nor governments can predict when the next recession will occur or what GDP will be five years from now. If they cannot understand the system well enough to do that, then how can anyone design a highly complex series of command-and-control actions to cause a nation's economy to work optimally and predictably? They can't. That's why the world has moved away from centrally planned solutions to market driven ones, which are self-managing. Only self-managing social systems can be efficient.

The three types of environmental sustainability problems concern pollution, renewable resources, and non-renewable resources. Can Common Property Rights handle all three types?

Yes. Any common property whose misuse jeopardizes its sustainability can be managed. For Common Property Rights to work, all that is required is the legal ability for stewards to: (1) file claims for unclaimed common properties needing wise

stewardship, (2) work with government to set a health target for a common property, (3) monitor its use rate by significant users, (4) charge significant users fees, and (5) use fee income for buys.

Note how generic these features are. They apply to all three types of sustainability problems. If a target can be set, stewards can manage any type of common property to meet the target.

In general this book ignores non-renewable resources, such as fossil fuels and minerals, because these are already being managed as private property, because they tend to fall more under the definition of private property, and because their extraction is not a major source of environmental degradation. (Their use, as in the burning of fossil fuel, sometimes is a major source, which is covered by management of pollution and renewable resources.) Non-renewable resources like oil and copper ore tend to be excludable and are thus best treated as private property. However, if a society wants to manage the sustainability of a crucial non-renewable resource so it lasts as long as possible, then it can define it as a type of common property.

How can Common Property Rights allocate resources fairly? There are huge allocation issues no one has figured out how to handle equitably.

A pollution sink, like the atmosphere and bodies of water, behaves as a renewable resource, like a forest or fishery. Sinks recycle or absorb pollution in a renewable manner unless overloaded. Thus this discussion applies to both pollution sinks and renewable resources.

The equitable allocation of resources problem boils down to a question of ownership. Who owns how much of a resource's output? How are allocation rights initially acquired or bought and sold? How are new users treated compared to old, grandfathered users? And so on.

Stewards don't decide discriminatory allocation policy. Governments do, if the parties involved cannot come to a cooperative agreement. Stewards do decide non-discriminatory allocation policy, such as auctioned permits that can be traded instead of flat fees. But stewards cannot offer grandfathered permits, for example, because that discriminates against old and new users.

Nor can stewards give out permits for an equal amount of resource use per person, because no two people are identical. There is always some difference, such as people's size, their metabolism rates, their energy needs based on where they live in the world, genetic differences, and so on. It would seem democratic and fair to allow equal permit quotas per person, but in fact that is discriminatory, because it favors people who naturally, through no fault of their own, use less or more of a resource than average. Better, because it's non-discriminatory, is flat fees or if necessary, auctioned permits.

Once allocation issues are settled, stewards can manage renewable resources just as well as they can manage pollution sinks because the mechanisms used are the same. They are the standard seven components of Common Property Rights.

The hidden cause of the fair allocation problem is that private property is mixing with common property. Allocation rights are a form of private property. Non-discriminatory use of a shared resource is a common property approach. An allocation right is a form of discrimination. It says one party is entitled to more or less than another. When two types of property are mixed, problems are bound to arise because normal property management mechanisms no longer run smoothly. Unique, cobbled-together-by-bargaining approaches are required. These quickly get into incredibly complicated messes of a solution. To avoid this it is best, whenever possible, to treat property as purely private or common.

Perhaps the fairest and most efficient approach is to consider what the solution would be if Common Property Rights had always existed. Take an unsettled watershed as an example. The steward moves in first. Water allocation rights would not exist. Instead, everyone moving into the watershed would pay a standard fee per unit of water use. No one would see this as unfair because everyone would be treated the same from the start. As the water supply approached carrying capacity, fees would rise to the point where no one would want to consume any more water. This is exactly how priced supply and demand works for private property. Prices cause supply and demand of scarce products and services to be self-regulating.

This example shows that allocation is not the real problem. Solving it somehow by better patterns of bargaining, cooperation, and mediation is a symptomatic solution. Allocation issues are cause of a deeper problem. *Endless allocation bickering and bargaining is a symptom of the need to transition to how environmental resources should have been managed all along.*

To ease this transition, a steward's management of a common property can start with some sort of allocation scheme so as to minimize shock to the system. Over a transition period of twenty years or so, this would gradually move from allocation rights to fees per unit of resource use. Why is this best? Because the free market mechanism of priced supply and demand is the most equitable and efficient form of scarce resource allocation known. In the long run, that's what all types of property need to use.

The above example said "As the water supply approached carrying capacity, fees would rise to the point where no one would want to consume any more water." If buys are not spent wisely, fees would rise quite high. This could cause hardship. But if buys are spent wisely, as they probably will be, all sorts of methods of minimizing water use will be perfected and implemented. That will cut water use to the bone. Water users in the watershed will know this. They will be grateful. They will see that as high as fees might appear to be to some, they are in fact a bargain for a scarce resource.

The above example is ridiculous. Water rights should be allocated in proportion to how much land one owns. The rich can afford fees but the middle class will suffer and the poor will starve.

If this is indeed the case then those involved should work with government to come to a cooperative agreement, one that would not need stewardship. If they can't do that then Common Property Rights would be a workable alternative, one that, as this book later explains, would be far more efficient than the command-and-control solution likely to be the result of government managed allocations.

Common Property Rights is not a magic panacea for contentious problems like this. Stewards only manage rights that have been defined by government. Stewards are essentially public contractors. The contracts are initiated by claims.

Fees are really taxes. The last thing we need is another tax.

Fees may seem like a new tax, but in reality they are the price of something that's been free before. Basically society has been ignoring the true price of what it costs to reduce environmental impact to a sustainable level. Because the modern human system has left that cost out of transactions for so long, the biosphere is beginning to become severely degraded. What fees do is what the world's economic system should have done from the start: include the true cost of avoiding degradation in the price of all transactions causing degradation. If we had done that starting two hundred years ago when the Industrial Revolution began, the system would be running so efficiently by now that we would barely notice fees.

What's to keep corruption out of big common property corporations?

The same thing that keeps corruption out of big utilities: proper oversight. If it can be done for utilities, it can be done for stewards.

Stewards are comparable to non-profits. Non-profits have historically been much less corrupt than for-profits because their mission is non-selfish. They have much less incentive to engage in the-end-justifies-the-means tactics like bribery, and power centric behavior like nepotism and excessive executive compensation. Stewards won't be perfect. But they will, on the average, behave much more beneficially toward society than for-profits because they have the right incentives.

What if pollution sources form a non-profit coop, file a claim, and win? Wouldn't that be like the fox guarding the hen house?

Yes, so it would not be allowed. Recall that the *Sample Legislation* said that "To be considered for acceptance the party must prove that: ... 3. The party has the means and proper incentives to execute the plan." In this case the party would have a conflict of interest, so it would not have "the proper incentives to execute the plan."

Why should stewards bother to be efficient, since they have a monopoly?

Eventually there will be many stewards spread across the world. Their efficiency is easily measured by how low they can keep fees and still hit their targets. The mission of stewards is to achieve common property health targets with the minimum amount of fees. Stewards with higher fees will look to those with lower fees for advice. Just as for-profit corporations rapidly learn from each other, stewards will learn from each other. Since stewards are cooperating with each other rather than competing and they work transparently because they have no competitive secrets, stewards are expected to learn from each other much better than for-profit corporations. This learning can be accelerated with government coordination, stewardship associations, conferences, etc. The result should be just what we want: rapid continuous improvement in how to run stewardships efficiently.

Stewards will pool their R&D buys for economy of scale. What's to keep this from becoming another quasi-government pork barrel?

The same thing that prevents it from happening in private industry: the proper incentives to do it efficiently. As explained above, each steward is driven by its charter to achieve its goal (which is monitored) on time and reasonably efficiently (as shown by how low its fees are), or it loses its claim. How well one steward is doing that is easily compared to other stewards, both by government and stewards themselves. This creates the incentives for joint ventures, even large ones, to work as well for non-profit stewards as it has routinely worked for for-profit corporations. Some problems will occur in the non-profit common property sector. But they will be no greater than those in the for-profit private property sector.

This will never work because it's too radical.

It is radical. But it's also prudent and sorely needed. We don't need another hundred years of piecemeal solutions that solve part of the problem or command-and-control solutions that look good in theory but fail in practice. We need a game changer. We need a generic solution so efficient it will automatically solve the entire sustainability problem as fast as possible, before it's too late. We need to be just as radical as those who dared to invent democracy or those who dared to believe that the earth revolves around the sun.

This takes away my private property rights. I should be able to do anything I want with my property.

In a democratic society one person's rights stop where another person's rights begin. No one has unlimited rights to do anything, even if they are on their own property when they do it. For example, the right to free speech stops when it be-

comes sedition (advocating the forceful overthrow of government) or when a person yells “fire!” in a crowded theater.

People with this objection are usually referring to land. They understandably feel infringed upon when required to change life long practices. But when a private property owner’s use of his or her land causes harm to others, that harm must be prevented. Otherwise the whole idea of social contract, where a government responsible to the people is formed to increase the common good, would be destroyed.

This is communism.

Actually it’s not. **Communism** is “a theory or system of social organization based on the holding of all property in common, actual ownership being ascribed to the community as a whole or to the state.”¹⁶¹ Common Property Rights do not move the system toward state ownership of anything at all. There are no ownership changes. What does change is the management of common properties that were not managed before or were managed by the state. Common property managers do not own common property. They own the right to manage it wisely for the people, who retain full control over how it is managed. This is why common property managers are called stewards. That word will forever emphasize their vital responsibility.

Because “communism” and “common property” sound so similar there is a natural tendency to sometimes equate the two. But upon inspection there is no connection. In communism, all property is owned by the community or state. **Common property** (more accurately called **commonly managed property** as defined on page 314) is anything whose use and management is shared by a population, such as air, water, and forests, game, and fish stocks. The two are not the same.

Confusing the matter slightly is the two sometime merge in the case of **state property**, which is whatever is deemed useful for a government to own to optimize the common good, such as buildings, land, money, cars, and equipment. When common and state property overlap, as in the case of parks, the state is playing the role of a common property steward.

Fees are going to cost me an arm and a leg. They will drive me out of business. I won’t support this solution and will do all in my power to resist it.

The same argument could be made if you and your community had been receiving free food for a hundred years and suddenly had to pay for it. Change is required because the world has discovered there is no free lunch anymore, due to growth hitting its limits.

In reality fees will not be exorbitant. They will drive very few out of business. Fees are designed to start low so the system can adjust to them without economic shock. Over time fees will gradually rise to the level necessary to reduce environmentally harmful behavior to a sustainable amount. Typically the benefits of new

technologies increase exponentially for decades or centuries, while their cost drops just as fast. We have long seen this pattern in agriculture, electronics, computers, physics, chemistry, medicine, and millions of consumer products. We are just at the beginning of the life cycle of the new technologies needed for sustainability, so it's likely that in the long run most fees will be very low.

A small fraction of fees will probably go up and stay there, such as fees for greenhouse gas emissions. They will, however, never reach an excessively high level because buys will go to reduce future fees by way of R&D, education on how to adopt new best management practices, some cost/share for initial conversion to these practices, and so on. It's in the best interests of common property stewards to use buys to lower future fees as much as possible any way they can, because that's part of their mission.

Therefore you should support this solution. It's the best possible one. Since it's market driven it will be just as fair and efficient as the solution you are already using to manage private property. No one is complaining about that solution, probably because it works so well.

If you choose not to support this solution, consider the alternative. This would be the equivalent of command-and-control. Do you want quotas? Do you want regulations and inspectors telling you how to run your business or your home? Probably not. Therefore we ask that you strongly support this solution so that implementation can begin as soon as possible. The sooner we start the lower fees can be, because the longer we wait the bigger the problem gets and the higher fees will be.

Developing countries will not be able to afford fees as well as developed countries. Attempting to pay fees could bankrupt them or prevent growth, leaving a large portion of the world in poverty. How can the solution address this problem?

Common Property Rights is flexible. The largest fees are expected to be on the world's largest problems, like climate change. On global problems, stewards are motivated to help each other reach global targets. For a global target they are all charging the same fee rates. These will generate large amounts of buys. If degradation sources in some areas of the world are having trouble paying fees but are honestly committed to reducing, say, pollution, then they can be assisted by buys from areas of the world that can afford the fees. This assistance can go to things like accelerated cost/share programs where the buys pay for most of the programs, restoration work like reforestation, greater amounts of education, local oriented R&D, and so on. In this manner fees in poor areas of the world would not cause undue hardship.

Use of fees would not make a bad situation worse for undeveloped countries. It would make it better because one of their biggest problems is environmental degradation.

An alternative solution to this problem is described below. It's basically a quota per person system with tradable permits that allows undeveloped countries to sell their unused permits for what would probably be a high income.¹⁶²

An incentive based pollution control approach pioneered by economists has been suggested for resolving equity issues between First and Third Worlds: a marketable permit or cap-and-trade system. Such a system would work in the following way. A successor to the Kyoto treaty would determine a worldwide greenhouse gas emissions target and then assign each country a quota based, for example, on its total population.

Thus each person in the world might initially be permitted to make an equal contribution to global warming. But because the average Indian, for example, uses only 4% as much energy as the average American, Third World countries would have an excess supply of permits, while we in the First World would have an excess demand.

Because the permits are marketable, we would buy some from the poorer countries of the world to maintain our energy-intensive lifestyles. The funds generated could then be used to support the kind of investments in non-carbon fuels that poor countries will require to develop. Moreover, because we would now be paying directly for our global warming, we would have the incentive both to conserve energy and to seek out new clean energy technologies.

This looks appealing on the surface but it introduces perverse incentives. For the solution to have significant effect, Third World countries would quickly become dependent on First World countries for income, just as so many developing countries have become dependent on oil income. Third World countries would then have the incentive to *continue* the relationship. But First World countries would have an equally strong incentive to *end* the relationship as soon as possible because of the considerable expense of buying permits. That should happen soon, due to the exponential fall in costs and rise in benefits usually encountered in new technology development. That curve is well underway. As the fruits of that curve start to appear, the relationship will end abruptly. Meanwhile, the Third World would have been continuing growth, which would be enhanced by buying their permits. When the relationship ended the tradable permit bubble would pop, leaving a bigger emission problem in the Third World than when we started.

A second type of perverse incentive is at work here. If the Third World gets a good price for its tradable permits, where is the incentive to get serious about solving the climate change problem? A third perverse incentive would be for Third World countries to increase their population to increase their permit income.

There's another drawback. This solution uses quotas. Should people living in the tropics or low altitudes receive the same permit amount as those living in cold cli-

mates or high altitudes, who require considerably more heat to survive? Should small people receive the same amount as large ones? What about infants versus adults, and single people versus married? What about the fact that census data is not accurate in some areas of the world? While the same quota per person is simple to set, efficient and equitable allocation is impossible.

Another problem is while the price of tradable permits is the equivalent of fees, there is no equivalent of buys. This greatly reduces solution efficiency.

There's another efficiency problem. This solution is not generic. It would move forward under its own management system, its own tradable permit markets, its own emissions measurement system, its own financial mechanisms, and so on. How much of this infrastructure and knowledge gained can be reused on other problems?

It would be wise to remember Occam's razor: entities must not be multiplied beyond necessity. ¹⁶³

Part 4

Putting It All Together

“XXXXX”

XXXXX

Chapter 22

Striking Where Change Resistance Is Low

Opening – We begin with some bad news. Change resistance is so high that ... run 28 can't be done. And such. Then we present the good news. There is a way forward. We simply strike where CR is low.

This chapter may need to add some runs from the Leverage Chain material, which was removed.

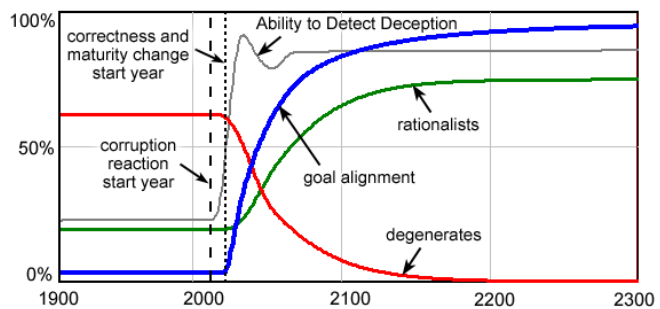
Ideas – Use material from paper 2 on self-replicating Corporation 2.0 solution. Also use CPR book material on chapter of the same name. Stewards are self-replicating. Can also implement solution elements to raise ATDD in pockets of low CR. Dramatically show how Thomas Paine's Common Sense struck where CR was low. Perhaps the Truth or Deception pamphlet can do the same.

Dummy endnote. ¹⁶⁴

(Need an introduction to the runs. Say what page the table of run settings is on.)

Run 29 – Can we do better if we raise goal correctness and process maturity from 80% to 100%? These are such fantastic high leverage points it could help tremendously.

Experimentation shows the answer is we can indeed do better. Instead of goal alignment topping out at 85% it hits 95%. And it passes the 50% level 7 years earlier in 2045. This is great results.



Run 29. Goal correctness and process maturity change to 100% in 2020. This is even better.

Unfortunately,

this run is a sham. It's unrealistic. It's not going to happen. 100% for these two points is unrealistically high. Perfection like that will not occur for hundreds of years. Sophisticated artificial life forms are so new, and so obviously hard to control, that we will be lucky enough to reach the 85% goal alignment of the previous run. So let's be content with run 28. It's the best we can realistically do.

Experimentation shows setting both points to 90% gives 90% goal alignment and crosses the 50% level in 2048. Even 90% is unrealistically high for what we, as

humans, can design. But perhaps we can find someone besides humans to design goal correctness and process maturity for us....

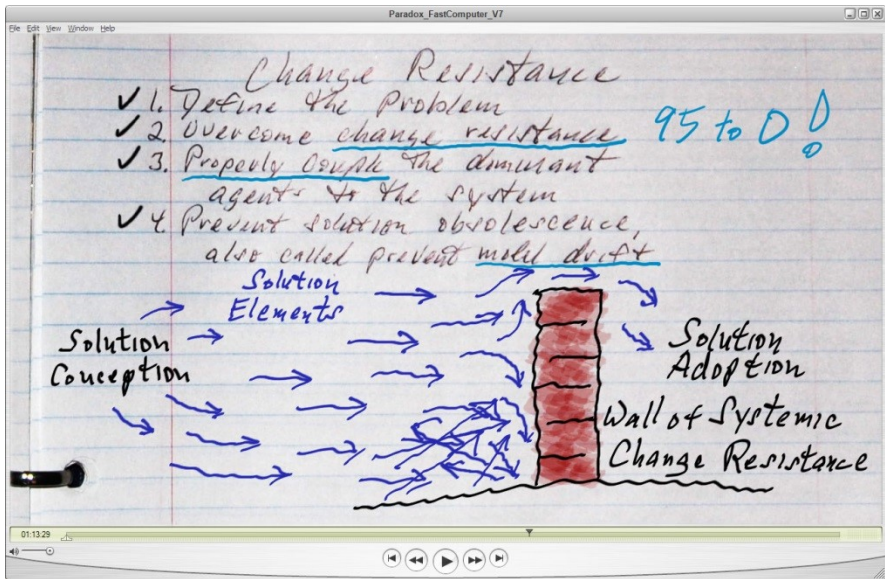
The invisible brick wall of systemic change resistance

We have alarming news. There comes a time when the truth must be told. However much sustainability advocates, myself included, would like to believe they can solve the problem this way, they can't. Even deep structural and well decomposed analyses like the one presented here so far cannot penetrate the brick wall of change resistance as sketched below.¹⁶⁵ The wall is so high and so thick that run 28 can't be done. It's a pipe dream. It's simply not going to happen.

Here's the proof pushing on the high leverage points of correctness of goals for ALFs and maturity of decision making process won't work:

Simulation runs 24 to 29 all assume that a reaction to corruption is going to occur sometime soon. But it hasn't. The three events discussed earlier on page 156 were each so large and damaging that they should have shocked enough people into waking up and spontaneously starting a reaction to corruption. But nothing happened beyond a few more progressive politicians getting elected.

A natural experiment has been run. We can see the inputs. These were the three mega-wakeup call events. We can see the outputs. Little changed. That's how re-

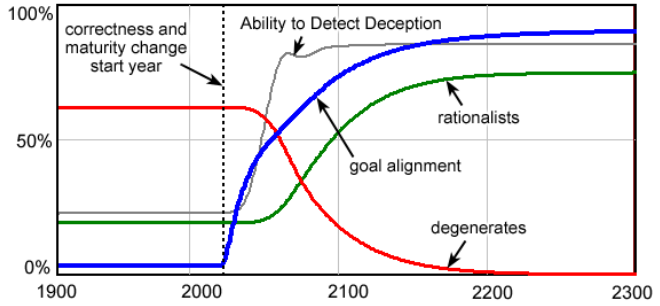


Graphic portrayal of how the process of Classic Activism causes solution elements to flow from conception to adoption. In theory it should work on problems whose solution would benefit the common good. But in practice there's an invisible brick wall (here made visible) that causes most solutions to bounce off the wall and fall to the ground, unadopted. There they pile up and accumulate, as does the growing frustration of classic activists. The frame occurs 73 minutes into *Cracking the Mystery of the Progressive Paradox*.

sistant the system is to change. *No natural reaction to corruption is going to occur about now.*

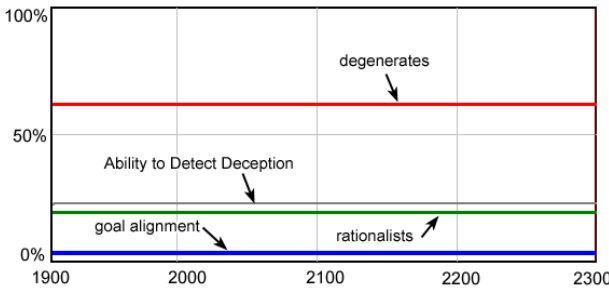
That realization means we need to run the model again, without the corruption reaction spontaneously occurring. Here are the results:

Run 30 – The results still look excellent. But looks can be deceiving. There’s nothing in the model *causing the system to allow pushing* on the high leverage points of artificial life form goal correctness and process maturity. Nor have we discussed anything that would do that, other than activists magically pushing on those points and getting fantastic results. Activists are not magicians. Nature cannot be fooled.



Run 30. As in run 28, goal correctness and process maturity both change from 10% to 80% in 2020. The corruption reaction start year is moved to 2300, so the corruption reaction is never triggered. The graph says the problem is solved, but this is unrealistic.

Run 31 – In this run the corruption reaction never starts, because the real system did not react to the three wakeup call events. The goal correctness change start year and the process maturity change start year are set to 2300, so they never start. This causes change resistance to remain so high that the system will reject any attempts to raise preferred goal correctness of artificial life form goals or preferred process maturity of the political decision making process. So in this run those two changes are never made.



Run 31. Goal correctness or process maturity cannot be changed now, due to high change resistance. For as far as the eye can see, the system remains locked in its present pattern of high degeneration and low rationalism.

The result is all four curves are dead flat, as billions of people will be unless the sustainability problem is solved proactively. Yes, there will be blips of sanity and thus more rationalists (or even more insanity and more degenerates, due to despera-

tion and conflict) as wakeup call catastrophes too huge to ignore appear. But by then it will be too late.

Therefore civilization is stuck. Unless we can find a way through this impasse, the cliff of environmental collapse lies dead ahead. This seems such a shame, because little *Homo sapiens* has come so far in only 200,000 years. Unlike the dinosaurs, whose existence came to an abrupt end due to an event they had no control over (a massive asteroid striking the Earth), humans seem destined to perish by their own hand.

In other words, even though we know where the root causes and high leverage points are, we can't push on those points hard enough *with traditional solutions* to manually trigger the corruption reaction. But what would happen if we pushed on the high leverage points *with innovative self-replicating solutions in pockets of low change resistance*? That's a viable strategy. In fact, it's the only seriously workable strategy we've been able to find. This strategy, appears to be humanity's only hope to avoid catastrophic global self-destruction.

(Material from the old section of striking where...)

The analysis has, however, uncovered some bad news. The corporate life form is so entrenched that there are probably not enough humanists left to support and implement the solution elements in subproblem A. Those who prefer to promote the common good rather than serve special interests are few in number. Fewer still can grasp innovative but complex alternatives like those presented in this book. As Part 2 explains, the result is we are stuck. We are blocked by a monumental brick wall of change resistance. It's a mile high and ten thousand miles wide.

So what can we humanists do? That's what subproblem D is for. If we can't knock down that brick wall of change resistance, why not go around it? Or why not go through it, if we can find a crack big enough?

Subproblem *D does this by the use of Common Property Rights and the strategy of striking where change resistance is low*. The idea is there are thousands of pockets of low change resistance to solving the environmental sustainability problem. Each little town, state, or region with a dire environmental problem is desperately looking for a solution that will work. In most of these cases Common Property Rights will work better than anything they have tried or considered. This is because by analogy to the private property rights system, Common Property Rights has inherent ultra high efficiency. It is functionally superior to regulation, pollution taxes, cap and trade, and home grown community level collective management solutions.

This will be an easy case to make, once how the Common Property Rights system works is explained to open minded problem solvers in these pockets of low

change resistance. It will become obvious that it will work just as well as private property rights are already working. That will cause the first few implementations of Common Property Rights. Thereafter each success will lead to one or two more.

Progress will be slow at first, as it always is with new technologies. But as the new system evolves and matures it will solve environmental problems faster and faster, and better and better. This will cause more pockets of low change resistance to give Common Property Rights a try. Stewards will start spreading. First they will solve small problems. Then medium problems. Finally, big ones like climate change and global deforestation will be tackled.

Somewhere in that course of events a beautiful thing will happen. *Voters will see that stewards are doing a great job.* Voters will then look a little deeper and notice stewards are doing a better job than corporations. Why? Because of no conflict of interest. Stewards are non-profit and exist to serve the common good. Their goals are aligned with those of humans. It will not take voters long to figure that out.

Voters will then figure out other things as well, such as where change resistance has been coming from and who is exploiting who. *Drawing the obvious conclusion, voters will begin to demand that governments change the goals of for-profit corporations in order to eliminate the destructive effects of conflict of interest.* After that the problem solves itself. The more corporations who support the goal of humanity, the more the system will want to solve the life form proper coupling subproblem. The more life form proper coupling that occurs, the more corporations there are supporting the goal of humanity. A virtuous cycle has been established. This will quickly lead to solution of all four subproblems because the most productive life form on the planet, the modern corporation, will be working *for* the common good instead of against it.

Centuries ago, the great mass of humanity began throwing off another tyrant: autocratic governments. Starting in 1776 and 1789, they did it with a succession of political revolutions, each of which led to a new democratic government.

Why can't we do it again, and throw off the tyranny of large for-profit corporate dominance forever?

Moving Forward with Evolutionary Nudges

Thomas Edison famously claimed that “*Genius is one percent inspiration and ninety-nine percent perspiration.*” What was he really saying? Perhaps we can find out from this popular urban legend:¹⁶⁶

There’s the old tale of the ocean liner engine that broke down. The ship’s owner called in one expert after another, but none of them could fix the problem. Finally, they tried an old tinkerer who knew everything there was to know about ship’s engines, especially big, old, cranky steam engines. He brought in a great big bagful of tools, plopped them down, and began inspecting the engine from top to bottom, climbing all over it. He was, however, dead silent as he worked. The minutes ticked by. Eventually, after several hours he reached inside his bag, pulled out a hammer, and gently tapped the engine somewhere. The engine instantly roared into life.

A week later the old man sent the ship’s owners a bill for ten thousand dollars. The owners were so upset they demanded an itemized bill. Another week went by and the itemized bill arrived in the mail. Here’s what it said: “Tapping with a hammer, 2 dollars. Knowing where to tap, 9,998 dollars.”

Being the creator of the world’s first invention factory, inventor of the telephone, phonograph, and the first long lasting light bulb, and holder of 1,093 US patents, Edison knew where to tap. For an explanation of *how* he knew where to tap, let’s turn to this extract from *Working at Inventing: Thomas A. Edison and the Menlo Park Experience*, William Pretzer, 1992, p84: (italics added)

As Edison succinctly characterized this process [of inventing the telephone] in 1878, “I had to create new things and overcome many obscure defects in applying my principle.” As this quote suggests, *invention may be seen as involving two elements similar* to what Edison called his “principle” and “new things.”

First, an inventor has a *principle or mental model* of how he or she thinks his or her creation should work. Second, an inventor uses “things” or devices to express his or her mental model in physical terms, and these devices will be called *building blocks*.

In this way, *the act of invention may be seen as the interplay of mental models and building blocks*. In developing something new, an inventor may begin with a mental model. This model incorporates a general idea of how a

device might work and an awareness of its potential significance. By manipulating and experimenting with a selection of building blocks, an inventor explores variations and changes. Eventually, insights from the building blocks may lead an inventor to modify his or her mental model. An invention may be complete when an inventor feels the fit between the mental model and the building blocks device is close....

In the case of the telephone, the *mental model* Edison used was the *principle of variable resistance*.

For the purpose of this book, the key takeaway here is “invention may be seen as involving two elements:” mental models of a key principle and physical building blocks to actualize the mental models. That was Edison’s unifying insight. It worked so well it drove everything he did.

What can we do with that idea? This book has presented a comprehensive method for analyzing and solving difficult large-scale social problems. How can we take that concept up to the next level and use it to birth a new field of engineering that can broadly apply and improve this concept?

We don’t know for sure, but we suspect it can be done by doing what Thomas Edison did. He invented the invention factory, aka the world’s first industrial research laboratory. We can invent the new field of Social System Evolutionary Engineering (SSEE) or **evoengineering** for short. “Ecoengineering” stands for engineering ecosystems. “Evoengineering” stands for engineering social systems by applying **evolutionary nudges**, which are carefully designed pushes on high leverage points. Let’s explain.¹⁶⁷

How new fields of science are born

All successful fields of science have, at their core, a small number of **productive unifying principles** (PUPs) that drive production of everything else. If the starting set of PUPs are productive enough, a newly born field will discover the rest of what it needs as the natural result of thoughtfully applying the initial PUPs or puppies, as they can more affectionately be called. We need the right puppies!

The starting set of PUPs is the **critical mass foundation** necessary for the successful birth of a new field. *Our goal is to create the critical mass foundation for the new field of evoengineering.* Insights on how to do that can be gleaned from examination of how new fields of science are born. Simplifying with high level summaries, we can discern the PUPs in the five fields listed below.

1. **Biology** began in earnest with the evolutionary algorithm and later added cell theory and the structure and role of DNA. These intertwined concepts form a single PUP, which spawned the further fields of ecology, genetic engineering, and so on.

2. **Physics** has Newton’s three laws of motion and the universal law of gravity. In the *Principia*, Newton used these laws to create a single starting PUP, from which the rest of the book derived further principles and for the first time explained many important phenomena, including marine tides, why the earth is shaped the way it is (it’s not a perfect sphere), and derivation of Kepler’s laws of planetary motion.
3. **Chemistry** has molecular and atomic structure, plus the Periodic Table. Here the first two concepts are the building blocks and the third concept is the PUP.
4. **Ecology** has the building block concepts of species and niches. To this is added the PUP that all species live in an ecological niche. Everything else grows from there, such as many species and niches form an ecosystem.
5. **Geometry** has the 5 postulates, 5 common notions, and 23 definitions of Euclid’s *Elements*. The book presented these items first and all else followed, using a long series of proofs. Euclid’s PUP was the principle that all of geometry can be deduced from a small number of starting axioms.

Note the small number of components (3 or 4) in all but geometry. But even that field has only 3 groups plus 1 PUP.

A possible PUP for Social System Evolutionary Engineering (SSEE)

Since 2001 the Thwink research has been resolutely closing in on the formidable task of how to solve the global sustainability problem. Recently, in 2018 and 2019, our core research team has grown. So have our insights as a team. It now appears that we have enough accumulated insights to propose a possible starting PUP for SSEE.

Following in the pattern set by the birth of other new fields, the work presented in this book suggests that our very young PUP looks like this:

The **three laws of social systems** are:

1. Most of the behavior of interest in a social system is driven by a small number of root cause forces. We estimate “small” to mean 1 to 5.
2. Root cause forces can only be correctly identified by root cause analysis, using a wrapper like the System Improvement Process.
3. Social systems are not designed. They evolve.

These laws form our initial building blocks. From them follows a single PUP, the **principle of evolutionary nudges**:

The best way to analytically “solve” difficult large-scale social problems (or to engineer large-scale social systems in general) is by identification of the root cause forces involved, followed by use of that knowledge to design the appropriate evolutionary nudges. If these nudges arise from deep glass box analysis from a Systems Engineering viewpoint, the result is SSEE.

An **evolutionary nudge** is a carefully designed push on a high leverage point for the purpose of resolving a connected root cause. We expect that sometimes one **evonudge** will be enough, but more often a long series of evonudges will be required to gently and precisely steer a system in the desired direction.

We use the term *evonudge* rather than *nudge*, since **nudge** is a behavioral economics term meaning “positive reinforcement and indirect suggestions as ways to influence the behavior and decision making of groups or individuals. Nudging contrasts with other ways to achieve compliance, such as education, legislation or enforcement.”¹⁶⁸

Note the third law, “*Social systems are not designed. They evolve.*” Unlike the other two laws this one was not explained earlier in this book, so let’s explain it here.

The reason social systems can’t be designed is high complexity and sensitive starting conditions. A striking example occurred in the year 1800 when the Industrial Revolution was just beginning. How could anyone have designed the system that emerged two hundred years later, not to mention the thousands of intermediate steps along that path, each of which also needs to be designed? That’s an impossible task. The global human system is so sensitive to starting conditions that tiny changes at one time point lead to enormous, unpredictable changes later. As time goes by, these changes evolve still further and interact. Then end result becomes totally unpredictable over a long period of time.

As another example, consider weather prediction. No matter how much information they have been able to collect, weather forecasters have hit a wall. They are unable to produce accurate forecasts beyond about 7 to 10 days. After that the best they can do is resort to using previous years data, such as “This fall will be about like last fall, adjusted for the El Nino effect.”

An outstanding example of an evonudge was invention of modern democracy, first in the US Constitution of 1787, followed by the French Declaration of the Rights of Man and of the Citizen of 1789. While this evonudge was intuitively designed instead of engineered, it worked. The system evolved away from autocracy and toward democracy, though that evolution is backsliding recently.

Social systems, like weather systems and forms of government, evolve. But that doesn’t mean we can’t influence the evolution of social systems. All that’s required is the right information about how a system would respond to pushing on its high leverage points. That’s how captains steer giant ocean liners. They gently push the

steering wheel this way and that, to steer toward their preferred destination. Lately this has become automated.

Likewise, once we understand a social system problem as well as we understand an ocean liner, we will be able to steer the evolution of that system towards its preferred destination. And once we've perfected that ability, we can automate it. This last step, automated solution management, solves one of the problems present in all difficult large-scale social problems: How to avoid excessive solution model drift.

Will what we have proposed here work? We don't yet know. It's an untested hypothesis. But it does give us a central strategy, a central productive unifying insight, to focus and guide all our work forward to success.

We close with what we hope the new young PUP of SSEE and the body of work described in this book will lead to. What we are about to describe should not come as a surprise. It's the logical outcome of what the book has covered so far.

The tantalizing potential of a permanent Race to the Top

Allow us to share an important observation. The dueling loops structure is generic. It applies to many problems, not just environmental sustainability. *Thus, the successful exploitation of the Race to the Bottom by the modern corporation and its allies is the fundamental reason progressive activists are encountering such strong resistance in achieving their objectives.* If **progressive philosophy** is defined as promotion of the objective truth for the good of all, then progressives (no matter what party they belong to) are rationalists at heart, and thus eschew falsehood and favoritism in its many forms. Progressives may not realize it, but their central strategy is the high road of winning the Race to the Top.

The chapter on Politician Decision Ratings explained how creating the right feedback loops can dramatically improve the quality of group decision making at all levels of politics. *The system will now have automatic accountability.* Imagine what the beneficial effects might be. And imagine what problems would already be solved if Politician Decision Ratings already existed.

Decision ratings would cause a sea change in the way bills are developed. High ratings would require sound analysis of the causes of a problem, deep understanding of how people and systems behave, a thorough look at all reasonable alternatives, lots of synthesis to create new ideas, a method of picking the best solution path, and techniques to prove that all this is correct and not just highly plausible. Undue personal bias would not be allowed. This of course is exactly how successful corporations have worked for a long time.

If you are a politician and your government is making less than excellent decisions, then the most important item on your agenda should be to help create something like Politician Decision Ratings. Or this short sketch may give you even better ideas. Start simple. For example, start with only the most important bills, only one

legislative body, and only a few key objectives. Consider passing this deceptively short new law:

Congress shall install a formal decision-making process on itself that, in its first iteration, follows the process map for The Political Decision Making Process. The process shall include, as its topmost and permanent sacrosanct objective, optimizing quality of life for all living people *and their descendants*.

Once this deep structural change is made, democracy will have the foundation it needs to achieve what has never been possible but has long been dreamed of.



In 380 BC Plato conveyed an indelible vision of what was possible in *The Republic*, where he examined whether or not the just man is happier than the unjust man, and proposed a peaceful, beneficial-to-all society ruled by philosopher-kings and guardians. *The Republic* used the ancient device of dramatic philosophical dialog, with Socrates questioning the arguments of others to make a point. The most famous of these was the *Allegory of the Cave*, where: ¹⁶⁹

Plato imagines a group of people who have lived chained in a cave all of their lives, facing a blank wall. The people watch shadows projected on the wall by things passing in front of a fire behind them, and begin to ascribe forms to these shadows. According to Plato, the shadows are as close as the prisoners get to seeing reality. He then explains how the philosopher is like

a prisoner who is freed from the cave and comes to understand that the shadows on the wall are not constitutive of reality at all, as he can perceive the true form of reality rather than the mere shadows seen by the prisoners.

In 1516 Sir Thomas More revived Plato's dream in *Of the Best State of a Republic, and of the New Island Utopia*. More's world had few laws, no lawyers, and tolerance of all religions, as well as satirical and symbolic elements. The book contrasted what was desirable and possible with what was happening in Europe at the time.

In 1888 Edward Bellamy kept the dream alive with *Looking Backward: 2000-1887*. According to the forward in a later edition, "It is one of the few books ever published that created almost immediately on its appearance a political mass movement."¹⁷⁰ Interestingly, a major point was the dangers of the stock market.

These works had one central theme in common: a well-formed vision of a good world, one abundantly filled with examples of quality of life. Starkly missing were the evils that plagued people's lives, like bad rulers, war, poverty, famine, pestilence, crime, greed, and endemic corruption. These good worlds never dipped into evil. They were always basketfuls of *near* perfect goodness, which seemed perpetual.

Can it be done in the real world? Is it possible to engineer the right evonudges necessary to evolve society to a good world and keep it there perpetually, even if we don't know exactly what the outcome will look like?

If the right new feedback loops can be installed, why not?

Hidden deep in the system's structure is the loop whose dominance matters most. It's the second one added to the Dueling Loops model: **The Race to the Top among Politicians**. This is *the* loop of goodness. It's *the* loop each of the best-of-all-possible-worlds writers was fantasizing about without consciously knowing it. The loop explains why their plots centered on good and bad rulers. Rulers are politicians. What each writer was actually describing was what might happen to a human system if a political Race to the Top became dominant and stayed that way. *They were all essentially describing what a permanent Race to the Top would look and feel like.* Their dream, our dream, and I hope your dream, is for this universal dream to soon come true.

For that to happen requires something like the four pushes (evonudges) presented earlier. One of those pushes must install something like Politician Decision Ratings. Perhaps the short new law described above will be part of that change.

Each nation has thousands of laws already. But this one is totally different. As short as it is, it will quickly be seen as the most important law of all, because it maximizes the chance of achieving all the others over the long term. Let's repeat the law here:

Congress shall install a formal decision-making process on itself that, in its first iteration, follows the process map for The Political Decision Making Pro-

cess. The process shall include, as its topmost and permanent sacrosanct objective, optimizing quality of life for all living people *and their descendants*.

The last words in that carefully designed new law are “and their descendants.” Those three words are the ones that historians, ten thousand years from now, are going to thank us for the most.

Is all this too good to be true? We think not, because unlike the other visions of a better world, this one is based on the tried-and-true tools of root cause analysis, process driven problem solving, model based analysis, and above all, sound engineering.

Appendix

Acknowledgements

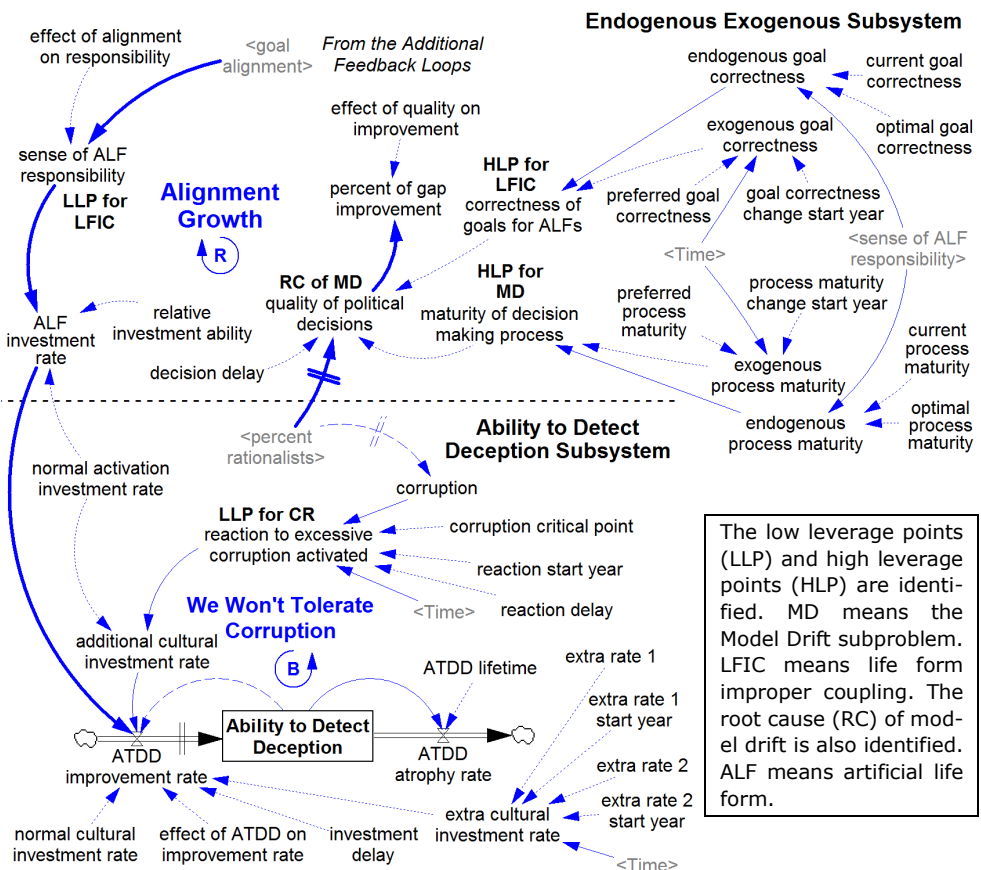
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The Artificial Life Form Subsystem

This appendix item describes how the Dueling Loops model was extended by adding a subsystem to better understand how artificial life forms, especially corporations, behave in relation to their goals. The Artificial Life Form Subsystem was added. This contains several feedback loops, the most important of which is the **Alignment Growth** loop, shown below. The model drift subproblem is included.

The subsystem is intricate and so is in the appendix rather than a normal chapter. The subsystem is used in the chapter on Subproblem B – How to Achieve Life Form Proper Coupling for the simulation runs beginning on page 154. The subsystem is also used in runs in the chapter on Striking Where Change Resistance Is Low.

The Alignment Growth Loop



The endogenous exogenous subsystem

Attached to the **Alignment Growth** loop on the right side is the Endogenous Exogenous Subsystem. The subsystem controls the values of the two HLPs.

Endogenous means coming from within a system. The system itself causes a change. Holding all else equal, the more model behavior that's internally generated the better, because the important factors for the model's behavior are included in its feedback loops—as they almost always are in the real world.

But not all model behavior can or should be internally generated. That's why models need at least some externally generated behavior for input. **Exogenous** means coming from outside a system. Exogenous nodes are constants, which includes functions in lookup tables. Arrows coming from them are dotted to indicate they are constant and do not change during a run, unless deliberately changed during a run to support an experiment.

One must be cautious about using too many constants in a model to exhibit the desired behavior. Modelers can fool themselves badly by doing this. The model may behave well but for the wrong reasons. The important behavior of a model must emerge endogenously from the structure of its feedback loops, not its constants. However, trying to make too much behavior endogenous can cause just as big a problem, as the model grows too large and complex to clearly comprehend.

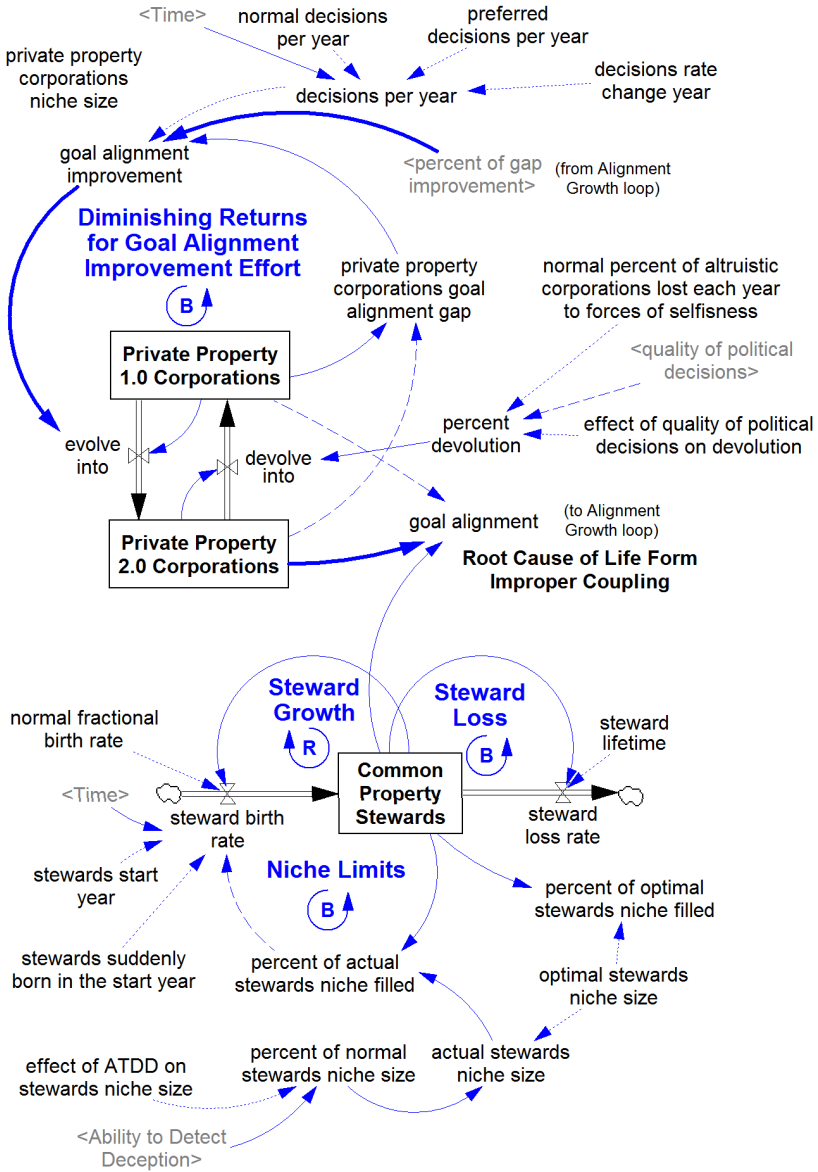
On the above subsystem the sense of ALF responsibility, a node copied from the **Alignment Growth** loop, increases goal correctness and process maturity, which in turn increase the two HLPs. This happens internally, without any outside intervention. This is how systems, including living systems, are self-directed. This node provides the endogenous quality of the subsystem. (ALF means artificial life form.)

The exogenous quality is provided by the eight constants that can be changed from run to run. Of these, two are never changed. They are considered to be the natural unchangeable behavior of the system. These are optimal goal correctness and optimal process maturity. The ones that are varied from run to run are current goal correctness, preferred goal correctness, preferred process maturity, current process maturity, goal correctness change start year, and process maturity change start year.

The additional feedback loops

These are shown on the next page. On the **Alignment Growth** loop sits a phrase called *From the Additional Feedback Loops*. These additional loops are on another page of the actual simulation model, so it takes two image to show the model. There's an arrow running from percent of gap improvement in the additional feedback loops to the **Alignment Growth** loop, and another arrow coming back from the **Alignment Growth** loop to sense of ALF responsibility in the additional feedback loops.

Additional Feedback Loops



We're about to get ahead of ourselves a little. The model includes some references to stewards, which is part of subproblem D and its Common Property Rights solution. This is because the model was created before subproblem D was extracted from subproblem B. The references to stewards support subproblem D pretty well, so rather than remove them and then somehow add a model or a complicated explanation to the analysis of subproblem D, we've left the model unchanged. This gives a simpler overall analysis.

On both images, the heavy arrows show the path of the **Alignment Growth** loop through the Artificial Life Form Subsystem. At the bottom of the Additional Feedback Loops, Ability to Detect Deception travels through a series of arrows to influence the Common Property Stewards stock. About one third down from the top on the right, quality of political decisions affects the rate that 2.0 corporations devolve into 1.0 corporations.

The additional feedback loops section of the model contains three stocks, one for each of the artificial life form types modeled. 1.0 Corporations are what we have today. Their goal is maximization of short term profits. 2.0 Corporations are what we need to transition to in order to solve the life form proper coupling problem. 2.0 Corporations have a goal fully aligned with that of *Homo sapiens*, which is the long term optimization of quality of life for those living and their descendants. 1.0 and 2.0 Corporations manage private property. Common property is managed by Common Property Stewards, a new type of corporation whose goal is also aligned with that of *Homo sapiens*. Stewards are part of the sample solution for subproblem D.

*The purpose of the Artificial Life Form Subsystem is to model how proper management of three key artificial life forms can cause the **Alignment Growth** loop to grow strong enough to solve the life form proper coupling problem.* Only one of these life forms, 1.0 Corporations, exists now. That fact is the root cause of life form improper coupling. If we can cause enough Private Property 1.0 Corporations to evolve into Private Property 2.0 Corporations, the life form proper coupling problem is solved. Here's how that can be done.

Starting at one of the additional loops, **Diminishing Returns for Goal Alignment Improvement Effort** causes initial efforts to improve goal alignment to have a big effect. But later efforts have a smaller and smaller effect, until alignment has grown as high as it's going to be. The equation used to calculate goal alignment is:

$$\begin{aligned} & (\text{Stewards} + 2.0 \text{ Corps}) / (\text{Stewards} + 1.0 \text{ Corps} + 2.0 \text{ Corps}) \\ & = \text{goal alignment} \end{aligned}$$

Stewards and 2.0 Corporations have goals in full alignment with *Homo sapiens*. 1.0 Corporations don't. Thus goal alignment is the percent of corporations whose goals are aligned with people. This is the fundamental concept of the subsystem.

A similar equation calculates private property corporations goal alignment gap:

$$\begin{aligned} & 1.0 \text{ Corps} / (1.0 \text{ Corps} + 2.0 \text{ Corps}) \\ & = \text{private property corporations goal alignment gap} \end{aligned}$$

This is the percent of private property corporations whose goals are not aligned with people. Perfect alignment is 100%, so anything less than that is the gap.

Managers think in terms of gaps. The smaller the gap, the closer they are to a goal. The greater the gap, the more that needs to be invested in closing it. The model cap-

tures this investment effort as percent of gap improvement. (This node is explained later.) The higher that is, the higher goal alignment improvement. That node is calculated by:

$$\begin{aligned} & \text{private property corporations goal alignment gap} \\ & \times \text{percent of gap improvement} \times \text{decisions per year} \\ & = \text{goal alignment improvement} \end{aligned}$$

The gap starts at 100%. Suppose percent of gap improvement was 40%. That means that quality of political decisions is so high that decision makers are trying to close 40% of the gap per year. But decisions per year is low. In initial runs it's a meager .1 per year. $100\% \times 40\% \times .1 = 4\%$. This would cause 4% of 1.0 corporations to evolve into 2.0 corporations in one year. That increases the stock of Private Property 2.0 Corporations, which increases goal alignment, which becomes an input to the **Alignment Growth** loop.

Percent devolution (I hope Darwin doesn't mind that term.) has a small but noticeable effect. Normally it's 2%. But as quality of political decisions rises to over 60% in the later runs, percent devolution falls to about ¼ of one percent. That's basically how the **Diminishing Returns** loop works.

The lower part of the Additional Feedback Loops models the Common Property Stewards stock. This is very straightforward. **Steward Growth** occurs the same way population growth is usually handled. **Steward Loss** is handled differently. In the model, stewards are treated as life forms release into a niche. Because they are given a monopoly on their common properties, they have no competitors. Thus the steward lifetime is infinite. Since our number system has no value for that, a zero is used to indicate infinite lifespan. This causes the steward loss rate to be zero for all runs. Testing shows that a lifespan of 50 to 100 years makes very little difference in model behavior.

The **Niche Limits** loop imposes a limit to the steward birth rate. The optimal stewards niche size is 10,000. But society is so blind to the need for that size that the lower Ability to Detect Deception, the lower the actual stewards niche size.

The stock of stewards starts empty. In the stewards start year the number of stewards suddenly born in the start year is added to the stock. Thereafter no more are exogenously (externally) added. The stock grows endogenously (internally) thereafter. Causing it to grow is the **Steward Growth** reinforcing loop. Putting on the breaks is the **Niche Limits** balancing loop. Because of the balancing loop the percent of optimal stewards niche filled never reaches 100%, but it comes close. In run 39 it hits 97%. This can be interpreted as 3% of the common property problems needing wise stewardship are not getting it. That's basically how the stewards stock works.

The Artificial Life Form Subsystem is highly simplified. We've tried to include only the most influential components needed for useful behavior. The main lesson is

that to solve the global environmental sustainability problem, we need to think in terms of what artificial life forms are needed to automatically manage the problem. This is light years from where thinking is today.

Explaining the Alignment Growth loop

The **Alignment Growth** loop is a reinforcing loop. designed architects the subsystem around the behavior we would most like to see: automatic growth leading to high goal alignment. Once goal alignment between *Corporatis profitis* and *Homo sapiens* goes high and stays high, the root cause of subproblem B is resolved.

Our journey around the loop begins in the center of the model at percent rationalists. This node originates from the left side of the basic Dueling Loops model on page 111. It has been copied here so we can use it in the **Alignment Growth** and **We Won't Tolerate Corruption** loops. Following percent rationalists upward, we see percent rationalists is used in calculating quality of political decisions. Leaving out the delay for simplicity, this crucial calculation is:

$$\text{maturity of decision making process} \times \text{correctness of goals for ALF's} \\ \times \text{percent rationalists} = \text{quality of political decisions}$$

This employs the same logic used on page 42 where:

$$\text{process maturity} \times \text{quality of effort} = \text{quality of results}$$

The analogy is that percent rationalists is quality of effort in the second equation. In the model percent rationalists measures quality of effort because the higher percent rationalists is, the better the quality of decision making effort becomes. This occurs because the influence of degenerates on decisions making is lower. Degenerates don't favor good decisions that benefit the common good. They favor decisions that selfishly benefit themselves.

The second equation doesn't contain anything like correctness of goals because it's simplified. It doesn't include what goal a process is trying to achieve. That's not part of a process. It's an external input. Nor is correctness of goals part of quality of effort. A goal is direction of effort. The first equation improves the second equation by adding correctness of goals. To express this clearly, the more complete principle is:

$$\text{process maturity} \times \text{quality of effort} \times \text{correctness of goals} \\ = \text{quality of results}$$

That's the principle the quality of political decisions node uses.

Continuing around the **Alignment Growth** loop, quality of political decisions is used to calculate percent of gap improvement. Here's how this works.

Goal alignment is calculated in the ALF Subsystem. It varies from 0% to 100%. Perfect alignment is 100%. Anything less than 100% is the gap to be closed. The

technique of closing the gap prevents goal alignment from exceeding 100%, which is impossible. The technique also allows easy introduction of the effect of diminishing returns, handled in the ALF Subsystem. The smaller the gap, the higher the quality of decisions required to close it.

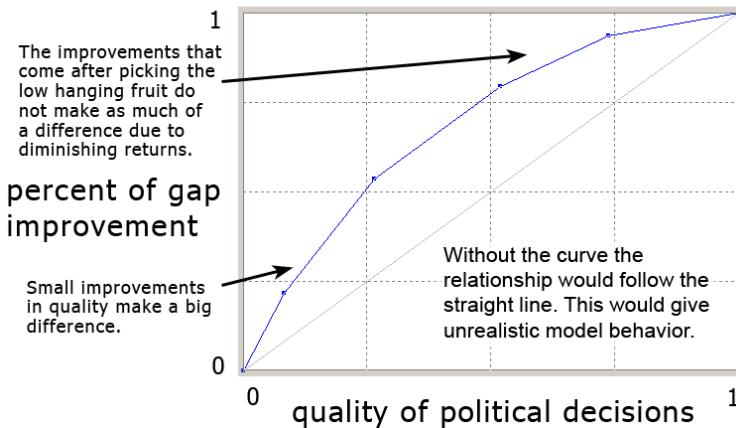
However, the most important thing the technique of closing the gap does is reflect how people really think and work. We see problems and fix them, and don't worry about what's going well. Problems are symptoms of what needs treatment. Here the gap is the symptoms of a misbehaving artificial life form that need treatment. The gap is what needs fixing. Gaps are usually closed in incremental amounts as solutions evolve. Sometime we can do better, if deep understanding of a problem makes it possible to take big leaps. This is sorely needed here.

The calculation for gap improvement is:

$$\begin{aligned} &\text{effect of quality on improvement (quality of political decisions)} \\ &= \text{percent of gap improvement} \end{aligned}$$

The effect of quality on improvement is a function that converts quality of political decisions into percent of gap improvement. This greatly improves model realism by a causing a small quality improvement to make a big difference and larger improvements to not make as big a difference due to diminishing returns. The curve used is shown below. The curve demonstrates the estimates modelers frequently use in qualitative models like this one, until the estimate can be replaced with measurement if necessary.

Effect of quality on improvement function



The usefulness of the **Alignment Growth** loop lies in its ability to explain some extremely important system behavior.

Low goal alignment is the systemic root cause of life form improper coupling. As solution elements push on the high leverage points to resolve that root cause, goal alignment will rise. This will in turn cause sense of ALF responsibility to rise. This could be called corporate social responsibility, though not every artificial life form is a corporation. There are also robots, intelligent software systems, governments, religions, political parties, cultures, etc.

Environmental activists have valiantly struggled to solve the sustainability problem by using a multitude of intuitively attractive solutions to increase sense of ALF responsibility directly. Corporate social responsibility (CSR) is the most popular. The location of sense of ALF responsibility in the loop shows why it's a low leverage point. Pushing on that node *directly* can help some. But it requires an impossibly large amount of force to make that solution work, as the failure of corporate social responsibility campaigns and related efforts have shown. But suppose you took the same amount of force and pushed on either of the two high leverage points on the **Alignment Growth** loop. That would lead to an increase in goal alignment, which would then *indirectly* cause sense of ALF responsibility to rise. That rise would be orders of magnitude greater than the insignificant one caused by corporate social responsibility efforts, because nothing affects a life form's behavior nearly as much as its goals. The principle that *a social agent's goals define its self-interest* is at play here.

Adam Smith highlighted the critical importance of self-interest in *The Wealth of Nations* in 1776: (Italics added)

Give me that which I want, and you shall have this which you want, is the meaning of every such offer; and it is in this manner that *we obtain from one another the far greater part of those good offices which we stand in need of*. It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own *self-interest*. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages.

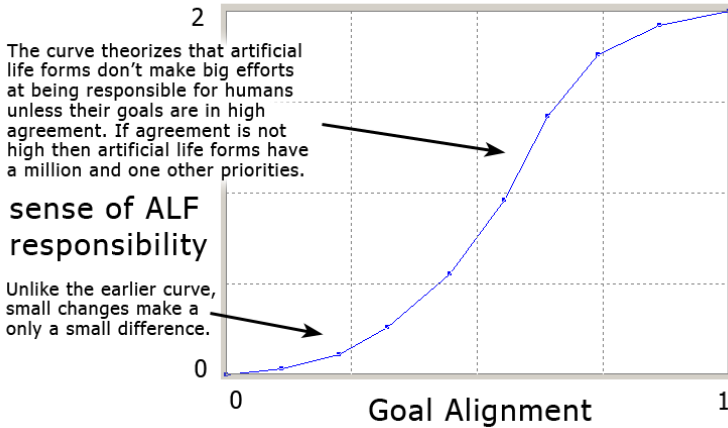
If we can reengineer the New Dominant Life Form to where its "own self-interest" aligns with that of humans, then "we [will] obtain from one another the far greater part of those good offices which we stand in need of."

The value of an artificial life form's self-interest to solve problems whose solution would benefit the common good is approximated by:

$$\begin{aligned} &\text{effect of alignment on responsibility (goal alignment)} \\ &= \text{sense of ALF responsibility} \end{aligned}$$

This involves another function. It works the same as the earlier function but uses an S curve instead of a goal seeking curve. How it works is shown.

Effect of alignment on responsibility function



Our journey around the **Alignment Growth** loop now comes to an end. The last node in the loop is the ALF investment rate. This equals:

$$\text{sense of ALF responsibility} \times \text{normal activation investment rate} \\ = \text{ALF investment rate}$$

The ALF investment rate is added to the other two investment rates to give the ATDD improvement rate. As this goes up so does Ability to Detect Deception. This is how strengthening the **Alignment Growth** loop solves the problem. It does it by turning on the power of the **We Won't Tolerate Corruption** loop all the time, rather than waiting for the corruption critical point to be activated. This is a fundamental change to the human system.

As explained earlier on page 119, the normal activation investment rate is how much a society starts investing in raising Ability to Detect Deception when a cycle of corruption runs out of control and the corruption critical point is triggered. But that's an intolerably painful way to manage corruption, not to mention focusing on what society should be doing once corruption is out of the way. Much better would be to have a super servant perform these roles. Fortunately one is standing by. It's a little recalcitrant now, but with some retraining it should do a praiseworthy job. Once that servant's goals become aligned with its master, its sense of responsibility grows. That increases how much of the normal activation investment rate job it will take on when needed. In other words, once Goal Alignment goes high, the New Super Servant wants to please its master so strongly that it sees keeping Ability to Detect Deception sufficiently high all the time *as its normal job*. That's what the above formula does.

And it does it better than humans do, because the New Dominant Life Form has so much influence. Note how in the above graph the vertical axis varies from 0 to 2 rather than from 0 to 1. This theorizes that large corporations, once their goals are aligned with those of humanity, will spend *twice* as much effort as people to solve the corruption problem. Why not? After all, solving that problem is now their business. Large corporations are not exactly poor.

This completes description of The Artificial Life Form Subsystem.

Endnotes

Introduction

¹ The Sherlock Holmes quotes is from *A Study in Scarlet*, by Sir Arthur Conan Doyle, 1887, chapters 4 and 7.

² 82% of Fortune 100 companies use Six Sigma, the most popular form of root cause analysis. Source: *Some pros and cons of six sigma: an academic perspective*, by Jay Antony, 2004, TQM Magazine.

³ The UNEP report is *Global Environmental Outlook-5*, 2012, available on UNEP's website.

⁴ See *The Root Causes of Biodiversity Loss*, by Alexander Wood and others, 2000, Earthscan Publications.

Chapter 1. Navigating Solution Landscapes by Increasing Process Maturity

⁵ Ecological footprint graph created by Thwink.org from a graph in [www.rprogress.org/publications/2007/GPI 2006.pdf](http://www.rprogress.org/publications/2007/GPI%2006.pdf). Suggestions for callouts by Tommy Topmiller.

⁶ *Human Problem Solving*, by Allen Newell and Herbert Alexander Simon, 1972, Prentice Hall.

⁷ The three fitness landscape images are from: (1) *Crowdsourcing As A Solution To Distant Search*, by Allan Afuah, *The Academy of Management Review*, 2012. (2) *Annual Reports in Combinatorial Chemistry and Molecular Diversity*, by Moos et. al., ESCOM. (3) Wikimedia, https://commons.wikimedia.org/wiki/File:SWAG_Fitness_Landscape.png.

Chapter 2. Tunneling Through Solution Landscapes with Root Cause Analysis

⁸ The Toyota quote is from *Toyota Production System: Beyond Large-Scale Production*, by Taiichi Ohno, 188, Productivity Press, page 77.

⁹ *Ibid*, page 18.

¹⁰ *Ibid*, page 17.

¹¹ Source of ISO 9001 information: http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm, the PowerPoint presentation. Interestingly, the ISO 9001 standards never mention root cause or root cause analysis. The concept runs so deep that terms like "cause" are used instead.

¹² "The common desire to improve quality of life" is discussed in a long paper on *The IPAT Equation and Its Variants*, by Marian Chertow, 2001, page 22.

¹³ From *World Dynamics*, by Jay Forrester, 1971, Wright-Allen Press. Italics added.

¹⁴ See *The Transition to a Sustainable Society*, by James Gustave Speth, 1991, Proceedings of the National Academy of Sciences, Vol 89, pages 870 to 872.

¹⁵ The UNEP process was described in *Global Environmental Outlook-5*, UNEP, 2012, available on the UNEP website.

¹⁶ See *The Root Causes of Biodiversity Loss*, edited by Alexander Wood, Pamela Stedman-Edwards, and Johanna Mang, 2000, Earthscan Publications.

¹⁷ “Going to the Gemba” is described in *Manufacturing Systems: Foundations of World-Class Practice*, the chapter on *Going to the Gemba*, by Albertus Welliver, 1992, National Academies Press, page 233 to 237.

Chapter 3. The System Improvement Process (SIP)

¹⁸ The quote about NASA’s root cause analysis tool is from <https://nsc.nasa.gov/RCAT/>.

¹⁹ Source of defect rates, *The Six Sigma Handbook: A Complete Guide for Green Belts, Black Belts, and Managers at All Levels*, by Thomas Pyzdek, 2003, McGraw Hill.

²⁰ The 4 Ps of marketing are from *Basic Marketing: A Managerial Approach*, by Jerome McCarthy, 1960, R.D. Irwin.

²¹ The original 4 Ms of manufacturing are from *Guide to Quality Control*, by Kaoru Ishikawa, 1986 edition, Asian Productivity Organization, page 19. Numerous sources increase this to the 6Ms by adding Mother Nature (environments) and Man (workers, people).

²² The 9Ms of quality control are from a classic book in the quality field, *Total Quality Control*, by Armand Feigenbaum, 1991, page 59.

²³ Origin of change resistance from Dent, Eric and Goldberg, Susan. 1999. *Challenging Resistance to Change*, The Journal of Applied Behavioral Science, Vol. 35, No. 1, 25-41.

²⁴ Definitions of pre-science and normal science are from www.hu.mtu.edu/~tlockha/h3700kuhn.f06.doc.

²⁵ The passage on Kuhn is from en.wikipedia.org/wiki/The_Structure_of_Scientific_Revolutions#Incommensurability as retrieved on September 19, 2009.

²⁶ The process control phase of industrial root cause analysis is described by Thomas Pyzdek in *The Six Sigma Handbook: A Complete Guide for Green Belts, Black Belts, and Managers at All Levels*, 2002, McGraw Hill, page 649. The page includes the quoted material. Six sigma is the leading form of root cause analysis in business.

²⁷ The definition of resilience is from The Resilience Alliance’s website, <http://www.resalliance.org/resilience>, last retrieved June 9, 2016.

²⁸ Image source for cause-and-effect diagram: https://en.wikipedia.org/wiki/Ishikawa_diagram.

²⁹ The definition of systemic is from *Change Resistance as the Crux of the Environmental Sustainability Problem*, by Jack Harich, 2010, System Dynamics Review.

³⁰ The pre-analytic vision quote is from *History of Economic Analysis*, by Joseph Schumpeter, 1954, Routledge.

³¹ For a simple simulation model showing how more efficient technology makes the sustainability problem worse, not better, see film one on *Cracking the Mystery of the Progressive Paradox* at Thwink.org.

³² From *Root Cause Analysis: The Core of Problem Solving and Corrective Action*, by Duke Okes, 2009, p15.

³³ The passage on the urban decay problem is from sysdyn.clexchange.org/sdep/papers/D-4224-4.pdf on October 31, 2007. This was a chapter by Jay Forrester titled *System Dynamics and the Lessons of 35 Years*. It's an excellent read.

Chapter 4. Overview of Analysis Results

³⁴ The definition of sustainable development is from *Our Common Future*, by the World Commission on Environment and Development, 1987, p. 43.

³⁵ See *Where on Earth Are We Going?* by Maurice Strong, 2000, p123 for how solving the environmental sustainability problem had to include solving the poverty problem, in order to "persuade the developing countries to take part. ... The key concept called for a redefinition and expansion of the concept of environment to link it directly to the economic development process and the concerns of developing countries."

³⁶ The comic strip is the *Wizard of Id*, by Johnny Hart and Brant Parker, as republished in an article by the Warrior-Lawyer at <http://www.guerrillalaw.com/warriorlawyer.html>.

Chapter 5. Subproblem A – How to Overcome Change Resistance

³⁷ The sinister interest quote come from *Bentham's Handbook of Political Fallacies*, as revised and edited by Harold Larrabee, 1852, page xx.

³⁸ The Václav Havel quote is from cestazmeny.net/veracity-in-politics.html. Havel was famous for his essays, most particularly for his brilliant articulation of "Post-Totalitarianism," a term used to describe the modern social and political order that enabled people to "live within a lie". (This sentence is from the Wikipedia entry on Václav Havel.)

³⁹ The quote on fear is by George Gerbner, past dean emeritus of the University of Pennsylvania's Annenberg School for Communications, from an obituary in the Washington Post on January 2, 2006, at www.washingtonpost.com/wp-dyn/content/article/2006/01/02/AR2006010200577.html.

⁴⁰ The Frank Rich book review is from www.nytimes.com/2006/09/22/books/22book.html.

⁴¹ "They cannot tell a bigger truth" holds for the Boolean sense that something is either true or false. This allows the model to be a useful simplification of reality. Actually a bigger truth is possible if the quality of a statement is considered. For example, there may be many ways to balance the budget. Some will solve many problems, some will solve only a few, and some will cause more problems than they solve. Modeling this finer shade of behavior was not needed to analyze the particular problem under consideration.

⁴² The actual quote is "All power tends to corrupt and absolute power corrupts absolutely." Lord Acton. 1887. Letter to Mandell Creighton. From en.wikiquote.org/wiki/Lord_Acton.

⁴³ IPCC quote from: ww.ipcc.ch/publications_and_data/publications_and_data.htm.

⁴⁴ Al Gore, at the end of *An Inconvenient Truth*, says "We have everything that we need to reduce carbon emissions, everything but political will." But Al never uses the term "change resistance." It's a missing abstraction. It's not on his radar. If a concept like change resistance is not in your paradigm, then you can't do anything about it.

⁴⁵ The Herman Daly quote is from *2052: A Global Forecast for the Next Forty Years*, by Jorgen Randers, 2012, page 73.

⁴⁶ From *The Rise and Fall of Economic Growth*, by Heinz Arndt, 1978, Longman Cheshire.

⁴⁷ The widely cited definition of sustainable development is from *Our Common Future* (The Brundtland Report), World Commission on Environment and Development, 1987.

⁴⁸ *Ibid*, page xii.

⁴⁹ The quotation on the fundamental attribution error is from *Business Dynamics: Systems Thinking and Modeling for a Complex World*, by John Sterman, 2000, p28. McGraw-Hill. This book is a classic in systems thinking and feedback loop modeling. The book overflows with insights, principles, relevant examples to drive a point home, and all sorts of things needed for deep analysis of highly complex system problems.

Chapter 6. Subproblem C – How to Achieve Life Form Proper Coupling

⁵⁰ The entire *Left and Right in Global Politics* book is available online at:

<http://www.hiunpar.org/wp-content/uploads/2015/10/Left-and-Right-in-Global-Politics.EBOOKOID.pdf>

⁵¹ Source of quote about conservative versus liberal think tanks:

www.gih.org/newsletter2679/newsletter_show.htm?doc_id=329675. This was part of a presentation by Andrew Rich, assistant professor of political science at the City College of New York, and author of *The War of Ideas: Why Mainstream and Liberal Foundations and the Think Tanks They Support Are Losing in the War of Ideas in American Politics*, which appeared in the spring 2005 issue of the Stanford Social Innovation Review.

⁵² Quote from *Global Spin: The Corporate Assault on Environmentalism, Revised Edition*, by Sharon Beder, 2002, Chelsea Green, page 219.

⁵³ *Ibid*, page 1.

⁵⁴ Quote from *Global Inc. An Atlas of the Multinational Corporation*, by Gabel and Bruner, 2003, page vi.

⁵⁵ Quote from *The Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability*, by James Gustave Speth, 2008, pages 7 and 172.

⁵⁶ This raises a question: How can you tell whether a corporation is pursuing green behaviors just for better PR and to avoid being called anti-environmental, or because they are altruistic, and sincerely want to help solve the sustainability problem?

One way to answer this is to see if they are trying to find out when certain sustainability subproblems (like climate change and natural resource depletion) need to be solved by to avoid catastrophic collapse. If they are seeking out this data and using it to set their own targets of being 100% sustainable by those deadlines, then they are behaving responsibly. They are not a threat to the future health of the environment. But if they are setting impact reduction targets without regard to reducing their impact to a sustainable level in time to avoid collapse, then you can safely assume that those targets and actions are window dressing and greenwash, no matter how skillfully they are marketed as proof that corporation has climbed aboard the sustainability bandwagon.

⁵⁷ Source of quote: <http://trc.ucdavis.edu/catoft/EVE101/Lec8c1.htm>. Graph reconstructed from the one at marinebio.org/Oceans/Conservation/Moyle/ch7.asp.

⁵⁸ Image of three pillars of sustainability from the Wikipedia entry on sustainability. Later image of the environment and its two subsystems by Thwink.org.

⁵⁹ Emissions growth quote from www.globalcarbonproject.org/carbontrends/index.htm, retrieved March 14, 2009.

⁶⁰ For Earth Watch's attempts at corporate partnerships to promote sustainability, see *Corporate Partnerships* at <http://earthwatch.org/corporate-partnerships>.

⁶¹ The implicit system goal quote is from *The Fifth Discipline: The Art and Practice of the Learning Organization*, by Peter Senge, 1990, pages 85-88.

⁶² Quote from *Steady-State Economics – Second Edition*, by Harman Daly, 1991, Island Press.

Chapter 7. Subproblem C – How to Avoid Excessive Model Drift

⁶³ Dawkins quote from the first edition of *The Selfish Gene*, by Richard Dawkins, 1976. The quote is in the final chapter, titled *Memes: the New Replicators*, page 192, first edition.

⁶⁴ Regarding my changing majors “on the theory that if I could understand how people behaved I could understand the whole world better.” – It took me thirty years to realize why this was naive. Social system behavior is far more dependent on systemic factors than individual social agent factors. It is in systemic factors, like the nodes and loops in a system's structure, where root causes and high leverage points (and hence the deep understanding I was searching for) are far more likely to be found.

⁶⁵ A PDF of the *Limits to Growth*, 1972, has been graciously made available by the Club of Rome at <http://www.clubofrome.org/report/the-limits-to-growth>. The PDF is a scan of the book but the text is easily readable. The graph has been cleaned up by use of new text for better reading. “Resources” on the original graph has been replaced by “nonrenewable resources” for clarity.

⁶⁶ Causal loop diagram from *Dynamics of Growth in a Finite World*, by Meadows et al, 1974, page 11. This thick 637 page book was the technical companion to *Limits to Growth*. It explains the World3 model in complete and persuasive detail.

Chapter 9. Laying the Foundation for a Truth Literate Electorate

⁶⁷ Image of Archimedes from www.math.nyu.edu/~crrres/Archimedes/Lever/LeverIntro.html. Text about his quote from en.wikiquote.org/wiki/Archimedes with revisions. Quote by Plutarch from www.uz.ac.zw/science/math/zimaths/33/archimed.htm.

⁶⁸ “A lie repeated often enough becomes the truth” – Authorities differ on the source of this quote. Some say Vladimir Lenin and other say Joseph Goebbels. Since both sources exploited the principle embodied in the quote for monstrous destruction, either source will do.

⁶⁹ Quote is from *Bentham's Handbook of Political Fallacies*, as revised and edited by Harold Larrabee, 1852, page xii.

⁷⁰ *Ibid*, page 232.

⁷¹ *Ibid*, page vii.

⁷² *Ibid*, pages vi-vii.

⁷³ Ibid, page xxi.

⁷⁴ Ibid, page V.

⁷⁵ The Cameron quote is from *Cameron Accuses EU Leave Campaigners of Telling Six Lies*, The Guardian, June 7, 2016, <http://www.theguardian.com/politics/2016/jun/07/cameron-accuses-eu-leave-campaigners-six-lies-brexit>.

⁷⁶ The article about Julian Burnside is from The Age, an Australian newspaper, at: www.theage.com.au/news/national/pollie-graph-idea-to-stamp-out-porkies/2007/05/14/1178995076746.html.

⁷⁷ How the Brexit Campaign Lied to Us—and Got Away with It, published in the New Statesman, June 30, 2016, <http://www.newstatesman.com/politics/uk/2016/06/how-brexit-campaign-lied-us-and-got-away-it>.

⁷⁸ From *Ad hominem politics*, by Kate Hardiman, November 2, 2015, The Observer, <http://ndsmcobserver.com/2015/11/ad-hominem-politics>.

⁷⁹ Ibid page 211 and 212.

⁸⁰ From *Donald Trump and the politics of paranoia*, by Michael Goldfarb, BBC News Magazine, January 24, 2016, <http://www.bbc.com/news/magazine-35382599>.

⁸¹ The quote about cherry picking is from *Neil deGrasse Tyson's Warning For Politicians Who 'Cherry-Pick' Science*, by Ryan Buxton, August 28, 2015, Science, The Huffington Post, http://www.huffingtonpost.com/entry/neil-degrasse-tyson-politicians-science_us_55df6b11e4b0e7117ba94207.

⁸² Source: archives.cnn.com/2001/US/11/06/ret.bush.coalition/index.html.

⁸³ Source: en.wikipedia.org/wiki/You're_either_with_us,_or_against_us.

⁸⁴ From *Two Forms of the Straw Man*, by Robert Talisse and Scott Aikin, Argumentation, 2006, www.academia.edu/download/29038287/Aikin-Talisse_Straw_Man.pdf.

⁸⁵ The article with the quote on “truth predictor software” is from Eaglesham, Jean. 2006. *Politicians yet to realize impact of internet, warns Google chief*. Financial Times, October 4, 2006. See www.ft.com/cms/s/06adcbee-5345-11db-99c5-0000779e2340.html.

⁸⁶ Image from <http://www.politifact.com/personalities/hillary-clinton>.

⁸⁷ The “Choosing claims to check” quote is from: <http://www.politifact.com/truth-o-meter/article/2013/nov/01/principles-politifact-punditfact-and-truth-o-meter>.

⁸⁸ Quote from *All Politicians Lie. Some Lie More Than Others.*, by Angie Holan, December 11, 2015, New York Times, <http://www.nytimes.com/2015/12/13/opinion/campaign-stops/all-politicians-lie-some-lie-more-than-others.html>.

⁸⁹ Ibid.

⁹⁰ Source of testimony on corporate bond ratings: hsgac.senate.gov/032002lieberman.htm.

Chapter 11. General Mechanisms for Raising Ability to Detect Political Deception

⁹¹ Source of table on Bhutan’s Gross National Happiness Index weights: <http://sevenpillarsinstitute.org/wp-content/uploads/2015/11/Bhutan-GNH-EDITED.pdf>.

- ⁹² *An Analysis of Bhutan's Gross National Happiness* is available at: <http://sevenpillarsinstitute.org/wp-content/uploads/2015/11/Bhutan-GNH-EDITED.pdf>.
- ⁹³ Source of the OECD's 35 member states account for 63% of world GDP: <http://usoecd.usmission.gov/mission/overview.html>. Accessed July 15, 2016.
- ⁹⁴ The OECD's Better Life Index announcement remarks may be found at: <http://www.oecd.org/social/yourbetterlifeindex.htm>.
- ⁹⁵ The OECD Better Life Index is at: <http://www.oecdbetterlifeindex.org>. The illustrations used in this chapter were prepared in early July 2016.
- ⁹⁶ The requirement for nonrenewable resources comes from Herman Daly's statement long ago, that "For nonrenewable resources the depletion of the nonrenewable resources should require comparable development of renewable substitutes for that resource." Source: Daly, H. E. 1990. *Toward some operational principles of sustainable development*. *Ecological Economics* 2:1–6.
- ⁹⁷ From *Kyoto climate change treaty sputters to a sorry end*, by Max Paris, December 31, 2012, CBC News, <http://www.cbc.ca/news/politics/kyoto-climate-change-treaty-sputters-to-a-sorry-end-1.1184986>.
- ⁹⁸ From *Paris climate talks were a noble failure*, by Eric Reguly, December 18, 2015, The Globe and Mail, <http://www.theglobeandmail.com/report-on-business/rob-commentary/paris-climate-talks-were-a-noble-failure/article27859263>.
- ⁹⁹ See *Roger Revelle's Discovery*, by Spencer Weart, July 2007, for Revelle's role in *The Discovery of Global Warming*, at: <https://www.aip.org/history/climate/Revelle.htm>.
- ¹⁰⁰ The 20 year estimate comes from a variety of sources, such as *Earth Will Cross the Climate Danger Threshold by 2036*, by Michael Mann, April 1, 2014, *Scientific American*, <http://www.scientificamerican.com/article/earth-will-cross-the-climate-danger-threshold-by-2036>.
- ¹⁰¹ Regarding most scientists doubt the 2 degree target is realistic. For example, see *A scientific critique of the two-degree climate change target*, by Knutti and others, *Nature Geoscience*, 2015.
- ¹⁰² The "patiently unrealistic" and "obviously unattainable" quote is from *The magic number Holding warming under two degrees Celsius is the goal. But is it still attainable?*, by Chris Mooney, November 29, 2015, *The Washington Post*, <http://www.washingtonpost.com/sf/national/2015/11/29/carbon>.
- ¹⁰³ For the 4 degree catastrophe level of climate change, see the above two sources.
- ¹⁰⁴ Source of graph is *The magic number* article above.
- ¹⁰⁵ PR extraction graph from *A half-century of global phosphorus flows, stocks, production, consumption, recycling, and environmental impacts*, Minpeng Chena and T.E. Graedelb, 2016, *Global Environmental Change*, using data to 2013. Scenario added by Thwink.org.
- ¹⁰⁶ Information on the Global TraPs project is from <http://www.globaltraps.ch> and *Sustainable use of phosphorus: A finite resource*, by Scholz and others, 2013, *Science of the Total Environment*.
- ¹⁰⁷ The 8,041 Mt data is from Chena and Braedelb, above.

¹⁰⁸ The 40 years to peak phosphorous estimate is from *The story of phosphorus: Global food security and food for thought*, by Dana Cordell and others, 2009, Global Environmental Change.

¹⁰⁹ Overall deforestation rate data from *World Forest Area Still on the Decline*, by Emily Adams, August 31, 2012, Earth Policy Institute, <http://www.earth-policy.org/indicators/C56>.

¹¹⁰ Tropical deforestation rates are from <http://www.scientificamerican.com/article/earth-talks-daily-destruction>.

¹¹¹ Jakarta meeting quote from <http://www.fao.org/docrep/meeting/011/ag398e/ag398e12.htm>.

¹¹² These FAO quotes are from <http://www.fao.org/about/en> on July 24, 2016.

¹¹³ The World and USA data is from the *Ecological Footprint and Biocapacity, 2007* Excel spreadsheet from www.footprintnetwork.org/en/index.php/GFN/page/ecological_footprint_atlas_2008. This lists footprints per nation and the world in terms of global hectares per capita. The world's footprint is 2.7 and its total biocapacity is 1.8. Thus its number of planets used ratio is $2.7 / 1.8 = 1.50$. The United States footprint is 8.0 and its total biocapacity is 3.9. Thus its number of planets used ratio is $8.0 / 3.9 = 2.05$.

The World and USA data is from *Ecological Footprint of Nations 2005 Update*, at www.ecologicalfootprint.org/pdf/Footprint%20of%20Nations%202005.pdf on June 9, 2007. For the world, $21.91 / 15.71 = 139\%$. For the USA $108.95 / 20.37 = 535\%$.

Chapter 12. The Rise to Dominance of *Corporatis profitis*

¹¹⁴ A dummy endnote for chapter on The Rise to Dominance

Chapter 13. Moving Capitalism from Corporation 1.0 to 2.0

¹¹⁵ Extract from *Thinking in Systems: A Primer*, by Donella Meadows, 2008, Chelsea Green, page 111, 112, and 138.

¹¹⁶ The Wilson paper is from: faculty.smu.edu/jmwilson. As of January 17, 2012 it had 7 citations.

¹¹⁷ Image of Anthora coffee cup from www.krudmart.com/anthora-ceramic-coffee-cup.html. Idea and wording fragments from www.nytimes.com/2010/04/30/nyregion/30buck.html?hp.

¹¹⁸ Quote on design of corporation from *The Divine Right of Capital: Dethroning the Corporate Aristocracy*, by Marjorie Kelly, 2001, p129.

¹¹⁹ See *Unequal Protection: The Rise of Corporate Dominance and the Theft of Human Rights*, by Thom Hartman, 2002, chapter 5: *The Early Role of Corporations in America*.

¹²⁰ For a “conceptual analysis” of a general “sustainable quality of life” index see *Sustainability quality of life: Conceptual analysis for a policy-relevant empirical specification* by Robeyns, I. and R. J. van der Veen. 2007. Netherlands Environmental Assessment Agency. See www.pbl.nl/en/publications/2007/Sustainablequalityoflife.html.

¹²¹ The non-eligible portion might go to areas like public costs for the index program, helping those hurt by that company's low level of performance, R&D on proper practices, assistance to firms in developing countries, etc. Negative or low indexes would serve as a survival of the fittest gate. Over 100% might lead to awards, a share of the non-eligible portion of other

corporations, a “surplus fund” to offset future shortfalls, etc. Perverse incentives must be avoided.

Corporate servant indexes would be included in advertisements and printed on product packaging and literature, so that customers could make more informed decisions. This is a critical new feedback loop.

¹²² “A recent survey of empirical applications shows that at present, no scholar even has worked out the theoretical foundations of a capability-index of life quality, let alone engaged in the work of operationalizing and testing empirically such a quality index. Thus in the prevailing state of the art, developing a capability-index is a pioneering task.” (Robeyns, 2007, p. 57) But so was inventing modern democracy.

Index calculation is complex, potentially expensive, and fraught with subjective opinion. The index as described may be unworkable. Thus the index and other changes are intended only as a placeholder example. But if we keep it simple at first, there is a way forward.

¹²³ See *The Triple Bottom Line* by Andrew Savitz, 2006. Published by Jossey-Bass.

¹²⁴ About replacing profit maximization: Please don’t interpret this to mean we are saying profits are bad. In a modern economy, corporate profits are as necessary as the people profits employees make from selling their labor. It is only the blind or overly selfish pursuit of profit that is harmful.

¹²⁵ The five characteristics of the modern corporation are from en.wikipedia.org/wiki/Corporate_law. These are credited to Professors Hansmann of Yale University and Kraakman of Harvard University, published in *The End of History for Corporate Law?*, 2001, 89 *Georgetown Law Journal* p439-443.

¹²⁶ Summary of a B corp from *A Scorecard for Companies With a Conscience*, by Tina Rosenberg, April 11, 2011, *New York Time*. See <http://opinionator.blogs.nytimes.com/2011/04/11/a-scorecard-for-companies-with-a-conscience/?hp> for the article. See www.bcorporation.net for much more.

¹²⁷ Philippine ad from *When Corporations Rule the World*, by David Korten, 2001, p161,

¹²⁸ WTO quote from *ibid*, p167.

¹²⁹ Stock market image from online *The New York Times*, May 4, 2010.

¹³⁰ Quote about common stock from *The Divine Right of Capitol: Dethroning the Corporate Aristocracy*, by Marjorie Kelly, 2001, page 2.

¹³¹ List of Nobel prizewinners used is en.wikipedia.org/wiki/List_of_Nobel_laureates.

¹³² Credit union quote from en.wikipedia.org/wiki/Credit_union.

¹³³ Table data from articles.moneycentral.msn.com/Banking/BetterBanking/DitchYourBankForACreditUnion.aspx. Source: Datatrac, December 2008.

¹³⁴ From *An appraisal of cooperative banks versus plc banks*, by Ory and Lemzeri, 2007. See: www.eurocoopbanks.coop/GetDocument.aspx?id=68b68723-ebe0-4fd6-8cda-8c569c46a3ff.

¹³⁵ The long quote is from *The Mondragon Experiment*, by Greg MacLeod, 2008, *The Harvard International Review*, hir.harvard.edu/index.php?page=article&id=1855.

¹³⁶ Quote from *Mondragon Cooperative Corporation: An Introduction*, by F. Freundlich, 1988.

¹³⁷ Quote on speculation, gambling, and investment from *The Divine Right of Capital: Dethroning the Corporate Aristocracy*, by Marjorie Kelly, 2001, p33.

Chapter 14. Raising Quality of Political Decisions with the Right Feedback Loop

¹³⁸ Later even a 5% favoritism rating will be too high, as structures are built that cause a zero tolerance to corruption. This will cause favoritism to fall to zero.

Chapter 15. The Basic Concept of Common Property Rights

¹³⁹ Definition of private property from: www.businessdictionary.com/definition/private-property.html.

¹⁴⁰ Quote about Hobbes from *The Political Institution of Private Property* by Itai Sened, 2008, p15.

¹⁴¹ Ibid, p18-20.

¹⁴² Ronald H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959).

¹⁴³ "The Industrial Age became a colossal wreck." The last two words come from Percy Bysshe Shelley's *Ozymandias*, published in 1818. The poem was inspired by the inscription on the base of a large statue of Ramesses the Great, Pharaoh of the 19th dynasty of ancient Egypt, 1298 to 1187 BC. The inscription translates as "King of Kings am I, Ozymandias. If anyone would know how great I am and where I lie, let him surpass one of my works."

OZYMANDIAS

I met a traveller from an antique land
 Who said: Two vast and trunkless legs of stone
 Stand in the desert. Near them, on the sand,
 Half sunk, a shattered visage lies, whose frown
 And wrinkled lip, and sneer of cold command
 Tell that its sculptor well those passions read
 Which yet survive, stamped on these lifeless things,
 The hand that mocked them and the heart that fed.

And on the pedestal these words appear:
 "My name is Ozymandias, king of kings:
 Look on my works, ye Mighty, and despair!"
 Nothing beside remains. Round the decay
 Of that colossal wreck, boundless and bare
 The lone and level sands stretch far away.

¹⁴⁴ Horse and wagon image from public-domain.zorger.com/samantha-at-the-worlds-fair/horse-drawn-wagon-full-of-supplies-boxes-of-bibles-missionary-pen-ink-drawing.php. The pen and ink drawing is from *Samantha at the World's Fair* by Marietta Holley, 1893. Illustrations are by Baron C. de Grimm. It shows a horse drawn wagon full of supplies with boxes of bibles and barrels of whiskey driven by a missionary. The book was a satire.

Chapter 16. Solving the Tragedy of the Commons

¹⁴⁵ A full copy of Hardin's classic and endlessly controversial essay, *The Tragedy of the Commons*, may be found at www.sciencemag.org/content/162/3859/1243.full.

Chapter 17. Why the Solution Must Be Generic and Efficient

¹⁴⁶ The *Global Environmental Outlook 2000* is available at www.unep.org/geo2000. This contains the Scientific Committee on Problems of the Environment (SCOPE) study on page 339.

¹⁴⁷ Source of 92 watersheds statistic: *Fact Sheet for Chesapeake Bay TMDLs*, available at: www.epa.gov/reg3wapd/pdf/pdf_chesbay/BayTMDLFactSheet8_6.pdf.

¹⁴⁸ Source of 818 watersheds statistic: www.usgs.gov/newsroom/article.asp?ID=2181.

¹⁴⁹ Source of number of types of toxic chemicals: www.unep.org/ceh/ch03.html#j2.

¹⁵⁰ Source of 2.8 million or more species threatened with extinction: www.en.wikipedia.org/wiki/Species#Numbers_of_species lists the total number of species as 7 to 100 million. www.en.wikipedia.org/wiki/Endangered_species states that "The International Union for Conservation of Nature (IUCN) has calculated the percentage of endangered species as 40 percent of all organisms based on the sample of species that have been evaluated through 2006." 40 percent times 7 million equals 2.8 million.

¹⁵¹ Stern quote from *Achieving Sustainable Development and Promoting Development Cooperation*, United Nations, 2008, the section on *Towards a Global Deal on Climate Change* by Lord Stern of Brentford, page 23.

Chapter 18. How the Seven Components Work Individually

¹⁵² The definition of stewardship is from Merriam-Webster's 11th Collegiate Dictionary.

¹⁵³ Definition of steward from The Collaborative International Dictionary of English v.0.48, available at: www.dictionary.net/steward.

¹⁵⁴ US EPA stewardship quote from: www.epa.gov/stewardship.

¹⁵⁵ Available at <http://lwa.gov.au/files/products/innovation/pn22135/pn22135.pdf>.

¹⁵⁶ Definition of utility from en.wikipedia.org/wiki/Public_utility.

¹⁵⁷ Definition of ecosystem services from en.wikipedia.org/wiki/Ecosystem_services.

¹⁵⁸ Source of conventional wisdom that technology standards (C&C) are the best solution for small pollution sources: *Markets and the Environment*, by Keohane and Olmstead, 2007, p178.

Chapter 19. How the Seven Components Work Together as a System

¹⁵⁹ Quote from *Business Dynamics: Systems Thinking and Modeling for a Complex World*, by John Sterman, 2000, page 268. John is director of MIT's system dynamics group.

Chapter 20. Sample Legislation

¹⁶⁰ Source of nitrogen limit: www.water-research.net/nitrate.htm. The US EPA's actual drinking water limit for nitrate-nitrogen concentration is 10 mg/liter. The sample target is less than that to allow for a safety buffer, called a "danger zone" on the fee graph.

Chapter 21. Questions about Common Property Rights

¹⁶¹ Definition of communism from *Webster's Encyclopedic Unabridged Dictionary*, 1989.

¹⁶² The description of the per capita cap-and-trade solution is from *Economics and the Environment*, by Eban Goodstein, 2008, page 15. Note how this solution focuses on solving the global poverty problem by giving it as much priority as the climate change problem, when in fact the latter deserves much higher priority. While well intentioned, this causes the trap of sub-optimization and unintended consequences. Problem solvers need to consider the system as a whole and proper problem priority when designing solutions.

¹⁶³ This wording of Occam's razor is from en.wikipedia.org/wiki/Occam%27s_razor. See www.phys.ncku.edu.tw/mirrors/physicsfaq/General/occam.html for a thoughtful essay on this timeless principle. The essay points out that:

Occam's razor is often cited in stronger forms than Occam intended, as in the following statements. . .

"If you have two theories that both explain the observed facts, then you should use the simplest until more evidence comes along."

"The simplest explanation for some phenomenon is more likely to be accurate than more complicated explanations."

"If you have two equally likely solutions to a problem, choose the simplest."

"The explanation requiring the fewest assumptions is most likely to be correct."

...or in the only form that takes its own advice: "Keep things simple!"

Chapter 22. Striking Where Change Resistance Is Low

¹⁶⁴ Dummy endnote.

¹⁶⁵ The brick wall of change resistance appears in *Cracking the Mystery of the Progressive Paradox*, a full length film, available for free download at www.thwink.org/sustain/videos/FilmSeries/index.htm.

Chapter 23. Moving Forward with Evolutionary Nudges

¹⁶⁶ The story of tapping with a hammer is widely available on the internet. I've read several versions of it and am unable to find the one I based this version on. That's the way it is with urban legends.

¹⁶⁷ The concept of birthing the new field of Social System Evolutionary Engineering arose in a two-day work session with Montserrat Koloffon, Michael Hoefler, and Jack Harich on March 2 and 3, 2019 in Atlanta. The chief insight from the weekend was the principle that "*Social systems are not designed. They evolve.*"

¹⁶⁸ The definition of nudge comes from the Wikipedia entry for nudge theory, at https://en.wikipedia.org/wiki/Nudge_theory.

¹⁶⁹ Passage from en.wikipedia.org/wiki/Allegory_of_the_cave. Image from commons.wikimedia.org/wiki/File:Platon_Cave_Sanraedam_1604.jpg. Engraving of Jan Saenredam (1565-1607) after a painting of Cornelis Corneliszoon van Haarlem (1562-1638).

¹⁷⁰ Quote from the 1960 edition of *Looking Backward: 2000-1887*, by Edward Bellamy. The quote is in the forward by Erich Fromm, p vi.

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