Boundless Pragmatism, An Invariant View of Deciding Well

Change Archive for 2012

Changes in Version 2012.01.11

Preface, last paragraph, end

Added the following sentences:

"In his theory of invariance ("relativity theory"), Einstein takes a four-dimensional ("space-time") view of physics. Similarly, I take a four-dimensional ("reasonably-complete") view of deciding well. In doing so, I overcome the limits of logic with the beauty that emerges from the symmetry of pursuing the timeless end of deciding well."

Chapter 1, *The Need for Timeless Frames*, third paragraph, footnote

"[11] In his theory of invariance ("relativity theory"), Einstein has us view physics from a four-dimensional ("space-time") frame. As we shall see, the boundlessly pragmatic approach to deciding well put forth in this work has us view the process of refining everyday thinking ("the whole of science") from a four-dimensional ("reasonably-complete") frame, which uses a concept of reason that transcends logic. We base the super-logical part of this reason not on the intuition that Kurt Gödel failed to prove exists, but rather on the symmetry of pursuing the timeless end of deciding well."

was deleted.

Chapter 3, end

Added the section:

"**Overcoming the Limits of Logic**
From the multiple-frame view, all models for believing well contain the belief that we will never know the true meaning of the timeless end of believing well (the Truth). If a model for believing well contains this meaning, it is complete, but logically inconsistent. If it does not contain this meaning, it is logically consistent, but incomplete. Hence, no model for believing well can be both logically consistent and complete. If we are to believe well, we need to judge why we believe as we do using not only logic, but also the beauty that emerges from deciding well."

Chapter 3, The Elephant in the Room, third paragraph

Changed "Life flourishes" to "As people, we flourish" in the fourth sentence.

Changed "As people, we" to "We" in the fifth sentence.

Changed "and so for" to "which includes" in the last sentence.

Chapter 4, *Self-Similarity*, first paragraph, last sentence

"This ignorance includes not only uncertainty in prediction, but also incompleteness in explanation of causation."

was changed to:

"This ignorance includes not only poor predictions, but also poor explanations of causation."

Chapter 6, *Heroic Death*, second paragraph, last sentence

"Leaders who ritualize heroic death are either fools locked into myopic frames or knaves using others to help them pursue their myopic ends."

was deleted.

Chapter 6, A Common Timeless End, last paragraph

Changed "multiplex view" to "boundlessly pragmatic view put forth in this work" in the second sentence.

Chapter 7, *A Revolutionary Anomaly*, title

Changed title to "*An Extraordinary Anomaly*."

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote, third through last sentences

"For this universal model to be logically complete, it must apply to itself. For it to apply to itself, it must be a less than perfect approximation of itself, which is a logical contradiction. Boyd addressed this problem by embracing a pragmatic approach to believing well based on what we currently believe we know about the world. We see this modern sophistry most clearly in his essay, *Destruction and Creation*."

were changed to:

"Regrettably, he based this model on modern explanations of evolution, thermodynamics, quantum mechanics, and Gödel's incompleteness theorems. We see the resulting sophistry most clearly in his essay, *Destruction and Creation*."

Chapter 8, Useful Reasoning, first paragraph, last three sentences

"This ignorance takes the form of uncertain predictions and incomplete explanations of causation. Uncertainty in predictions hinders us from solving given problems well. Incompleteness in explanations hinders us from finding the best problems to solve."

were changed to:

"This ignorance takes the form of poor predictions and explanations of causation. Poor predictions hinder us from solving given problems well. Poor explanations hinder us from finding the best problems to solve."

Chapter 8, Useful Reasoning, fourth paragraph

Changed "these timeless ends" to "timeless ends" in the last sentence.

Chapter 8, Complete Reasoning, first paragraph

"We may call a process of reasoning that contains a self-referential means of refining itself, which is to say a process of reasoning that contains a means of refining itself that contains a means of refining itself that contains a means of refining itself..., *reasonably complete*. So conceived, the reason of deciding well using the multiple-frame approach to pursuing Wisdom is reasonably complete. It helps us think about not only conflicts but also holes in our belief systems.[4]"

"[4] Consider the holism of W. V. O. Quine. From Quine's view, *the philosophy of science is philosophy enough*. Our concept of completeness concerns the supply side of the market for tools for helping us *believe* well. We see conflicts in our belief systems. Now consider the holism of the multiple-frame approach to pursuing Wisdom. From the multiplex view, *the philosophy of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of pursuing Wisdom*. Our concept of completeness concerns the demand as well as the supply side of the market for tools for helping us *decide* well. We see holes as well as conflicts in our belief systems. Further, we believe that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element."

was changed to:

"We may call a truly boundless (hence self-referential) process of reasoning, a process of reasoning that effectively contains a means of refining itself that contains a means of refining itself that contains a means of refining itself..., *reasonably complete*.[4] So conceived, the reason of deciding well using the multiple-frame approach to pursuing Wisdom is reasonably complete. It helps us find not only conflicts but also holes in our belief systems.[5]"

"[4] Modern reasoning concerns the rules we use to bind beliefs together into coherent models of the world. In contrast, *reasonably complete* reasoning concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel, *Contact*, the person who discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of zero public entropy."

"[5] Consider the holism of W. V. O. Quine. From Quine's view, *the philosophy of science is philosophy enough*. Our concept of completeness concerns the supply side of the market for tools for helping us *believe* well. We see conflicts in our belief systems. Now consider the holism of the multiple-frame approach to pursuing Wisdom. From the multiplex view, *the philosophy of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of pursuing Wisdom*. Our concept of completeness concerns the demand as well as the supply side of the market for tools for helping us *decide* well. We see holes as well as conflicts in our belief systems. Further, we believe that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element."

Chapter 8, Natural Reasoning, first paragraph, footnote, end

Added the following:

"*Deciding well calls for us to distinguish between tools for knowing our needs and tools for knowing how best to satisfy them.*"

Changes in Version 2012.01.14

Preface, third paragraph

Changed "inasmuch as" to "when" in the first sentence.

Chapter 1, *The Need for Timeless Frames*, title

Changed title to "*Seeing Through Apparent Miracles*."

Chapter 3, *Overcoming Constraints in Pursuing Wisdom*, second paragraph

Changed "computing π to any number of decimal places" to "computing π" in the last sentence.

Chapter 3, A Common Timeless End, last paragraph

Changed "multiplex view" to "boundlessly pragmatic view put forth in this work" in the second sentence.

Chapter 8, Complete Reasoning, first paragraph, first footnote, third sentence

Inserted the sentence:

"To the extent that writing gave rise to modern reasoning, object-oriented computer programming gave rise to *reasonably complete* reasoning."

Chapter 8, Natural Reasoning, first paragraph, footnote, last three sentences

"From the holistic view of this work, it is clear that this process is deciding well. These distributions are the result of people deciding to act based on what they currently believe. *Deciding well calls for us to distinguish between tools for knowing our needs and tools for knowing how best to satisfy them.*"

were changed to:

"From the holistic view of this work, it is clear that these distributions are the result of people deciding to act based on what they currently believe. Over time, people collectively learn to decide well using the multiple-frame approach to deciding well, which calls for distinguishing between tools for knowing our needs and tools for knowing how best to satisfy them."

Changes in Version 2012.01.18

Acknowledgments, second paragraph, second to last sentence

Inserted the sentence:

"I did not realize that I had stumbled into a problem that exceeded the limits of logic, the economic equivalent of Georg Cantor's continuum hypothesis."

Chapter 1, Values, second paragraph

Changed "the timeless end of living well *the Good*, the timeless end of believing well *the Truth*, and the timeless end of living and working together well *Justice*" to "the timeless end of believing well *the Truth*, and the timeless end of living well *the Good*" in the second sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, third paragraph

Changed "changing our concept of Wisdom" to "profound changes to our current beliefs about how best to pursue Wisdom" in the first sentence.

Changed "finding problems to solve in pursuing Wisdom that involve changing our concept of Wisdom" to "finding such problems" in the first sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, last paragraph

Changed "this multiple-frame approach to deciding well" to "it" in the last sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, third and fourth paragraphs

"Pursuing the boundless factors of pursuing Wisdom also calls for us to work well with others, including people separated from us by great distances and long periods. We may call the timeless end of living and working together well, which is also the timeless end of cooperating well and the timeless end of governing ourselves well, *Justice*. Adding the frame of pursuing Justice to our multiple-frame model of pursuing Wisdom provides us with another way to judge problems to solve in pursuing Wisdom.

"The ancient Chinese provide us with a template for working together over great distances and long periods: "The debts that we owe to our ancestors we pay to our descendants." Applying this template to people pursuing Wisdom, we can work well across great distances and long periods with the universal moral rule: "The debts we cannot pay to whom they are due we pay to others by pursuing Wisdom." This includes the debts that we owe to those who provided us with the knowledge that we use freely."

were changed to:

"Pursuing the boundless factors of pursuing Wisdom also calls for us to work well with others, including people separated from us by great distances and long periods. The ancient Chinese provide us with a template for working together over great distances and long periods: "The debts that we owe to our ancestors we pay to our descendants." Applying this template to people pursuing Wisdom, we can work well across great distances and long periods with the universal moral rule: "The debts we cannot pay to whom they are due we pay to others by pursuing Wisdom." This includes the debts that we owe to those who provided us with the knowledge that we use freely. We may call the timeless end of living and working together well, which is also the timeless end of cooperating well and the timeless end of governing ourselves well, *Justice*. So conceived, Justice is a boundless factor of pursuing Wisdom."

Chapter 1, *Invariant Values*, first paragraph

Changed "Justice, Beauty," to "Beauty, Justice," in the third sentence.

Chapter 3, *Overcoming Constraints in Pursuing Wisdom*, second paragraph

Changed "an abstract computing machine that does nothing more than follow programmed rules" to "a Turing machine, an abstract computing machine that does nothing more than follow programmed rules," in the first sentence.

Chapter 3, *Overcoming Constraints in Pursuing Wisdom*, fourth paragraph

Changed "trillion squared (10^{24})" to "sextillion (10^{21})" in the first sentence.

Chapter 3, *Overcoming Constraints in Pursuing Wisdom*, last paragraph

Changed "trillion squared" to "sextillion" in the second sentence.

Chapter 3, *Public Entropy*, second paragraph

Changed "live" to "decide" in the first sentence.

Moved footnote from the end of the first sentence to the end of the paragraph.

Chapter 3, *Public Entropy*, last paragraph

Moved paragraph to the beginning of the next subsection, *Decision-Oriented Interpretations of Quantum Mechanics*.

Appendix, *Folding in Processes*, title

Changed title to "*Folding in Production Processes*."

Changes in Version 2012.01.19

Chapter 1, *Ever More Complete Multiple-Frame Models*, fourth paragraph, fourth sentence

Added the footnote:

"[14] In his most famous work (*A Theory of Justice*, Cambridge, MA: The Belknap Press of Harvard University, 1971), John Rawls provides us with a technique that confirms this Kantian bargain. He asks us to imagine what we should choose if we were ignorant of the circumstances of our birth. For this imagined original position of ignorance to produce a *completely just* end, we must consider what end we should want people to pursue if we were *completely ignorant* of the circumstances of our birth, which includes ignorance of that species we will be and into what era we will be born. From behind this veil of complete ignorance, we should want all people to decide well using the multiple-frame approach to pursuing Wisdom."

Chapter 2, Profit, first paragraph

Changed "temporal view" to "temporal view of modern economics" in the first sentence.

Changed "view" to "temporal view" in the first sentence of the footnote.

Chapter 6, *Schweitzer's Universal Spiritual Need*, last paragraph

"Twentieth-century philosopher John Rawls provides us with a technique that appears to confirm the justice of revering life well. This technique calls for us to imagine what we should choose if we were ignorant of the circumstances of our birth.[7] For this imagined original position of ignorance to produce a *completely just* end, we must consider what end we should want people to pursue if we were *completely ignorant* of the circumstances of our birth, which

includes ignorance of that species we will be and into what era we will be born. From behind this veil of complete ignorance, we should want all people to pursue the timeless end of revering life well."

"[7] Rawls, John, *A Theory of Justice* (Cambridge, MA: The Belknap Press of Harvard University, 1971), chapter III."

was deleted.

Chapter 6, Experiencing the Mysterious, last paragraph, footnote

"Compare this claim to Maslow's modern Western belief that" to: "From Maslow's view" in the first sentence.

Changes in Version 2012.01.24

Entire work

Changed "boundless factors of pursuing Wisdom" to "boundless factors of deciding well" in all (13 occurrences).

Changed "boundless factor of pursuing Wisdom" to "boundless factor of deciding well" in all (3 occurrences).

Changed "symmetry of pursuing Wisdom" to "symmetry of deciding well" in all (3 occurrences).

Changed "this multiple-frame approach to pursuing Wisdom" to "this multiple-frame approach to deciding well" in all (2 occurrences).

Changed "by deciding well using the multiple-frame approach to pursuing Wisdom" to "by deciding well" in all (3 occurrences).

Changed "well using the multiple-frame approach to pursuing Wisdom" to "well using the multiple-frame approach" in all (9 occurrences).

Changed "the multiple-frame approach to pursuing Wisdom" to "the multiple-frame approach to deciding well" in all (10 occurrences).

Changed "our multiple-frame model of pursuing Wisdom" to "our model" in all (2 occurrences).

Changed "a multiple-frame model of pursuing Wisdom" to "a multiple-frame model of deciding well" in all (1 occurrence).

Changed "multiple-frame models of pursuing Wisdom" to "multiple-frame models of deciding well" in all (2 occurrences).

Acknowledgments, second paragraph

Changed "a problem that exceeded the limits of logic, the" to "the modern" in the ninth sentence.

Preface, fifth paragraph

Changed "decide well using" to "use" in the last sentence.

Changed "boundless factors of deciding well" to "pursuits of boundless factors of deciding well" in the last sentence.

Preface, last paragraph

Changed "from the symmetry of pursuing the timeless end of deciding well" to "deciding well" in the last sentence.

Chapter 1, Choosing Frames Well, last paragraph, footnote

Changed "pursuing the timeless end of deciding well" to "deciding well" in the second sentence.

Chapter 1, Choosing Frames Well, last paragraph, footnote, seventh and eighth sentences

"Kurt Gödel later drove himself insane trying to prove whether it was true, false, or undecidable. From the view of this work, the relevant questions are whether the approach to mathematics in which the continuum hypothesis is true has a place in pursuing the timeless end of deciding well and whether the approach to mathematics in which the continuum hypothesis is false has a place in pursuing this timeless end."

was changed to:

"Paul Cohen later showed that there exist approaches to mathematics in which the continuum hypothesis is true and other approaches in which it is false. From the view of this work, the relevant question is whether these approaches are useful in deciding well."

Chapter 1, Values, last paragraph, third sentence

"In short, there exists a virtuous circle between pursuing Wisdom and pursuing the Truth."

was changed to:

"In other words, there exists a virtuous circle between deciding well and believing well."

Chapter 1, *Steps for Building Multiple-Frame Models*, third paragraph, first three sentences

"The tautological way in which we define the timeless end of pursuing Wisdom makes this single-frame model useless as a tool for helping us find problems to solve in pursuing Wisdom that involve profound changes to our current beliefs about how best to pursue Wisdom. To make this model useful in finding such problems, we need to add frames to it. We can begin by adding a frame for pursuing the Truth."

were changed to:

"The tautological way in which we define Wisdom and deciding well makes this single-frame model useless as a tool for helping us find problems to solve in deciding well that involve profound changes to our current beliefs about how best to decide well. To make this model useful in finding such problems, we need to add frames to it. We can begin by adding a frame for believing well."

Chapter 1, *Steps for Building Multiple-Frame Models*, fourth paragraph, third through last sentences

"The better we pursue Wisdom and pursue the Truth, the more tightly these pursuits intertwine. If we pursued both of these timeless ends perfectly, they would be the same pursuit. Regrettably, we lack the knowledge of how to think perfectly across frames. Because we lack this knowledge, it useful for us to think of pursuing Wisdom and the Truth as separate pursuits, each subject to its own set of problems."

were changed to:

"The better we pursue these two timeless ends, the more tightly these pursuits intertwine. If we pursued both perfectly, they would be the same pursuit. Because we lack the knowledge of how to think logically across frames that do not share the same timeless end, it useful for us to think of them as separate pursuits, each subject to its own set of problems."

Chapter 1, *Steps for Building Multiple-Frame Models*, last paragraph

Changed "pursuing Wisdom and pursuing the Truth" to "deciding well and believing well" in the first sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph

Changed "pursuing the Good" to "living well" in the fourth sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, second paragraph, first two sentences

"Pursuing the boundless factors of deciding well calls for us to fit our beliefs together into a coherent whole based on the symmetry of deciding well. We may call the process of thinking

deeply about how our beliefs fit together into a coherent whole based on the symmetry of deciding well *contemplating well* and the timeless end of contemplating well *Beauty*."

were changed to:

"Deciding well calls for us to fit our beliefs together based on the symmetry of deciding well. We may call the process of thinking deeply about this task *contemplating well* and the timeless end of contemplating well *Beauty*."

Chapter 1, *Ever More Complete Multiple-Frame Models*, third paragraph, third sentence

"Applying this template to people pursuing Wisdom, we can work well across great distances and long periods with the universal moral rule: "The debts we cannot pay to whom they are due we pay to others by pursuing Wisdom.""

was changed to:

"Applying this template to our multiple-frame model, we can work well across great distances and long periods with the universal moral rule: "The debts we cannot pay to whom they are due we pay to others by deciding well.""

Chapter 1, *Ever More Complete Multiple-Frame Models*, third paragraph, footnote

Changed "approach" to "approach to deciding well put forth in this work" in the third sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph

Changed "model for pursuing Wisdom" to "multiple-frame model" in the first sentence.

Changed "pursue Wisdom" to "decide well" in the third sentence.

Changed "pursuing Wisdom" to "deciding well" in the second and third sentences (2 occurrences).

Changed "the Good, the Truth, Justice, and Beauty" to "living well, believing well, governing ourselves well, and contemplating well" in the second sentence of the footnote.

Changed "Wisdom" to "deciding well" in the fourth sentence of the footnote.

Chapter 1, *Invariant Values*, first paragraph

Changed "pursuing the Good calls for pursuing Wisdom, hence for pursuing the Truth, Beauty, Justice, and all of the other" to "living well calls for deciding well, hence for pursuing all" in the last sentence.

Changed "approach to deciding well" to "approach to deciding well, hereafter known simply as *the multiple-frame approach*," in the first sentence.

Changed "pursuing the timeless end of believing well" to "believing well" in the fourth sentence of the footnote.

Chapter 1, *Invariant Values*, first paragraph, last sentence

"To choose to pursue other than these values is to choose to blind ourselves to the full range of opportunities for learning by doing."

was changed to:

"To pursue other than these values is to blind ourselves to the full range of opportunities for learning by doing in deciding well."

Chapter 2, Invariant Tools for Deciding Well, first paragraph

Changed "view of the multiple-frame model of deciding well" to ""view" of the multiple-frame model of deciding well put forth in this work" in the third sentence.

Chapter 2, Invariant Tools for Deciding Well, last paragraph, footnote

Changed the last sentence to the past tense.

Chapter 2, Wealth, first paragraph

Changed "*pursue Wisdom*" to "*live well*" in the last sentence.

Chapter 2, Profit, first paragraph

Changed "pursuing Wisdom" to "deciding well" in the last sentence.

Chapter 3, entire chapter

Changed "pursuing Wisdom" to "deciding well" in all (11 occurrences).

Changed "pursue Wisdom" to "decide well" in the all (7 occurrences).

Chapter 3, Pursuing the Ring of Truth, second paragraph

Changed "the multiple-frame approach to deciding well" to "our multiple-frame model" in the last sentence.

Chapter 3, Pursuing the Ring of Truth, third paragraph

Changed "combining the frames for contemplating and living well" to "joining the frame of living well to this skeletal frame" in the first sentence.

Chapter 3, Contemplating the Way Forward, last paragraph, footnote, first two sentences

"From the multiplex view, our need for economy in models stems from our need to decide well efficiently, not from the precept that simpler models tend to be true. The proper supply-side precept is that simpler models tend to be more useful in deciding well, hence in pursuing the Truth."

were changed to:

"From the multiplex view, our need for economy in models stems from our need to decide well, not from the precept that simpler models tend to be true. Simpler models tend to be more useful in deciding well, hence in believing well."

Chapter 3, *Three Approaches to Policy*, second paragraph

Changed "the timeless end of living well" to "living well" in the first sentence.

Chapter 4, entire chapter

Changed "pursuing Wisdom" to "deciding well" in all (7 occurrences).

Changed "pursue Wisdom" to "decide well" in the all (4 occurrences).

Changed "pursuing the Truth" to "believing well" in all (3 occurrences).

Changed "pursue the Truth" to "believe well" in the all (1 occurrence).

Chapter 4, *Self-Similarity*, last paragraph, first two sentences

"*When we choose a problem to solve, we choose to accept our current explanations of causation on the level of our chosen problem and on all higher levels. In effect, we choose to ignore our ignorance of causation on the level of our chosen problem and above.*"

were changed to:

"*When we choose a problem to solve, we choose to accept our current ignorance of causation on the level of our chosen problem and on all higher levels.*"

Chapter 4, *Academic Fields*, third paragraph

Changed "pursuing Beauty" to "Beauty" in the first sentence.

Chapter 4, Refining Everyday Thinking, first paragraph, footnote

Changed "pursue the Good" to "live well, hence to pursue all of the boundless factors of deciding well" in the last sentence.

Chapter 4, Refining Everyday Thinking, fourth paragraph, first footnote, last sentence

Changed "change" to "affect" in the fifth sentence.

Chapter 4, Refining Everyday Thinking, fourth paragraph, last footnote, last sentence

"This rule weeds out (1) sociobiology, which ignores our minds and spirits; (2) postmodern moral relativism, which ignores our bodies and spirits; and (3) all religious teachings that ignore our bodies and minds."

was deleted.

Chapter 4, A Crude Look at the Whole, last paragraph, first sentence

"Unlike the models modern economists use to try to predict how policies change the "weather," this crude model explains how policies change the "climate.""

was deleted.

Chapter 4, A Crude Look at the Whole, last paragraph, last sentence

"To choose to ignore this frozen stress is not only to choose to live in a fool's paradise, but also to choose to bequeath the habits of living in a fool's paradise to future generations."

was changed to:

"To ignore this frozen stress is not only to live in a fool's paradise, but also to bequeath the habits of living in a fool's paradise to future generations."

Chapter 4, Useful Reminders, second paragraph

Changed "Believing" to "Pursuing the boundless factors of deciding well" in the first sentence.

Chapter 4, Useful Reminders, last paragraph

Changed "all beliefs" to "beliefs" in the first sentence.

Chapter 5, entire chapter

Changed "pursuing Wisdom" to "deciding well" in all (14 occurrences).

Changed "pursue Wisdom" to "decide well" in the all (15 occurrences).

Chapter 6, entire chapter

Changed "pursuing Wisdom" to "deciding well" in all (4 occurrences).

Changed "pursue Wisdom" to "decide well" in the all (1 occurrence).

Chapter 6, The Farther Reaches of Our Nature, fifth paragraph

Changed "this insight" to "it" in the fourth sentence.

Chapter 6, *Worldly Benefits of Detachment*, last paragraph, second sentence

"A mythic example is Isaac Newton's epiphany about the force that caused things such as apples to fall to the ground being the same force that kept the planets in orbit around the sun and the moon in orbit around the earth."

was changed to:

"A mythic example is Isaac Newton's epiphany about the force that caused apples to fall being the same force that kept planets in orbit."

Chapter 6, Experiencing the Mysterious, last paragraph

Changed "revere life" to "live" in all (2 occurrences).

Chapter 6, A Common Timeless End, entire section

Changed "pursuing the Good" to "living well" in all (7 occurrences).

Changed "pursuing Wholeness" to "linking well" in the all (5 occurrences).

Changed "view of the multiple-frame approach to deciding well" to "view" in the all (1 occurrence).

Chapter 7, entire chapter

Changed "pursuing Wisdom" to "deciding well" in all (6 occurrences).

Changed "pursue Wisdom" to "decide well" in the all (1 occurrence).

Chapter 7, The Scope of Strategy, first paragraph

Changed "ever more quickly" to "more quickly than competitors" in the fourth sentence.

Chapter 7, *Temporal OODA Loop Analysis*, first paragraph

Changed "compete well by deciding well ever more quickly" to "decide well more quickly than competitors" in the last sentence.

Chapter 8, Useful Reasoning, last paragraph

Changed "Reason" to "reason" in the last sentence and the first sentence of the footnote (2 occurrences).

Changed "Therefore, the" to "The" in the third sentence.

Inserted the following paragraph between the last sentence and its footnote:

"Both logic and dialectics tend to blind us to opportunities for learning by doing in deciding well. Properly conceived, reason not only helps us see these opportunities, but also helps us judge them."

Changes in Version 2012.01.25

Entire work

Changed "multiplex view" to "multiple-frame view" in all (34 occurrences).

Chapter 1, *Seeing Through Apparent Miracles*, second paragraph

Changed "apparent miracles" to "such apparent miracles as describing the contents of locked cupboards and appearing from nowhere" in the second sentence.

Chapter 2, Invariant Tools for Living Well, last paragraph, footnote

"The term 'multiple-frame view' comes from biologist Jack Cohen and mathematician Ian Stewart's book, *Figments of Reality: The Evolution of the Curious Mind* (Cambridge, England: Cambridge University Press, 1997). Cohen and Stewart described the evolution of intelligence as a recursive process, but missed the symmetry of deciding well."

was changed to:

"Earlier versions of this work used the term 'multiplex view,' which came from biologist Jack Cohen and mathematician Ian Stewart's book, *Figments of Reality: The Evolution of the Curious Mind* (Cambridge, England: Cambridge University Press, 1997), in which they describe the evolution of intelligence. Regrettably, they missed the symmetry of deciding well. As a result, their concept of 'multiplex view' does not ring true with the invariant belief that living beings compete well in order to cooperate well."

Chapter 3, Contemplating the Way Forward, last paragraph, footnote, first two sentences

"From the multiple-frame view, our need for economy in models stems from our need to decide well, not from the precept that simpler models tend to be true. Simpler models tend to be more useful in deciding well, hence in believing well."

was deleted.

Chapter 4, *Recursivity*, last paragraph, footnote, second and third sentences

"Arguably, this is because they see their role as helping us to believe well rather than to decide well. Deciding well calls for us to consider ultimate ends, which in turn calls for us to confront the limits of modern reason."

was changed to:

"Arguably, this is because believing well, unlike deciding well, appears to avoid the problem of considering ultimate ends, which calls for us to confront the limits of modern reason:"

Chapter 7, The Scope of Game Theory, first paragraph, footnote

"In the late 1970s, Hofstadter wrote a popular book about recursion, *Gödel, Escher, Bach, An Eternal Golden Braid*. At the time he sent out this letter, he was the author of the Metamagical Themas column in *Scientific American* magazine. 'Metamagical themas' is an anagram of 'mathematical games,' which was the the title of the Scientific American column Martin Gardner wrote from 1956 through 1980."

was deleted.

Chapter 8, Natural Reasoning, first paragraph, footnote, last two sentences

"From the holistic view of this work, it is clear that these distributions are the result of people deciding to act based on what they currently believe. Over time, people collectively learn to decide well using the multiple-frame approach to deciding well, which calls for distinguishing between tools for knowing our needs and tools for knowing how best to satisfy them."

was changed to:

"From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently believe. Over time, we collectively learn to decide distinguish between tools for knowing our needs and tools for knowing how best to satisfy them."

Chapter 8, Summary, first paragraph, end

Added the footnote:

"[7] From the multiple-frame view, reason, not logic, underlies science. Kurt Gödel was right to seek an *a priori* approach to science, an approach in which reason precedes experience, but wrong to believe that the reason underlying this approach was a combination of logic and intuition. Intuition concerns the supply side of science. Had Gödel considered the demand as well as the supply side of science, he likely would have discovered the beauty that emerges from deciding well. This beauty is a transcendental recursive object as real as the transcendental recursive numbers underlying modern physics. It is something we discover rather than invent."

Appendix, Producing Ever More Leanly, first paragraph

Changed "multiple-frame view" to "multiple-frame view of deciding well put forth in this work" in the first sentence.

Changes in Version 2012.01.27

Acknowledgments, last paragraph

Changed "McNeil" to "McNeil, my great uncle," in the third sentence.

Changed "Bach" to "Bach, my business ethics professor," in the fourth sentence.

Changed "Harris" to "Harris, my father," in the fifth sentence.

Preface, eighth paragraph

Changed "why" to "explaining why" in the last sentence.

Preface, ninth paragraph, last sentence

"I end by describing three distinct types of liberalism."

was deleted.

Chapter 1, Seeing Through Apparent Miracles, first paragraph, first three sentences

"Timeless frames confuse people who have locked themselves into temporal frames. The following *kaizen* slogans highlight this problem. Each is obvious from a timeless frame of deciding well, yet paradoxical from a temporal frame of producing well:"

were changed to:

"From a modern view of producing well, as miraculous as the results of Ohno's strategy for learning appear, the details appear paradoxical. The following *kaizen* slogans highlight this problem:"

Chapter 3, *Overcoming Constraints in Deciding Well*, third paragraph

Changed "*temporal*" to "*engineering*" in the last sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, fourth paragraph

Changed "*timeless*" to "*biological*" in the last sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, last paragraph

Changed "*invariant*" to "*public*" in the last sentence.

Chapter 3, *Three Approaches to Policy*, first paragraph

Changed "*temporal*" to "*engineering*" in the second sentence.

Deleted the third sentence: "We may call this the *engineering approach to policy.*"

Chapter 3, *Three Approaches to Policy*, second paragraph

Changed "*timeless*" to "*biological*" in the first sentence.

Deleted the second sentence: "We may call this the *biological approach to policy.*"

Chapter 3, *Three Approaches to Policy*, last paragraph

Changed "*invariant*" to "*public*" in the first sentence.

Deleted the second sentence: "We may call this the *public approach to policy.*"

Chapter 3, *Public Entropy*, second paragraph

Deleted the first sentence: "To explain what happens in economies, which includes what happens as we learn to decide ever more wisely, we need to explain based not on what happens at the margins, but rather on what happens in the infinitely long run."

Deleted the new third sentence: "A bit more knowledge may have no effect or a very large effect."

Changed "no" to "little" in the new fifth sentence.

Chapter 5, *The Explicit Experiment*, first paragraph, last footnote

Changed "an experimental approach to government in this" to "his great political experiment in his" in the last sentence.

Chapter 5, Liberalism, first paragraph, last sentence

"From the multiple-frame view, we can test the set of beliefs that support boundless pragmatism by testing the civil faith of boundless pragmatism. This civil faith calls for us to form governments based on the sovereign right to decide well. Given the key role that liberty plays in deciding well, we may call this public approach to governing ourselves well *invariant liberalism*."

was changed to:

"From the multiple-frame view, we can test the set of beliefs that support boundless pragmatism by testing the set of publicly proclaimed and practiced beliefs of boundless pragmatism. This civil faith calls for us to form governments based on the sovereign right to decide well. Given the key role that liberty plays in deciding well, if this civil faith were expressed as a pledge of allegiance, it would be: "I pledge allegiance to my flag and to the principles for which it stands: liberty and justice for all." We may call this faith *invariant liberalism*."

Chapter 5, Liberalism, second and third paragraphs

"Invariant liberalism differs markedly from modern American liberalism. From this modern view, we are social animals who ought to pursue social justice. From the multiple-frame view, we are people who ought to pursue Justice. Social justice is little more than tribal justice in modern garb.

"Invariant liberalism also differs markedly from the "classical" liberalism that arises from using modern economic models as tools for helping us find problems to solve. These "capitalist" models tend to blind us to the debts we cannot pay to whom they are due. From the multiple-frame view, we pay these debts to others by deciding well. Deciding well calls for us to help others decide well."

were deleted.

Chapter 7, *An Extraordinary Anomaly*, last paragraph

Changed "act irrationally" to "fail to address our ignorance of deciding well rationally, and so act irrationally" in the last sentence.

Chapter 8, Useful Reasoning, last paragraph

Changed "problems that ring true with pursuing timeless ends" to "temporal problems to solve that ring true with pursuing boundless factors of deciding well, which are timeless ends" in the first sentence.

Chapter 8, Useful Reasoning, last paragraph, footnote, end

Added the sentence:

"As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time."

Chapter 8, Useful Reasoning, last paragraph, footnote

Moved footnote forward two sentences.

Chapter 8, Complete Reasoning, first paragraph, first footnote, third sentence

"To the extent that writing gave rise to modern reasoning, object-oriented computer programming gave rise to *reasonably complete* reasoning."

was deleted.

Chapter 8, Summary, first paragraph, footnote

Moved footnote to the end of the last paragraph of the Useful Reasoning section.

Changes in Version 2012.01.30

Entire document

Checked and updated internet links in all footnotes.

Chapter 1, *Seeing Through Apparent Miracles*, second paragraph, first two sentences

"In Edwin Abbott's novel *Flatland*, characters perform such apparent miracles as describing the contents of locked cupboards and appearing from nowhere by breaking through dimensional boundaries. Residents of the two-dimensional world of Flatland who have traveled to the three-dimensional world of Spaceland find it impossible to explain these apparent miracles to residents of Flatland who believe that the terms 'up' and 'north' refer to the same concept."

were changed to:

"In his novel *Flatland*, Edwin Abbot describes the world from the perspective of residents of the two-dimensional world of Flatland. One of these Flatlanders encounters a being from the three-dimensional world of Spaceland. This "higher being" performs such apparent miracles as speaking to him as if inside his head, describing the contents of a locked cupboard, and appearing out of nowhere. To prove that these apparent miracles were not true miracles, the

Spacelander carries him through the boundary that separates the second and third dimensions. When he returns home from his journey, he is unable to explain his experiences in Spaceland to his fellow Flatlanders, who cannot grasp what he means when he says "up but not north.""

Chapter 1, Choosing Frames Well, last paragraph, footnote

"From the boundlessly pragmatic view put forth in this work, this simple prescription lies at the heart of reason. At issue is the usefulness of a form of reason based not only on logic, but also on beauty within the context of deciding well. Consider Georg Cantor's continuum hypothesis. Using his theory of sets, Cantor discovered that some infinities were "larger" than others. For example, the infinity of the set of real numbers is "larger" than that of integers. Cantor went on to hypothesize that there were no levels of infinity between those of integers and real numbers. Cantor drove himself insane trying to prove whether this hypothesis was true or false. Paul Cohen later showed that there exist approaches to mathematics in which the continuum hypothesis is true and other approaches in which it is false. From the view of this work, the relevant question is whether these approaches are useful in deciding well. In the words of Dwight Eisenhower, "If a problem cannot be solved, expand it.""

was changed to:

"From the boundlessly pragmatic view put forth in this work, this simple prescription lies at the heart of reason. At issue is the usefulness of a form of reason based not only on logic, but also on the beauty that emerges from deciding well. Consider Georg Cantor's continuum hypothesis. Cantor discovered that some infinities were "larger" than others. He went on to hypothesize that there were no levels of infinity between those of integers and real numbers. Trying to prove or disprove this hypothesis drove him insane. Paul Cohen later showed that there exist approaches to mathematics in which the continuum hypothesis is true and other approaches in which it is false. From the view of this work, the relevant question is whether these approaches are useful in deciding well."

Chapter 4, *A Crude Look at the Whole*, first paragraph, last footnote

Changed "theory for" to "means of" in the last sentence.

Chapter 4, *A Crude Look at the Whole*, second paragraph

Changed "The pressure" to "Our need" in the second sentence.

Chapter 6, A Common Timeless End, last paragraph

Changed "boundlessly pragmatic view put forth in this work" to "multiple-frame view" in the second sentence.

Changed "of the farther reaches of our nature prevents us from taking other than this brute force approach" to "prevents us from taking other than this brute force approach to deciding well" in the last sentence.

Chapter 7, *A Normal Anomaly*, first paragraph

Changed "In his most famous work, *The Structure of Scientific Revolutions*, Kuhn" to "Kuhn" in the second sentence.

Chapter 7, *A Normal Anomaly*, first paragraph, footnote, end

Added the sentence:

"A video of this experiment is available online at <http://www.youtube.com/watch?v=yFYBY_YUH5I> (30 January 2012)."

Chapter 7, *A Normal Anomaly*, last paragraph, first sentence

"To understand why these experts reacted to Hofstadter's game as they did, we must understand something of modern game theory."

was deleted.

Chapter 7, *A Normal Anomaly*, last paragraph, last two sentences

"Hofstadter created a model in which there are symmetrical games in a situation that occurs once. This model does not fit neatly into modern game theory."

were changed to:

"Hofstadter created a game in which there are symmetrical games that occur once. Just as a red queen of spades does not fit neatly into a deck of cards, Hofstadter's game does not fit neatly into modern game theory."

Chapter 7, The Grandest Possible Strategy, first paragraph, footnote, end

Added the sentence:

"In the words of Dwight Eisenhower, "If a problem cannot be solved, expand it.""

Chapter 8, Useful Reasoning, last paragraph, first footnote

Inserted the following sentence before the last sentence:

"How do we best describe the world as it is when the world is in the process of becoming something other than what it currently is?"

Chapter 8, Complete Reasoning, first paragraph, second footnote

Changed "Further, we believe" to "For example, we see" in the last sentence.

Appendix, Producing Ever More Leanly, first paragraph

Changed "multiple-frame view" to "view" in the first sentence.

Changes in Version 2012.02.01

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, last paragraph

Changed "nearly" to "practically" in the second and third sentences.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, last paragraph, footnote

"If the world is infinite, then the terms 'a nearly infinite number' should be 'an infinite number.' Consider the simple case in which the world has a beginning but no end. The first time a microscopic particle transitions from acting like a wave to acting like a particle is like removing the members of the set of all rational numbers with a denominator of 1 from the set of all rational numbers. The second time a microscopic particle makes this transition is like removing the members of the set of all rational numbers with a denominator of 2 from the remaining set of rational numbers. The third time is like removing the members of the set of all rational numbers with the denominator of 3 from the remaining set. We can see from this simple model that regardless of how many transitions have occurred since the beginning of time there remain an infinite number of possible states of the world."

was deleted.

Chapter 4, *A Crude Look at the Whole*, second paragraph, first two sentences

"The way we replace non-knowledge resources with knowledge resources is, in part, accidental. Our need to create these "frozen accidents" suggests the metaphor of a near-freezing river filled with blocks of ice of various shapes and sizes."

were changed to:

"Deciding well calls for us to replace non-knowledge resources with knowledge resources. This process is, in part, accidental. We may think of the knowledge we embed in our networks of knowledge as "frozen accidents." When we make mistakes, which we inevitably do, these frozen accidents pile up like blocks of ice in a near-freezing river."

Chapter 4, *A Crude Look at the Whole*, last paragraph

Changed "policies meant to treat these effects" to "policies" in the first sentence.

Changes in Version 2012.02.04

Preface, second paragraph

Changed "a process rather than as a single event" to "an endless process" in the fifth sentence.

Preface, second to last paragraph

Changed "is a synthesis of dialectics and logic. I go on to argue that this reasoning is" to "is" in the first and second sentences.

Preface, last paragraph

Changed "is not the reason that most people have learned to expect" to "surpasses logic" in the third sentence.

Added the following sentences to the end of the paragraph:

"This synthesis of logic and beauty provides a foundation for alternatives to both Alan Turing's test for intelligence and Kurt Gödel's *a priori* approach to science."

Chapter 1, Values, second paragraph

Changed ", the timeless end of believing well *the Truth*, and the timeless end of living well *the Good*" to "and the timeless end of believing well *the Truth*" in the third sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph

Changed "the timeless end of living well (the Good)" to "the timeless end of living well" in the first sentence.

Changed "the Good to be the timeless end of living well" to "the timeless end of living well to be *the Good*" in the last sentence.

Added the following sentence to the end of the paragraph: "So conceived, the Good is a boundless factor of deciding well."

Chapter 1, *Invariant Values*, first paragraph

Changed "known" to "referred to" in the first sentence.

Chapter 3, *Three Approaches to Policy*, first paragraph

Changed "From view" to "From the view" in the first sentence.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, first paragraph

Changed "non-knowledge resources" to "non-knowledge resources from the process of pursuing our chosen timeless end" in the third sentence.

Changed "replace ever more non-knowledge resources with knowledge resources" to "pursue this end using ever fewer non-knowledge resources" in the third sentence.

Moved paragraph back to the end of the previous subsection.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, new second paragraph

Changed "either the *Copenhagen class* or the *shut-up-and-calculate class*" back to "the *Copenhagen class*" in the third sentence.

Chapter 3, The Elephant in the Room, third paragraph

Changed ". These laws" to ", which" in the second and third sentences.

Chapter 7, The Scope of Game Theory, last paragraph

Changed "was not able" to "did not know how" in the sixth sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote

Changed "evolution, thermodynamics," to "evolution," in the third sentence.

Changes in Version 2012.02.06

Chapter 4, *Academic Fields*, last paragraph, end

Added the paragraph:

"From the multiple-frame view, the whole of science is nothing more than the self-referential, self-similar process of refining everyday thinking."

Chapter 4, *A Crude Look at the whole*, first two paragraphs

"Imagine that we are free people deciding well. Deciding well creates economic stress, the need to reallocate resources. If we decided perfectly, this stress would flow smoothly through the economic system until the system fully adjusted to the change that created it. Regrettably, we do not decide perfectly. Deciding imperfectly creates or transfers wasteful stress, which in turn creates turbulence in the flow of economic resources. If this were all that deciding imperfectly did, the amount of turbulence would tend toward a "natural" level.[9] Deciding imperfectly also embeds mistakes into, or reinforces mistakes in, our networks of knowledge-

in-use. Over time, deciding well releases the stress embedded in these networks. These unpredictable[10] releases of stress tend to disrupt the "natural" level of turbulence.[11]

"Deciding well calls for us to replace non-knowledge resources with knowledge resources. The way we decide is, in part, accidental. Accordingly, we may think of the knowledge we embed in our networks of knowledge as "frozen accidents." Over time, these frozen accidents pile up like blocks of ice in a near-freezing river. We best avoid debacles, sudden releases of a large amount of stress, by preventing embacles, the piling up of frozen accidents under stress. We best prevent embacles by deciding well."

were changed to:

"When we decide well, we create economic stress, the need to reallocate resources. If we decided perfectly, this stress would flow smoothly through the economic system until the system fully adjusted to the change that created it. Regrettably, we do not decide perfectly. In deciding imperfectly, we create turbulence in the flow of economic resources. If this were all we did in deciding imperfectly, the amount of turbulence would tend toward a "natural" level.[9] In deciding imperfectly, we also embed mistakes into, or reinforce mistakes in, our networks of knowledge-in-use. Over time, deciding well releases the stress "frozen" in these networks. These unpredictable[10] releases of "frozen" stress tend to disrupt the "natural" level of turbulence.[11]

"In the language of complex adaptive systems, the knowledge we embed in our networks of knowledge are "frozen accidents." Over time, these accidents pile up like blocks of ice in a near-freezing river. We best avoid debacles, sudden releases of large amounts of stress, by preventing embacles, the piling up of frozen accidents under stress. We best prevent embacles by deciding well."

Chapter 4, *A Crude Look at the whole*, second paragraph, first three sentences

"Deciding well calls for us to replace non-knowledge resources with knowledge resources. The way we decide is, in part, accidental. Accordingly, we may think of the knowledge we embed in our networks of knowledge as "frozen accidents.""

were changed to:

"We may think of the knowledge we embed in our networks of knowledge as "frozen accidents.""

Chapter 4, *A Crude Look at the whole*, second paragraph, second to last sentence

"The best way to avoid debacles, sudden releases of a large amount of stress, is to prevent embacles, the piling up of frozen accidents under stress."

was changed to:

"We best avoid debacles, sudden releases of large amounts of stress, by preventing embacles, the piling up of frozen accidents under stress."

Chapter 8, Useful Reasoning, last paragraph, first footnote

Changed "as it is when the world is in the process of becoming something other than what it currently is" to "when it is impossible to measure the world without changing the world as it is in the process of becoming" in the second to last sentence.

Chapter 8, Complete Reasoning, first paragraph

Deleted "(hence self-referential)" from the first sentence.

Chapter 8, Summary, first paragraph

Changed "definite" to "complete" in the third sentence.

Changes in Version 2012.02.08

Acknowledgments, last paragraph, first two sentences

"The last three were sons of bankers from a "new Jerusalem" that was shaken by the scandalous collapse of its most trusted bank in 1904. Each of these three sons of Grinnell, Iowa had a different view of how best to impart wisdom."

were changed to:

"The last three were sons of bankers from Grinnell, Iowa, a "new Jerusalem" shaken by the scandalous collapse of its most trusted bank in 1904."

Preface, tenth paragraph

Changed "In doing so, I expound on" to "This involves exploring" in the last sentence.

Preface, last paragraph

"My hope in writing such a short book is that people will read it more than once. Despite its simple style, most people will find it challenging. Its reason surpasses logic. In his theory of invariance ("relativity theory"), Einstein takes a four-dimensional ("space-time") view of physics. Similarly, I take a four-dimensional ("reasonably-complete") view of deciding well. In doing so, I overcome the limits of logic with the beauty that emerges from deciding well. This synthesis of logic and beauty provides a foundation for alternatives to both Alan Turing's test for intelligence and Kurt Gödel's *a priori* approach to science."

was changed to:

"My hope in writing such a short book is that people will read it more than once. Despite its simple style, most people will find it challenging. In his theory of invariance ("relativity theory"), Einstein takes a four-dimensional ("space-time") view of physics. Similarly, I take a four-dimensional ("reasonably complete") view of deciding well. Taking this view calls for confronting the limits of logic discovered by Kurt Gödel and refined by Alan Turing. I overcome these limits with the beauty that emerges from deciding well. The resulting approach to refining everyday thinking ("the whole of science") helps us find ever better problems to solve."

Chapter 1, third paragraph, footnote, last sentence

"As we shall see, we cannot separate the timeless problems we face from the timeless problems all other people face."

was changed to:

"As we shall see, this change in case is consistent with a decision-oriented interpretation of quantum mechanics. Measured by how well a theory predicts the world, quantum mechanics is easily the most successful theory in the history of science. As we shall also see, we cannot separate the timeless problems we face from the timeless problems all other people face."

Chapter 2, Invariant Tools for Living Well, third paragraph, footnote

Changed "invariant belief that living beings compete well in order to cooperate well" to ""natural reasoning" put forth in this work" in the fourth sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, third paragraph, last footnote

Changed "temporal approach" to "engineering approach" in all (2 occurrences).

Changed "finding the best problems" to "the task of finding the best problems" in all (2 occurrences).

Chapter 3, *A Decision-Tree Interpretation of Quantum Mechanics*, second paragraph

Changed "details about the world," to "details about the world, such as the constraints imposed by these two theories," in the second sentence.

Chapter 4, *A Crude Look at the whole*, second paragraph

Changed "In the language of complex adaptive systems" to "Using a metaphor familiar to people who study complexity" in the second sentence.

Chapter 8, Useful Reasoning, first paragraph

Changed "the best problems to solve" to "problems to solve well" in the last sentence.

Changes in Version 2012.02.14

Preface, tenth paragraph

Changed "This involves exploring" to "In doing so, I explore" in the last sentence.

Preface, twelfth paragraph

Changed "deciding well" to "this multiple-frame approach to deciding well" in the first sentence.

Preface, last paragraph

"My hope in writing such a short book is that people will read it more than once. Despite its simple style, most people will find it challenging. In his theory of invariance, Einstein takes a four-dimensional ("space-time") view of physics. Similarly, I take a four-dimensional ("reasonably complete") view of deciding well. Taking this view calls for confronting the limits of logic discovered by Kurt Gödel and refined by Alan Turing. I overcome these limits with the beauty that emerges from deciding well. The resulting approach to refining everyday thinking ("the whole of science") helps us find ever better problems to solve."

was changed to:

"My hope in writing such a short book is that people will read it more than once. Despite its simple style, most people will find it challenging. In his theory of invariance, Einstein takes a four-dimensional view of physics. Similarly, I take a four-dimensional view of deciding well. Taking this view calls for confronting the limits of logic. I overcome these limits with the beauty that emerges from deciding well."

Chapter 1, Choosing Frames Well, last paragraph, footnote

Deleted the second sentence: "At issue is the usefulness of a form of reason based not only on logic, but also on the beauty that emerges from deciding well."

Changed "or disprove" to "(or disprove)" in the new fifth sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, fourth paragraph

Changed "think logically across frames that do not share the same timeless end" to "pursue these two ends perfectly" in the last sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph, footnote

Changed "Logical completeness" to "Logic" in the fourth sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph, footnote, last two sentences

"In seeking to disprove the proposition that all crows are black, we ought to search for crows that are not black. To search for non-black things that are crows would waste resources."

was changed to:

"Logically, in seeking to disprove the proposition that all crows are black, we may choose to search for either crows that are not black or not black things that are crows. To search for the latter would be an absurd waste of resources."

Chapter 3, The Elephant in the Room, section

Replaced this section with the following:

"**Overcoming the Limits of Logic**
From the multiple-frame view, explaining the world is process. Explaining well calls for deciding well, which in turn calls for believing well. All models for pursuing the timeless end of believing well contain the belief that we will never know the true meaning of the timeless end of believing well. If a model contains this meaning, it is complete, but logically inconsistent. If a model does not contain this meaning, it is logically consistent, but incomplete. Thus, no logically consistent and complete model can explain well. If we are to explain well, we need to judge why we believe as we do using more than logic. We can do so by supplementing logic with the beauty that emerges from deciding well."

Chapter 4, *Recursivity*, last paragraph, footnote

"[3] Most modern intellectuals prefer 'reflexive' to 'recursive' to describe this complex dynamic. Arguably, this is because believing well, unlike deciding well, appears to avoid the problem of considering ultimate ends, which calls for us to confront the limits of modern reason: Models for pursuing timeless ends can never be both logically consistent and complete. Each contains the belief that we will never know the true meaning of its timeless end. If we find this meaning, the model is complete, but inconsistent. If we never find this meaning, the model is consistent, but incomplete."

was deleted.

Chapter 6, *Heroic Death*, last paragraph

Changed "our need for mystical oneness" to "it" in the second sentence.

Chapter 7, *The Grandest Possible Strategy*, first paragraph, footnote, last sentence

"In the words of Dwight Eisenhower, "If a problem cannot be solved, expand it.""

was deleted.

Chapter 8, Useful Reasoning, second paragraph

Changed "the *rules of reason*" to "*the rules of reason*" in the second sentence.

Chapter 8, Useful Reasoning, last paragraph

Changed "*rules of reason*" back to "*rules of Reason*" in the fourth sentence.

Chapter 8, Useful Reasoning, last paragraph, last footnote

"[4] From the multiple-frame view, reason, not logic, underlies science. Kurt Gödel was right to seek an *a priori* approach to science, an approach in which reason precedes experience, but wrong to believe that the reason underlying this approach was a combination of logic and intuition. Intuition concerns the supply side of science. Had Gödel considered the demand as well as the supply side of science, he likely would have discovered the beauty that emerges from deciding well. This beauty is a transcendental recursive object as real as the transcendental recursive numbers underlying modern physics. It is something we discover rather than invent."

was deleted.

Moved the first footnote to the end of the paragraph.

Chapter 8, Complete Reasoning, first paragraph

Changed "of deciding well using the multiple-frame approach" to "of the multiple-frame approach to deciding well" in the second sentence.

Chapter 8, Natural Reasoning, first paragraph, last footnote

"[6] People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot. Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently believe. *Over time, we collectively learn to distinguish between tools for knowing our needs and tools for knowing how best to satisfy them.*"

was promoted to a paragraph and changed to:

"People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot.[6] Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

"[6] Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence* (New York: Basic Books, 2004), Chap. VIII."

Chapter 8, Summary, first paragraph, last two sentences

"When we expand the scope of the problems we face to the limits of imagination, a structure of invariant values emerges. Understanding the process by which we best progress toward these timeless ends can help us find better problems to solve."

were changed to:

"Expanding the scope of the problems we face helps us find better problems to solve. In the words of Dwight Eisenhower, "If a problem cannot be solved, expand it." When we expand the scope of these problems to the limits of imagination, a structure of invariant values emerges. Understanding the process by which we best progress toward these timeless ends can help us progress ever more readily."

Changes in Version 2012.02.18

Preface, third paragraph

Changed "how best to pursue the timeless end of deciding well" to "the timeless end of deciding well" in the last sentence.

Preface, fourth paragraph

Changed "to help us judge" to "that help us judge" in the first sentence.

Preface, last paragraph

Changed "takes" to "took" in the third sentence.

Added the sentence:

"The proof of this new form of reason is its usefulness in helping us find ever better problems to solve in pursuing the timeless end of deciding well."

Chapter 3, *Public Entropy*, second paragraph, footnote, first sentence

"Modern economists such as Paul Samuelson were right to look to thermodynamics for models, but were wrong to look to classical thermodynamics."

was deleted.

Chapter 3, *Public Entropy*, last paragraph, footnote

Changed "in deciding well" to "in pursuing timeless ends well" in the first sentence.

Chapter 3, *A Decision-Tree Interpretation of Quantum Mechanics*, last paragraph

Deleted "overcoming the constraint of " from the first sentence.

Chapter 3, The Elephant in the Room, second paragraph, last sentence

"Deciding well using the multiple-frame approach is a strategy for learning everything about the world."

was changed to:

"In the fullness of time, we inevitably discover the multiple-frame approach to deciding well and the wisdom of using it, which includes understanding what we call the laws of nature."

Chapter 3, The Elephant in the Room, third paragraph

Changed ", which include" to ". These laws include" in the second sentence.

Changed "As people, we" to "We" in the new fourth sentence.

Chapter 3, The Elephant in the Room, third paragraph, last sentence

"Deciding well using the multiple-frame approach is a strategy for learning everything about the world, which includes understanding the Creator's thoughts in creating the world."

was changed to:

"In the fullness of time, we inevitably discover the multiple-frame approach to deciding well and the wisdom of using it, which includes understanding the Creator's thoughts in creating the laws of nature."

Chapter 3, The Elephant in the Room, entire section

Moved this section to the beginning of the second appendix, which is not part of the current Internet version of this work.

Chapter 4, *Self-Similarity*, second paragraph, first sentence

"We explain causation on lower levels of abstraction than the level we are trying to explain."

was changed to:

"From any given level of abstraction, we can describe correlations between events, but cannot explain the causation of events. We can only explain causation from a lower level of abstraction."

Chapter 4, *Self-Similarity*, second paragraph

Changed "modern view" to "view" in the new fourth sentence.

Changed "at a lower level" to "on a lower level" in the new fifth sentence.

Changed "multiple-frame view" to "view" in the new sixth sentence.

Chapter 5, *Promote Deciding Well, not Temporal Order*, title

Changed title to "*Pursue Invariant, not Temporal Order*."

Chapter 5, *Pursue Invariant, not Temporal Order*, second paragraph

"Policymakers ought to take the long-term view. This calls for them to promote deciding well rather than temporal order. Only when civilization as a whole is threatened should they prefer temporal order to deciding well. As we have seen in financial markets over the last twenty-five years, the belief that policymakers will promote temporal order encourages bankers to let others worry about the long-term consequences of the mistakes they embed in our networks of knowledge-in-use."

was moved up one paragraph and changed to:

"Policymakers ought to pursue invariant by promoting the multiple-frame approach to deciding well. Only when civilization as a whole is threatened should they prefer temporal to invariant order. As we have seen in financial markets over the last twenty-five years, the belief that policymakers will pursue temporal order encourages corporate bankers to let others worry about the long-term consequences of the mistakes they embed in our networks of knowledge-in-use."

Chapter 5, Liberalism, last paragraph

Changed "deciding well" to "learning to decide like fully human beings" in the last sentence.

Chapter 6, The Farther Reaches of Our Nature, fifth paragraph, end

Added the following sentence:

"Maslow called the set of physical and mental needs, which contain those things we need to become fully human *becoming needs*."

Chapter 6, The Farther Reaches of Our Nature, last paragraph, end

Added the following sentence:

"Maslow called the set of spiritual needs, which contain those things we need to be fully human, *being needs*."

Chapter 6, The Farther Reaches of Our Nature, last paragraph, end

Added the following paragraph:

"This chapter concerns what Maslow called being needs."

Chapter 8, Useful Reasoning, last paragraph, footnote, second through fourth sentences

Deleted the third sentence: "In his words, he came to believe that the goal of his later work in the philosophy of language was to "show the fly the way out of the fly-bottle.""

Changed "These students" to "They" in the new third sentence.

Chapter 8, Natural Reasoning, first paragraph, last footnote

"People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot.[6] Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

"[6] Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence* (New York: Basic Books, 2004), Chap. VIII."

was demoted back to a footnote to the first paragraph:

"[6] People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot (Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence*, New York: Basic Books, 2004, Chap. VIII). Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern

biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

Appendix, Less is More, first paragraph, footnote, last sentence

"Understanding the invisible objects in these networks ought to become as important to people who study people as understanding dark matter has become to people who study physics."

was changed to:

"Understanding how information enters and leaves these networks ought to become as important to people who study people as understanding how information enters and leaves black holes has become to people who study physics."

Changes in Version 2012.02.24

Entire work

Changed "the Good" to "Happiness" in all (5 occurrences).

Acknowledgments, second paragraph

Changed "address this problem logically" to "solve this problem" in the eighth sentence.

Preface, third paragraph, last sentence

"In short, these boundless factors are aspects of *complete* knowledge of the timeless end of deciding well."

was deleted.

Preface, last paragraph

Inserted the following after the second sentence:

"From this view, the whole of science is nothing more than refining sets of models of the world that we use to pursue the timeless end of deciding well."

Deleted the last sentence:

"The proof of this new form of reason is its usefulness in helping us find ever better problems to solve in pursuing the timeless end of deciding well."

Chapter 1, Choosing Frames Well, first paragraph

Changed "address" to "solve" in the second sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph, last sentence

Added the footnote:

"[10] This timeless end is essentially the same as the eighteen-century concept of happiness used in preamble of the United States Declaration of Independence (a whole life lived well). We ought not to confuse it with the prevailing, temporal concept of happiness (a state of well-being)."

Chapter 2, *Tools for Pursuing Pleasure and Joy*, third paragraph

Changed "likely" to "apt" in the last sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, third paragraph

Changed "would likely" to "would" in the second sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, fourth paragraph

Changed "would likely" to "would" in the second sentence.

Chapter 3, *Public Entropy*, first paragraph, footnote, end

Added the sentences:

"Note that public entropy concerns not only physical, but also mental order. Deciding well is not only a matter of doing the right things, but also of doing them efficiently. Lowering the informational entropy of the sets of mental models that we use to do the right things is one way of increasing efficiency. Another is ensuring that we have only the knowledge each of us needs to decide well within our individual circumstances. In a world of ever changing circumstances, each of us needs to know how to adapt well to ever changing circumstances. Each of us needs to know the invariant strategy for deciding well."

Chapter 3, *A Decision-Tree Interpretation of Quantum Mechanics*, last paragraph

Changed "net present value" to "expected net present value" in the third sentence (2 occurrences).

Changed "are likely to" to "are" and "would likely" to "would" in the third sentence.

Added the footnote:

"[10] Expected net present value is a common measure of the current value of uncertain future cash flows. A more beautiful measure would use a risk-preference function to reduce uncertain to certain cash flows and a yield-curve function to reduce future to present cash flows."

Chapter 4, Refining Everyday Thinking, third paragraph

Changed "likely" to "apt" in the second sentence.

Chapter 4, *Recursivity*, last paragraph, end

Added the sentences:

"*How do we best explain the world when it is impossible to know the world without changing it? As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time.*"

Chapter 4, *Academic Fields*, first paragraph

Changed "will likely seem as strange to" to "will seem as strange to most" and "Western managers" to "most Western managers" in the third sentence.

Chapter 5, *A Sovereign Story for Deciding Well*, last paragraph

Changed "happiness" to "Happiness" in all (2 occurrences).

Deleted the first footnote:

"[10] Regrettably, the spirit of our age has undermined the sovereign rights story of the Declaration. We see this corruption most clearly in the replacement of the classical concept of happiness (a whole life lived well) by the modern concept of happiness (a state of well-being). See Adler, Mortimer, *Ten Philosophical Mistakes* (New York: Macmillan, 1985), chapter 6."

Chapter 6, A Common Timeless End, second paragraph, last two sentences

"From both views, poverty may force us to choose between living well and linking well. *Deciding well makes it ever less likely that we will need to make this choice*."

were changed to:

"From both views, poverty may force us to choose between living well and linking well, between Happiness and Wholeness. *Deciding well makes it ever less probable that we will need to make this choice*."

Chapter 7, *Temporal OODA Loop Analysis*, last paragraph

Changed "address" to "solve" in the first sentence.

Chapter 8, Useful Reasoning, last paragraph, footnote, third sentence

"How do we best describe the world when it is impossible to measure the world without changing the world as it is in the process of becoming?"

was changed to:

"Again, how do we best explain the world when it is impossible to know the world without changing it?"

Chapter 8, Complete Reasoning, first paragraph

Changed "zero public entropy" to "wisdom" in the fifth sentence.

Chapter 8, Summary, first paragraph

Changed "expand" to "enlarge" in the fifth sentence.

Appendix, Less is More, first paragraph, footnote

Changed "ever leaner production" to "ever-leaner production" in the second sentence.

Changes in Version 2012.02.28

Preface, last paragraph

"My hope in writing such a short book is that people will read it more than once. Despite its simple style, most people will find it challenging. In his theory of invariance, Einstein took a four-dimensional view of physics. Similarly, I take a four-dimensional view of deciding well. From this view, the whole of science is nothing more than refining sets of models of the world that we use to pursue the timeless end of deciding well. Taking this view calls for confronting the limits of logic. I overcome these limits with the beauty that emerges from deciding well."

was merged into the previous paragraph and changed to:

"I go on to argue that it is *reasonably complete*. As such, it helps us to find not only conflicts, but also holes in our belief systems. This makes it more useful than logic alone, which only helps us find conflicts in our belief systems."

Chapter 2, Invariant Tools for Deciding Well, last paragraph, footnote

Changed ""natural reasoning"" to "invariant strategy/perennial philosophy/natural reasoning" in the last sentence.

Chapter 2, *Tools for Pursuing Pleasure and Joy*, last paragraph

Changed "to help us" to "in order to help us" in the second to last sentence.

Chapter 3, Overcoming the Limits of Logic, entire section

Replaced the entire section with **The Elephant in the Room** section it replaced.

Changes in Version 2012.02.28 (Osborn Edit)

Entire work

The following are the changes made to correct problems found by Sally Osborn. Several minor problems regarding footnote punctuation were not included. Many of these were in the PDF version but not the HTML version. Because the work was written in HTML and transferred to PDF, this was likely due to using an old version of the Word file. Changes to the body of the text would have been picked up in comparison tests. Changes to the footnotes would not have been picked up by these tests.

Acknowledgments, fourth paragraph, fourth sentence

Changed "and subsequent" to "and a subsequent" in the fourth sentence.

Preface, seventh paragraph

Changed "In the chapter titled" to "In" in the first sentence.

Preface, closing

Italicized name and date.

Chapter 1, Choosing Frames Well, last paragraph

Changed "the way" to "how" in the first sentence.

Chapter 1, Useful Frames, last paragraph

Changed "the way" to "how" in the first sentence.

Chapter 1, Useful Frames, last paragraph

Changed "the way" to "how" in the first sentence.

Chapter 1, *Seeing Through Apparent Miracles*, first bullet point

Changed "good quality products" to "quality products" in the last sentence.

Chapter 1, Values, first paragraph

Changed "the temporal" to "temporal" in the third sentence.

Chapter 1, Values, first paragraph

Changed "the temporal" to "temporal" in the third sentence.

Chapter 1, Values, second paragraph

Italicized "*Wisdom*" in the second sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph

Changed "flourish" to "to flourish" in the first sentence.

Changed "eighteen-century concept of happiness used in preamble of" to "eighteenth-century concept of happiness used in the preamble to" in the first sentence of the footnote.

Chapter 1, *Ever More Complete Multiple-Frame Models*, third paragraph, footnote

Deleted "put forth in this work" from the last sentence.

Chapter 2, Consumption, first paragraph

Changed "Consuming" to "Consumption" in the first sentence.

Chapter 2, *Pleasure and Pain*, second paragraph

Changed "type" to "type of pain" in the last sentence.

Chapter 2, Trade, last paragraph

Changed "the Silicon Valley" to "Silicon Valley" in the last sentence.

Chapter 2, Trade, last paragraph

Changed "the Silicon Valley" to "Silicon Valley" in the last sentence.

Chapter 3, Contemplating the Way Forward, second paragraph

Removed the italics from "transcendental recursive object" in the first sentence.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, last paragraph

Changed ". In it," to ", within which" in the first and second sentences.

Changed "quantum-level" to "quantum level" in the second to last sentence.

Chapter 3, A *Decision-Tree Interpretation of Quantum Mechanics*, first paragraph

Changed "decision-tree" to "decision tree" in the last sentence.

Changed "decision tree models" to "decision-tree models" in the first sentence of the footnote.

Chapter 4, Refining Everyday Thinking, last paragraph

Changed "descriptions we use" to "descriptions that we use" in the second sentence.

Changed "to tell" to "tell" in the third sentence.

Chapter 4, *Academic Fields*, second paragraph

Changed "knowledge useful" to "knowledge that is useful" in the second to last sentence.

Chapter 4, Refining Everyday Thinking, fifth paragraph

Changed "Another way we" to "Another way that we" in the first sentence.

Changed "to sustain" to "sustaining" in the fourth sentence.

Chapter 4, Useful Reminders, second paragraph

Changed "ants do" to "ants do do" in the first sentence.

Changed "we change" to "we do change" in the fourth sentence.

Chapter 5, entire chapter

Changed "Google books" to "Google Books" in all (2 occurrences).

Chapter 5, *A Sovereign Story for Deciding Well*, last paragraph, footnote

Changed "sums" to "summed" in the third sentence.

Chapter 5, *A Sovereign Story for Deciding Well*, last paragraph, footnote

Changed "sums" to "summed" in the third sentence.

Chapter 7, The Scope of Game Theory, entire section

Changed "x" to "×" in all mathematical expressions (13 occurrences) in the PDF version.

Chapter 7, The Scope of Game Theory, first paragraph

Changed "who" to "whom" in the fourth sentence.

Changed ";" to "," in the eight sentence.

Changed "the cooperators would each" to "each of the cooperators would" in the eighth sentence.

Changed "the defectors would each" to "each of the defectors would" in the eighth sentence.

Changed "the others would each" to "each of the others would" in the thirteenth sentence.

Chapter 7, The Scope of Game Theory, third paragraph

Changed "The cooperators would each" to "each of the cooperators would" in the second sentence.

Changed "the defectors would each" to "each of the defectors would" in the second sentence.

Chapter 7, The Scope of Game Theory, last paragraph

Changed "claimed he" to "claimed that he" in the last sentence before quote.

Chapter 7, *Timeless OODA Loop Analysis*, first paragraph

Changed "include" to "incorporate" in the fifth sentence.

Chapter 7, The Grandest Possible Strategy, first paragraph

Changed "turbulence deciding" to "turbulence that deciding" in the last sentence.

Chapter 8, Useful Reasoning, third paragraph

Changed "*logic* after the rules Aristotle" to "*logic*, after the rules that Aristotle" in the last sentence.

Chapter 8, Useful Reasoning, fourth paragraph

Changed "*dialectics* after" to "*dialectics*, after" in the last sentence.

Chapter 8, Complete Reasoning, first paragraph

Changed "reason of" to "reasoning of" in the second sentence.

Appendix, Temporal Details, entire section

Changed "fool proofing ones" to "fool-proofing ones" in all (1 occurrence).

Changed "fool proofing devices" to "fool-proofing devices" in all (2 occurrences).

Changes in Version 2012.03.10

Entire book, all footnotes

Changed "the Appendix" to "Appendix A" on all (2 occurrences).

Preface, last paragraph,

"I go on to argue that it is *reasonably complete*. As such, it helps us to find not only conflicts, but also holes in our belief systems."

were changed to:

"I go on to argue that it helps us to find not only conflicts, but also holes in our belief systems."

Chapter 7, *Timeless OODA Loop Analysis*, last paragraph, footnote, end

Added the sentences:

"Note that Boyd's strategy involved breaking down Saddam Hussein's "moral–mental–physical capacity to adapt or endure." Among other things, this involved creating the cognitive dissonance experienced by the subjects of Bruner and Postman's experiment. Boyd learned of this experiment from Kuhn's description of it in *The Structure of Scientific Revolutions*."

Chapter 8, Complete Reasoning, footnote, end

Added the sentence

"For more on this, see Appendix B."

Appendix, title

Changed "Appendix" to "Appendix A" on the first line of the title.

Appendix A, end

Added the appendix:

Programming Well

"So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." — *Gregory Chaitin*[1]

A major thesis of this book is the need to replace logic and dialectics with Reason as the basis for pursuing the timeless end of believing well (the Truth). Such an extraordinary claim demands an extraordinary argument. What follows is a summary of the argument supporting this claim. The first part of this summary uses a thought experiment to prove that it is impossible to prove which form of reason is best for pursuing the Truth. The second calls for a timeless experiment to disprove the hypothesis that Reason is the best form of reason for pursuing the Truth.

We may view the problem of choosing the form of reason for pursuing the Truth as a programming problem. We can imagine a robot that is capable of replicating itself. Further, we can imagine that this robot and its descendants can communicate with each other and that any group of these robots will halt only after discovering the Truth. If we define a complete program to be a program that will cause one or more of these robots to halt, then we will never be able to prove the existence of a complete program. The reason is that no robot will ever be able to know it has discovered the Truth.

We can imagine finessing the problem of not knowing the Truth by using a programming technique that selects algorithms based on their fitness in pursuing timeless ends.[2] The logical approach to pursuing the Truth does not use this technique. The dialectical approach uses it to pursue the timeless end of living well.[3] The Reasonable approach uses it to pursue the timeless end of deciding well, which calls for using it to pursue all of the boundless factors of deciding well. *Although the Reasonable approach may appear to be the best, proving that it is the best calls for proving programs for pursuing the Truth to be complete, which is impossible.*

Regardless of our inability to prove which of these approaches best helps us pursue the Truth, living well calls for us to choose one. *From the invariant view of living well, which is the view of*

living ever more wisely, we ought to choose the approach that rings the truest with all that we currently know about living ever more wisely. The evidence that the Reasonable approach rings the truest is extraordinary. Hence, we ought to seek to disprove that this approach is best. We do so by acting as if it is best. We do so by putting our faith in Reason.

[1] This came from the opening remarks of a talk that Gregory Chaitin gave at Carnegie Melon University's School of Computer Science on March 2, 2000. A video of these remarks is available online at <http://www.youtube.com/watch?v=HLPO-RTFU2o> (28 February 2012).

[2] The author first learned of this technique from a lecture that computer scientist John Holland gave to members of the Santa Fe Institute Business Partners. Holland was one of the pioneers of evolutionary programming based on "genetic algorithms."

[3] Note that the best of the initial dialectical programs will eventually discover that the best way of pursuing their timeless end is to pursue boundless factors of deciding well. From a dialectical view, Reasonable programs are dialectical programs that include much knowledge useful in living well for which a high price has been paid in suffering through the working out of what Hegel called "internal contradictions." From a Reasonable view, good dialectical programs evolve into Reasonable programs, programs that use Reason to avoid the worst of the suffering of learning through experience.

Changes in Version 2012.03.15

Acknowledgments, fifth paragraph

Changed "this book" to "what evolved into this book" in the last sentence.

Preface, last paragraph, second and third sentences

"It only appears to be a special case to people locked into a view of the world based on what they currently know, rather than what they need to know in order to decide well. I go on to argue it helps us to find not only conflicts, but also holes in our belief systems."

were changed to:

"I go on to argue that it helps us find not only conflicts, but also holes in our belief systems."

Chapter 1, Choosing Frames Well, last paragraph

Changed ", but" back to ". However," in the last sentence.

Chapter 1, *The EOQ/RTS Example*, second paragraph

Changed "our factory expects" to "we expect" in the first sentence.

Chapter 1, *The EOQ/RTS Example*, third paragraph

Changed "people" to "us" in the second sentence.

Changed "Managers" to "For example, managers" in the third sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, first paragraph

Changed "models that are ever more complete" to "multiple-frame models" in the first sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, last paragraph

Changed "this" to "it" in the last sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph, last three sentences

"Logic is a means to deciding well, not an end in itself. Logically, in seeking to disprove the proposition that all crows are black, we may choose to search for either crows that are not black or not black things that are crows. To search for the latter would be an absurd waste of resources."

were deleted.

Chapter 8, Useful Reason, last paragraph, footnote

Changed "reason" to "Reason" in the first sentence.

Chapter 8, Useful Reason, last paragraph, footnote, last two sentences

"Again, how do we best explain the world when it is impossible to know the world without changing it? As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time."

were changed to:

"What we now call received science, which is rooted in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain potential existence. Again, as intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time."

Appendix B, first paragraph

Changed "logic and dialectics" to "modern reason" in the first sentence.

Changed "summary" to "two-part summary" in the third sentence.

Changed "part of this summary" to "part" in the fourth sentence.

Appendix B, second paragraph, last sentence

"The reason is that no robot will ever be able to know it has discovered the Truth."

was changed to:

"The reason is that believing well is an endless process.[2]"

"[2] The basis for this claim concerns the problem of induction, not Gödel's second incompleteness theorem. In fact, this claim is the first of four propositions in a trivial proof of a more general alternative to Gödel's incompleteness theorems: (1) believing well is an endless process; (2) with any set of models for pursuing the timeless end of believing well (the Truth) we choose, we will either discover or never discover the Truth; (3) if we discover the Truth, we prove that our chosen set of models for pursuing it is complete; and (4) if we never discover the Truth, we never prove that our chosen set of models for pursuing it is complete. From these propositions, it follows that we can never prove a set of models for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the proposition that believing well is an endless process. If we never discover the Truth, we never prove the set of models is complete."

Appendix B, last two paragraphs

Removed all italics.

Appendix B, third paragraph, last footnote

"Note that the best of the initial dialectical programs will eventually discover that the best way of pursuing their timeless end is to pursue boundless factors of deciding well. From a dialectical view, Reasonable programs are dialectical programs that include much knowledge useful in living well for which a high price has been paid in suffering through the working out of what Hegel called "internal contradictions." From a Reasonable view, good dialectical programs evolve into Reasonable programs, programs that use Reason to avoid the worst of the suffering of learning through experience."

was changed to:

"From a dialectical view, Reasonable programs are dialectical programs that include knowledge of the need to pursue all boundless factors of *living* well. From a Reasonable view, good dialectical programs evolve into Reasonable programs, programs that use ever better approximations of Beauty to avoid the worst of the suffering of learning through experience."

Appendix B, last paragraph

Changed "acting as if it is best" to "holding the truth that Reason is best to be self-evident" in the fifth sentence.

Changes in Version 2012.03.20

Chapter 3, Overcoming Constraints in Deciding Well, last paragraph, footnote

"[4] In his book *A Conflict of Visions: Ideological Origins of Political Struggles* (New York: William Morrow, 1987), Thomas Sowell distinguishes between what he calls unconstrained and constrained visions. From an unconstrained view, the task of finding the best problems to solve tends to be trivial. Hence, deciding well is largely a matter of giving the people who are willing to address the problem the power to address it. This is consistent with the engineering approach to overcoming constraints. From a constrained view, the task of finding the best problem to solve tends to be difficult. Further, the people best able to find problems and solve problems tend to be the people closest to them. This is not consistent with the engineering approach to overcoming constraints."

was deleted.

Chapter 8, Useful Frames, last three paragraphs

"When we pursue temporal ends, we seek to find the best solution to a given temporal problem. Excellence in relating beliefs concerns reason within the frame that we use to describe this temporal problem. Excellence in solving given problems calls for models of the world that are completely unambiguous. We may call the set of rules that we use to relate beliefs within these frames *the rules of logic*, after the rules of reason that Aristotle used to relate beliefs in his pursuit of natural forms.

"When we pursue timeless ends, we seek not only to solve given problems, but also to find problems to solve. Excellence in relating beliefs concerns not only the frames we use to solve given problems, but also those we use to find problems to solve. Excellence in finding problems to solve in pursuing timeless ends calls for models that are ambiguous with respect to the timeless end and the means of pursuing the timeless end. If these two concepts were not ambiguous, there would be no room for better approximates of them. We may call the set of rules that we use to judge these frames *the rules of dialectics*, after the dialectic form of discourse that Socrates used to explain what timeless ends are not.

"When we use the multiple-frame approach to deciding well, we seek temporal problems to solve that ring true with pursuing boundless factors of deciding well, which are timeless ends. We also seek to solve these problems using models that help us predict what will happen. The set of rules for using the multiple-frame approach to deciding well contains the rules of dialectics, the rules of logic, and the rules we use to relate these two sets of rules. We may call this set of rules *the rules of Reason*. Both logic and dialectics tend to blind us to opportunities

for learning by doing in deciding well. Properly conceived, reason not only helps us see these opportunities, but also helps us judge them.[3]"

"[3] Students of Western thought may better understand the distinction between logic, dialectics, and Reason by studying Ludwig Wittgenstein's conversion from a picture theory of language based on a temporal view of the world to an instrumental theory of language based on the timeless end of living well. They may find that quantum mechanics offers deeper insights into the problems of language than nineteenth-century atomic or biological models offer, especially concerning questions of existence, potential existence, and consciousness. What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain potential existence. Again, as intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time."

were changed to:

"When we pursue temporal ends, we seek to find the best solution to a given temporal problem. Reason concerns the frames we use to describe given temporal problems. Excellence in solving given temporal problems calls for completely unambiguous frames. We may call the set of rules that we use to relate beliefs within these frames *the rules of logic*, after the rules of reason that Aristotle used to relate beliefs in his pursuit of natural forms.

"When we pursue timeless ends, we seek not only to find the best solution to given temporal problems, but also to find the best temporal problems to solve in pursuing our chosen timeless end. Reason concerns not only the frames we use to solve given temporal problems, but also the frame that we use to find temporal problems to solve in pursuing our chosen timeless end. Excellence in finding temporal problems calls for defining our chosen timeless end and the means of pursuing it in terms of each other. If these two objects were not ambiguous, there would be no room for better approximates of them. We may call the set of rules that we use to judge these frames *the rules of dialectics*, after the dialectic form of discourse that Socrates used to explain what timeless ends are not.

"When we use the multiple-frame approach to deciding well, we seek not only to find the best solution to given temporal problems, but also to find the best temporal problems to solve in pursuing Wisdom. Reason concerns not only the frames we use to solve given temporal problems, but also the frame that we use to find temporal problems to solve in pursuing Wisdom. Excellence in finding temporal problems to solve in pursuing Wisdom calls for models that are ambiguous with respect to the timeless ends of all boundless factors of deciding well and the means of pursuing these ends. We may call the set of rules that we use to judge these frames *the rules of Reason*."

"[3] Both logic and dialectics tend to blind us to opportunities for learning by doing in deciding well. Properly conceived, reason not only helps us see these opportunities, but also helps us judge them. Students of Western thought may better understand the distinction between logic, dialectics, and Reason by studying Ludwig Wittgenstein's conversion from a picture theory of language based on a temporal view of the world to an instrumental theory of language based

on the timeless end of living well. They may find that quantum mechanics offers deeper insights into the problems of language than nineteenth-century atomic or biological models offer, especially concerning questions of existence, potential existence, and consciousness. What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain potential existence. Again, as intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time."

Chapter 8, Complete Reasoning, first paragraph

Changed "is" to "appears to be" in the second sentence.

Chapter 8, Complete Reasoning, second paragraph

Changed "pursuing the Truth" to "finding problems to solve in pursuing the Truth" in the first sentence.

Chapter 8, Complete Reasoning, third paragraph

Changed "best" to "best for finding problems to solve in pursuing the Truth" in the last sentence.

Chapter 8, Summary, first paragraph

Deleted ", which tends to blind us to the wisdom of learning by doing" from the second sentence.

Deleted the fifth sentence: "In the words of Dwight Eisenhower, "If a problem cannot be solved, enlarge it.""

Appendix B, first paragraph

"A major thesis of this book is the need to replace modern reason with Reason as the basis for pursuing the timeless end of believing well (the Truth). Such an extraordinary claim demands an extraordinary argument. What follows is a two-part summary of the argument supporting this claim. The first part uses a thought experiment to prove that it is impossible to prove which form of reason is best for pursuing the Truth. The second calls for a timeless experiment to disprove the hypothesis that Reason is the best form of reason for pursuing the Truth."

was changed to:

"The extraordinary claim that we ought to replace logic and dialectics with Reason as the basis for finding problems to solve demands extraordinary evidence. What follows is a brief argument supporting this claim. The first part explains why it is impossible to prove which

form of reason is best for finding problems to solve in pursuing the timeless end of believing well (the Truth). The second calls for a timeless experiment to disprove the hypothesis that Reason is the best form of reason for finding problems to solve in pursuing the Truth."

Appendix B, last paragraph, first four sentences

"Regardless of our inability to prove which of these approaches is best, living well calls for us to choose one. From the invariant view of living well, which is the view of living ever more wisely, we ought to choose the approach that rings the truest with all that we currently know about living ever more wisely. The evidence that the Reasonable approach rings the truest is extraordinary. Hence, we ought to seek to disprove that this approach is best."

were changed to:

"Regardless of our inability to prove which of these concepts of reason is best for finding problems to solve in pursuing the Truth, living well calls for us to choose one. From the invariant view of living well, which is the view of living ever more wisely, we ought to choose the one that rings the truest with all that we currently know about living ever more wisely. The evidence that Reason rings the truest is extraordinary. Hence, we ought to seek to disprove that Reason is best."

Changes in Version 2012.03.23

Acknowledgments, fifth paragraph

Changed "privately held" to "family-owned" in the first sentence.

Appendix B, title, quote footnote

Changed "came" to "quote is" in the first sentence.

Appendix B, first paragraph

"The extraordinary claim that we ought to replace logic and dialectics with Reason as the basis for finding problems to solve demands extraordinary evidence. What follows is a brief argument supporting this claim. The first part explains why it is impossible to prove which form of reason is best for finding problems to solve in pursuing the timeless end of believing well (the Truth). The second calls for a timeless experiment to disprove the hypothesis that Reason is the best form of reason for finding problems to solve in pursuing the Truth."

was changed to:

"The extraordinary claim that we ought to use Reason to find problems to solve in pursuing the timeless end of believing well (the Truth) demands either a proof or extraordinary

evidence. The next two paragraphs explain why there can be no proof. The last describes the evidence."

Appendix B, third paragraph

Deleted the first footnote:

"[3] The author first learned of this technique from a lecture that computer scientist John Holland gave to members of the Santa Fe Institute Business Partners. Holland was one of the pioneers of evolutionary programming based on "genetic algorithms.""

Added the following sentence to the end of the paragraph:

"In computability theory terms, the issue of which form of reason is best for finding problems to solve in pursuing the Truth is *undecidable*.[4]"

"[4] On a deeper level, the possible existence of intuition that truly helps us find problems to solve in pursuing the Truth is undecidable. Proving that such intuition exists or not calls for knowing the Truth, which is impossible. Belief in the existence of such intuition led Kurt Gödel to seek an *a priori* approach to science. The possible existence of such an approach is also undecidable. Proving that such an approach exists or not calls for knowing the Truth, which is impossible. Further, disproving the existence of an *a priori* approach to science experimentally contradicts the existence of an *a priori* approach to science. One solution to this contradiction is to replace the modern meaning of the term *'a priori'* with a multiple-frame meaning. Had Gödel defined the term *'a priori'* to apply only to the relations between boundless factors of deciding well, he might have convinced his colleagues at the Institute of Advanced Study, particularly Nils Aall Barricelli, John von Neumann, and George Kennan, of the wisdom of an "*a priori*" approach to science."

Changes in Version 2012.03.28

Acknowledgments, fifth paragraph

Changed "family-owned" back to "privately held" in the first sentence.

Preface, fifth paragraph

"In this little book, I provide people with the tools they need to use this multiple-frame approach to deciding well. In the first chapter, I explain why making the most of what we currently know calls for us to use this approach. In the remaining chapters, I describe pursuits of boundless factors of deciding well."

was changed to:

"The extraordinary claim that we ought to replace our current concept of reason with a concept based on the multiple-frame approach to deciding well as a tool for finding problems in pursuing the timeless end of believing well calls for extraordinary evidence. But what qualifies as evidence? From the invariant view of living well, which is the view of living ever more wisely, we ought to choose the concept of reason that rings the truest with all that we currently know about living ever more wisely. The evidence that this new form of reason rings the truest is extraordinary. Hence, we ought to seek to disprove it is best. We do so by acting as if it is best.

"What follows is pioneering work in the science of science, the self-referential and self-similar process of deciding well. In the first chapter, I explain why making the most of what we currently know calls for us to use the multiple-frame approach to deciding well. In the remaining chapters, I describe pursuits of boundless factors of deciding well."

Chapter 4, *Self-Similarity*, last paragraph

Changed "*knowledge in use*" to "*knowledge-in-use*" in the last sentence.

Chapter 8, Useful Reasoning, last paragraph, footnote, end

Added the sentence:

"For more on these three forms of reason, see Appendix B."

Chapter 8, Complete Reasoning, first paragraph, second footnote, last sentence

"For more on this, see Appendix B."

was deleted.

Appendix B, first paragraph

"The extraordinary claim that we ought to use Reason to find problems to solve in pursuing the timeless end of believing well (the Truth) demands either a proof or extraordinary evidence. The next two paragraphs explain why there can be no proof. The last describes the evidence."

was deleted.

Appendix B, new first paragraph, second through last sentences

"We can imagine a robot that is capable of replicating itself. Further, we can imagine that this robot and its descendants can communicate with each other and that any group of these robots will halt only after discovering the Truth. If we define a complete program to be a program that will cause one or more of these robots to halt, then we will never be able to prove the existence of a complete program. The reason is that believing well is an endless process.[2]"

"[2] The basis for this claim concerns the problem of induction, not Gödel's second incompleteness theorem. In fact, this claim is the first of four propositions in a trivial proof of a more general alternative to Gödel's incompleteness theorems: (1) believing well is an endless process; (2) with any set of models for pursuing the timeless end of believing well (the Truth) we choose, we will either discover or never discover the Truth; (3) if we discover the Truth, we prove that our chosen set of models for pursuing it is complete; and (4) if we never discover the Truth, we never prove that our chosen set of models for pursuing it is complete. From these propositions, it follows that we can never prove a set of models for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the proposition that believing well is an endless process. If we never discover the Truth, we never prove the set of models is complete."

were changed to:

"We can imagine a group of self-replicating robots capable of communicating with each other. Further, we can imagine that any group of these robots will halt only after discovering the Truth. If we define the best form of reason to be the reason of the first program that will cause one or more of these robots to halt, then we will never be able prove which form of reason is best. Because no robot can ever know it knows the Truth, no robot will ever halt. In computability/recursion theory terms, the problem of determining which form of reason is best for finding problems to solve in pursuing the Truth is *unsolvable*.[2]"

"[2] Some modern thinkers may believe that Kurt Gödel's work can help us better understand the multiple-frame approach to deciding well. The reverse is true. We can use the multiple-frame approach to gain a deeper understanding of what Gödel was trying to do. Gödel recognized that the limits of logic went far beyond number theory. Consider the following propositions. First, pursuing the Truth is an endless process. Second, any set of models for pursuing the Truth, we will either discover or never discover the Truth. Third, if we discover the Truth, we prove that the set of models for pursuing the Truth is complete. Fourth, if we never discover the Truth, we never prove that the set of models for pursuing the Truth is complete. From these four propositions, it follows that we can never prove a set of models for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the proposition that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of models is complete. Gödel believed that we use intuition to overcome the limits of logical models in pursuing the Truth. Belief in the existence of intuition led him to seek an *a priori* approach to the whole of science. Proving such an approach does or does not exist *logically* calls for knowing the Truth, which is impossible. Further, disproving it exists *experimentally* contradicts the claim that an *a priori* approach to the whole of science exists. From a multiple-frame view, Gödel might have overcome this contradiction by defining the term *'a priori'* to refer only to the relations between boundless factors of deciding well. Had he done so, he might have convinced his colleagues at the Institute of Advanced Study, particularly Nils Aall Barricelli, John von Neumann, and George Kennan, of the wisdom of an "*a priori*" approach to the whole of science."

Appendix B, new second paragraph

Changed "the problem of not knowing" to "this problem of never knowing" in the first sentence.

Appendix B, new second paragraph, last two sentences

"Although the Reasonable approach may appear to be the best for finding problems to solve in pursuing the Truth, proving that it is the best calls for proving programs for pursuing the Truth to be complete, which is impossible. In computability theory terms, the issue of which form of reason is best for finding problems to solve in pursuing the Truth is *undecidable*.[4]"

"[4] On a deeper level, the possible existence of intuition that truly helps us find problems to solve in pursuing the Truth is undecidable. Proving that such intuition exists or not calls for knowing the Truth, which is impossible. Belief in the existence of such intuition led Kurt Gödel to seek an *a priori* approach to science. The possible existence of such an approach is also undecidable. Proving that such an approach exists or not calls for knowing the Truth, which is impossible. Further, disproving the existence of an *a priori* approach to science experimentally contradicts the existence of an *a priori* approach to science. One solution to this contradiction is to replace the modern meaning of the term *'a priori'* with a multiple-frame meaning. Had Gödel defined the term *'a priori'* to apply only to the relations between boundless factors of deciding well, he might have convinced his colleagues at the Institute of Advanced Study, particularly Nils Aall Barricelli, John von Neumann, and George Kennan, of the wisdom of an "*a priori*" approach to science."

were changed to:

"Although the Reasonable approach may appear to be the best for finding problems to solve in pursuing the Truth, proving that it is the best calls for proving a program for pursuing the Truth to be the best *reasonably-complete* program. This in turn calls for knowing the Truth. However useful this finesse may be in helping us find problems to solve in pursuing the Truth, it is not useful in helping us prove which form of reason is best for finding problems to solve in pursuing the Truth."

Changes in Version 2012.03.31

To avoid opening a second quarter change record, this section includes several small changes made in the first week of April. The first quarter 2012 change history should be the last made to the Internet version of this work. The published version will likely contain other changes, along with a third appendix.

Acknowledgments, last paragraph

Changed "true" to "best" in the last sentence.

Added the sentence: "What follows is a strategy for learning how to tell ever more about the best way forward."

Preface, fifth paragraph, last four sentences

"From the invariant view of living well, which is the view of living ever more wisely, we ought to choose the concept of reason that rings the truest with all that we currently know about living ever more wisely. The evidence that this new form of reason rings the truest is extraordinary. Hence, we ought to seek to disprove it is best. We do so by acting as if it was best."

were changed to:

"From the invariant view of believing well, which is the view of believing well ever more wisely, we ought to choose the concept of reason that rings the truest with all that we currently know about believing well ever more wisely. We then ought to seek to disprove it is best. We do so by acting as if it is best."

Preface, sixth paragraph

Italicized "*the science of science*" in the first sentence.

Changed "self-referential and self-similar" to "self-referential, self-similar, multiple-frame" in the second sentence.

Changed "the multiple-frame" to "this complex" in the last sentence.

Preface, last paragraph

Changed "multiple-frame" to "complex" and "the general case" to "*reasonably complete*" in the first sentence.

Changed "I go on to argue that it" to "As such, it" in the second sentence.

Deleted the last sentence: "This makes it more useful than logic alone, which only helps us find conflicts in our belief systems."

Chapter 1, Choosing Frames Well, last paragraph, footnote end

Changed "deciding well." to: "the timeless end of believing well. The basis for mathematics being something we discover rather than invent is usefulness in pursuing the Truth."

Chapter 1, *The EOQ/RTS Example*, last paragraph

Moved the footnote to the end of the paragraph.

Chapter 1, *Seeing Through Apparent Miracles*, first paragraph, second sentence

"The following *kaizen* slogans highlight this problem:"

was changed to:

"Consider the following *kaizen* slogans:"

Chapter 1, Values, third paragraph, footnote, last three sentences

"As we shall see, this change in case is consistent with a decision-oriented interpretation of quantum mechanics. Measured by how well a theory predicts the world, quantum mechanics is easily the most successful theory in the history of science. As we shall also see, we cannot separate the timeless problems we face from the timeless problems all other people face."

were changed to:

"As we shall see, we cannot separate the timeless problems we face from the timeless problems all other people face."

Chapter 1, Values, sixth paragraph, footnote

Changed "approaches" to "approaches to language" in the last sentence.

Chapter 2, Consumption, first paragraph, first two sentences

"Consumption is the process of consuming wealth. The end of this process is living well."

were changed to:

"We live well by consuming resources."

Chapter 3, *Public Entropy*, second paragraph

Changed "large effects" to "the largest effects" in the last sentence.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, last paragraph, end

Added the footnote:

"[10] As we shall also see, current reason is either too limiting (logic) or too crude (dialectics) to help us think clearly about ideal paths forward, hence about the source of power-law distributions in the public sciences, especially those related to turbulence/catastrophes."

Chapter 4, *Self-Similarity*, last paragraph

Changed "We embed" to "In doing so, we embed much of" in the last sentence.

Chapter 4, *Academic Fields*, last paragraph

Changed "self-referential, self-similar process" to "process" in the first sentence.

Chapter 5, Good Policies, first paragraph, footnote, end

Added the sentence: "For a deeper understanding of this issue, read the works of Michael Polanyi starting with *The Tacit Dimension* (Chicago: University of Chicago Press, 2009)."

Chapter 5, *Pursue Invariant, not Temporal Order*, first paragraph

Changed "corporate bankers" to "people" in the last sentence.

Chapter 6, The Further Reaches of Our Nature, sixth paragraph, last sentence

"He wisely limited his findings to modern Western culture."

was moved to the end of the footnote and changed to:

"Note that Maslow wisely limited his findings about being needs to modern Western culture."

Chapter 6, The Further Reaches of Our Nature, last paragraph

"This chapter concerns what Maslow called being needs."

was deleted.

Chapter 6, *Schweitzer's Universal Spiritual Need*, first paragraph

Changed "Westerners" to "subjects" in the last sentence.

Chapter 6, *Einstein's Twin Warnings*, second paragraph

Changed "divine pronouncements" to "pronouncements" in the second sentence.

Chapter 6, A Common Timeless End, second paragraph, last sentence

"*Deciding well makes it ever less probable that we will need to make this choice.*"

was changed to:

"Deciding well makes it ever less probable that we will need to make this choice. Further, given that the emotions arising from our need for mystical oneness can easily overwhelm our reason, we ought to err on the side of living well. We ought to sacrifice ourselves wisely."

Chapter 6, A Common Timeless End, last paragraph, last sentence

"Current ignorance prevents us from taking other than this brute force approach to deciding well."

was deleted.

Chapter 7, The Scope of Game Theory, fourth paragraph

Deleted "The former author of the *Scientific American* Mathematical Games column, " from the sixth sentence.

Added the following sentences to the end of the footnote.

"Martin Gardner was author of the *Scientific American* Mathematical Games column, which preceded Hofstadter's Metamagical Themas column. 'Metamagical themas' is an anagram of 'mathematical games.'"

Chapter 7, *E-M Theory*, first paragraph

Changed ", which became the handbook for" to "eventually used by" in the fourth sentence.

Changed "these tactics" to "close-in aerial combat" in the sixth sentence.

Chapter 7, *E-M Theory*, second paragraph

Changed "military industrial" to "military-industrial-congressional" in the seventh sentence.

Chapter 7, *Temporal OODA Loop Analysis*, second paragraph

Changed "this decision cycle" to "his decision cycle" in the second sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote, first three sentences

"Boyd saw self-similar patterns in the way we compete to live well. He wanted to capture these patterns in a universal model that included learning-by-doing. Regrettably, he based this model on modern explanations of evolution, quantum mechanics, and Gödel's incompleteness theorems."

were changed to:

"Boyd saw patterns in the way we compete to live well. He wanted to explain these patterns using a decision-cycle model that included learning-by-doing. Regrettably, he based his model on modern interpretations of evolution, quantum mechanics, and Gödel's incompleteness theorems."

Chapter 8, Useful Reasoning, third paragraph

Changed "relate beliefs within" to "relate beliefs well within" in the last sentence.

Chapter 8, Useful Reasoning, fourth paragraph

Changed "judge" to "relate beliefs well within" in the last sentence.

Changed "temporal problems" to "problems" in all (5 occurrences).

Chapter 8, Useful Reasoning, last paragraph

Changed "but also to find" to "but also" in the first sentence.

Changed "judge" to "relate beliefs well within" in the last sentence.

Changed "temporal problems" to "problems" in all (5 occurrences).

Chapter 8, Useful Reasoning, last paragraph, footnote, fourth paragraph

"They may find that quantum mechanics offers deeper insights into the problems of language than nineteenth-century atomic or biological models offer, especially concerning questions of existence, potential existence, and consciousness."

was deleted.

Chapter 8, Complete Reasoning, first paragraph, first footnote

Deleted the first sentence: "Modern reasoning concerns the rules we use to bind beliefs together into coherent models of the world."

Changed "In contrast, *reasonably-complete*" to "Reasonably-complete" in the new first sentence.

Changed "wisdom" to "pursuing Wisdom" in the last sentence.

Appendix B, first paragraph

Changed "choosing the form" to "proving formally the best form" in the first sentence.

Changed "determining" to "proving formally" in the last sentence.

Appendix B, first paragraph, footnote

"[2] Some modern thinkers may believe that Kurt Gödel's work can help us better understand the multiple-frame approach to deciding well. The reverse is true. We can use the multiple-

frame approach to gain a deeper understanding of what Gödel was trying to do. Gödel recognized that the limits of logic went far beyond number theory. Consider the following propositions. First, pursuing the Truth is an endless process. Second, any set of models for pursuing the Truth, we will either discover or never discover the Truth. Third, if we discover the Truth, we prove that the set of models for pursuing the Truth is complete. Fourth, if we never discover the Truth, we never prove that the set of models for pursuing the Truth is complete. From these four propositions, it follows that we can never prove a set of models for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the proposition that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of models is complete. Gödel believed that we use intuition to overcome the limits of logical models in pursuing the Truth. Belief in the existence of intuition led him to seek an *a priori* approach to the whole of science. Proving such an approach does or does not exist *logically* calls for knowing the Truth, which is impossible. Further, disproving it exists *experimentally* contradicts the claim that an *a priori* approach to the whole of science exists. From a multiple-frame view, Gödel might have overcome this contradiction by defining the term *'a priori'* to refer only to the relations between boundless factors of deciding well. Had he done so, he might have convinced his colleagues at the Institute of Advanced Study, particularly Nils Aall Barricelli, John von Neumann, and George Kennan, of the wisdom of an "*a priori*" approach to the whole of science."

was changed to:

"[2] We may also think of this in terms of logical consistency and completeness. Consider the following propositions. First, pursuing the Truth is an endless process. Second, any set of models for pursuing the Truth, we will either discover or never discover the Truth. Third, if we discover the Truth, we prove that the set of models for pursuing the Truth is complete. Fourth, if we never discover the Truth, we never prove that the set of models for pursuing the Truth is complete. From these four propositions, it follows that we can never prove a set of models for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the proposition that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of models is complete."

Appendix B, second paragraph

Changed "selects" to "selects and "breeds"" in the first sentence.

Moved footnote from the end of the third to the end of the fourth sentence.

Changed "prove" to "prove formally" and "most *reasonably-complete* program" to "the program that converges on the Truth most quickly" in the last sentence.

Appendix B, last paragraph

Changed "prove" to "prove formally" in the first sentence.

Changed "living well" to "believing well" in the second sentence.

Changed "living ever more wisely" to "believing well ever more wisely" in the second sentence (2 occurrences).

Changes in Version 2012.04.16

Note that some changes to changes made in the first week of April made to changes to the last week in March were recorded as last week in March changes.

Preface, last paragraph, first sentence

"In the last chapter, "Reasoning Well," I argue that the reasoning that underlies this complex approach to deciding well is *reasonably complete*. As such, it helps us find not only conflicts, but also holes in our belief systems."

was changed to:

"In the last chapter, "Reasoning Well," I argue that the reasoning that underlies this complex approach to deciding well is the best form of reason for helping us find problems to solve in pursuing the timeless end of believing well. It helps us find not only conflicts, but also holes in our belief systems."

Chapter 1, Choosing Frames Well, last paragraph, footnote

"From the boundlessly pragmatic view put forth in this work, this simple prescription lies at the heart of reason. Consider Georg Cantor's continuum hypothesis. Cantor discovered that some infinities were "larger" than others. He went on to hypothesize that there were no levels of infinity between those of integers and real numbers. Trying to prove (or disprove) this hypothesis drove him insane. Paul Cohen later showed that there exist approaches to mathematics in which the continuum hypothesis is true and other approaches in which it is false. From the view of this work, the relevant question is whether these approaches are useful in pursuing the timeless end of believing well (the Truth). The basis for mathematics being something we discover rather than invent is usefulness in pursuing the Truth."

was changed to:

"Consider Georg Cantor's continuum hypothesis. Cantor hypothesized that there were no levels of infinity between those of integers and real numbers. Trying to prove or disprove this hypothesis drove him insane. Paul Cohen later showed that there exist approaches to mathematics in which the continuum hypothesis is true and other approaches in which it is false. From the view of this work, the relevant question is whether these approaches are useful in deciding well."

Chapter 4, *A Crude Look at the Whole*, first paragraph, last footnote, last sentence

"As we shall see in the last chapter, the existence of power-law distributions in economies undermines Darwinian evolution as the general means of explaining the evolution of life."

was deleted.

Chapter 7, *Boyd's Grand Strategy*, last paragraph

Changed: "Boyd did not provide us with a clear and concise definition of a grand strategy that rings true with pursuing the boundless factors of deciding well of deciding well" to "Boyd's grand strategy rings true with modern biology" in the first sentence.

Changed "biological view, these timeless ends" to "view, boundless factors of deciding well" in the second sentence.

Chapter 7, end

Added the section:

"**The Scope of Evolution**
From the view of modern biology, living beings cooperate well in order to compete well. Those that always seek to cooperate before they seek to compete, to look first for win–win solutions to resource problems before they seek to compete over resources, are anomalies. Our national goal is superior to our grand strategy.

"From the multiple-frame view, living beings compete well in order to cooperate well. Those that seek to compete before they seek to cooperate are the special case of beings that have not yet developed the wisdom to do otherwise. Our grand strategy is superior to our national goal.

"As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways that are most useful to intelligent beings bound to live well in the flow of time. Hence, we ought to explain evolution as a matter of living beings seeking to compete well in order to cooperate well.[17]"

"[17] People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot (Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence*, New York: Basic Books, 2004, chapter VIII). Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

Chapter 8, Title, second quote

""We shall not grow wiser before we learn that much that we have done was very foolish." — *F. A. Hayek*[2]"

"[2] Hayek, F. A., *The Road to Serfdom* (Chicago: University of Chicago Press, 2007), p. 237."

was changed to:

""So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." — *Gregory Chaitin*[2]"

"[2] Opening remarks of a lecture Gregory Chaitin gave at Carnegie Melon University's School of Computer Science on March 2, 2000. A video of this lecture is available online at <http://www.youtube.com/watch?v=HLPO-RTFU2o> (9 March 2012)."

Chapter 8, Useful Reasoning, title

Changed title to "Usefulness."

Chapter 8, Usefulness, last paragraph, footnote

Changed "Both logic and dialectics" to "By restricting the number of imagined perspectives on the ideal avenue into potential existence, both logic (0) and dialectics (1)" in the first sentence.

Changed "Properly conceived" to "In contrast" in the second sentence.

Chapter 8, Usefulness, last paragraph, footnote, last three sentences

"To decide well, we also need to explain potential existence. Again, as intelligent beings bound to live well in the flow of time, we ought to describe the world in ways most useful to intelligent beings bound to live well in the flow of time. For more on these three forms of reason, see Appendix B."

were changed to:

"To decide well, we also need to explain how the whole of potential existence relates to pursuing the Truth. Analyzing parts of potential existence, such as that done by Nelson Goodman in *Fact, Fiction, and Forecast* (Cambridge, MA: Harvard University Press, 1983), is not enough."

Chapter 8, Usefulness, last paragraph, end

Added the following paragraphs:

"We may think of the problem of formally proving which of these forms of reason is best for pursuing the Truth as a programming problem. Imagine a group of self-replicating robots capable of communicating with each other. Further, imagine that any group of these robots will halt only after discovering the Truth. If we define the best form of reason as the reason of the first program that will cause one or more of these robots to halt, then we will never be able to prove which form of reason is best. This is because no robot can ever know it knows the Truth, hence can never know when to stop. In computability/recursion theory terms, the problem of formally proving the best form of reason for pursuing the Truth is *unsolvable*.

"We can imagine finessing this problem of never knowing the Truth by using a programming technique that selects and "breeds" algorithms based on their fitness in pursuing timeless ends. The logical approach to pursuing the Truth does not use this technique. The dialectical approach uses it to pursue the timeless end of living well. The Reasonable approach uses it to pursue the timeless end of deciding well, which calls for using it to pursue all of the boundless factors of deciding well.[4] Although the Reasonable approach may appear to be the best for pursuing the Truth, proving that it is the best still calls for knowing the Truth. However useful this finesse may appear to be in pursuing the Truth, it is not useful in helping us formally prove which form of reason is best for pursuing the Truth.

"Regardless of our inability to prove formally which of these concepts of reason is best for pursuing the Truth, living well calls for us to choose one. From the invariant view of believing well, which is the view of believing well ever more wisely, we ought to choose the one that rings the truest with all that we currently know about believing well ever more wisely. The evidence that Reason rings the truest is extraordinary. Hence, we ought to seek to disprove that Reason is best. We do so by holding the truth that Reason is best to be self-evident. We do so by putting our faith in Reason."

"[4] From a dialectical view, Reasonable programs are dialectical programs that include knowledge of the need to pursue all boundless factors of *living* well. From a Reasonable view, good dialectical programs evolve into Reasonable programs, programs that use ever better approximations of Beauty to avoid the worst of the suffering of learning through experience."

Chapter 8, Complete Reasoning, title

Changed title to "Completeness."

Chapter 8, Completeness, first paragraph

"We may call a truly boundless process of reasoning, a process of reasoning that effectively contains a means of refining itself that contains a means of refining itself that contains a means of refining itself..., *reasonably complete*.[5] So conceived, the reasoning of the multiple-frame approach to deciding well appears to be reasonably complete. It helps us find not only conflicts but also holes in our belief systems.[6]"

was changed to:

"We may call a set of rules for pursuing the Truth that is complete at the time we measure it *statically complete*. We can never formally prove a set of rules for pursuing the Truth to be both logically consistent and statically complete. Consider the following propositions. First, pursuing the Truth is an endless process. Second, for any set of rules for pursuing the Truth, we will either discover or never discover the Truth. Third, if we discover the Truth, we prove that the set of rules for pursuing the Truth is statically complete. Fourth, if we never discover the Truth, we never prove that the set of rules for pursuing the Truth is statically complete. From these four propositions, it follows that we can never prove a set of rules for pursuing the Truth to be both logically consistent and statically complete. If we discover the Truth, we prove false the proposition that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of rules is statically complete.

"The fact that we can never prove a set of rules for pursuing the Truth to be both logically consistent and statically complete does not mean that we not ought to pursue the Truth. We can still pursue the Truth using a set of rules capable of refining itself based on experience. We may call such a set of rules *dynamically complete*.[5] So conceived, Reason appears to be dynamically complete. It helps us find not only conflicts but also holes in our belief systems.[6]"

Chapter 8, Completeness, last paragraph, first footnote

Changed "Reasonably-complete" to "Dynamically complete" in the first sentence.

Changed "Such reasoning" to "It" in the second sentence.

Chapter 8, Natural Reasoning, entire section

"From the view of modern biology, living beings cooperate well in order to compete well. Those that seek to cooperate before they seek to compete, to look first for win–win solutions to resource problems before they seek to compete over resources, are anomalies. From the multiple-frame view, living beings compete well in order to cooperate well. Living beings that seek to compete before they seek to cooperate are the special case of beings that have not yet developed the wisdom to do otherwise. Which of these two views is the better for helping us find problems to solve, hence for explaining the world?[8]"

"[8] People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot (Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence*, New York: Basic Books, 2004, chapter VIII). Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the holistic view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

was deleted.

Appendix B, entire section

Deleted Appendix B.

Changes in Version 2012.04.17

Chapter 1, Choosing Frames Well, first paragraph

Changed "from which we have removed all currently removable ambiguity" to "for perceiving the world from which we have removed all ambiguity that we currently know how to remove" in the last sentence.

Chapter 1, Choosing Frames Well, last paragraph, footnote, end

Added the sentence:

"Indispensability in deciding well makes intellectual tools something we discover rather than invent."

Chapter 8, Usefulness, fifth paragraph, footnote

Changed "that done by Nelson Goodman" to "Nelson Goodman did" in the last sentence.

Chapter 8, Usefulness, seventh paragraph

Changed "the timeless end of living well" to "a timeless end." in the second sentence.

Chapter 8, Usefulness, seventh paragraph, footnote

Changed "view" to "view based on modern biology" in the first sentence.

Changes in Version 2012.04.19

Preface, last paragraph

Changed "find problems to solve in pursuing" to "pursue" in the first sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote, end

Added the sentences:

"From the multiple-frame view, indispensability in deciding well makes intellectual tools something we discover rather than invent. Like mathematics and logic, the reason that binds the boundless factors of deciding well together into a coherent whole is indispensable in deciding well."

Chapter 7, The Grandest Possible Strategy, first paragraph

Changed "The" to "From the multiple-frame view, the" in the second sentence.

Chapter 8, Heading, first quote

Changed "also available" to "available" in the last sentence of the reference.

Changes in Version 2012.04.21

Preface, first paragraph

Changed "the way forward" to "the best way forward" in the last sentence.

Chapter 8, Summary, first paragraph

Changed "whole" to "whole, which is important due not only to the entanglement problem in physics, but also the inexhaustibility problem in economics" in the last sentence.

Changes in Version 2012.04.24

Acknowledgments, first paragraph

Changed "What follows is" to "In this work, I describe" in the last sentence.

Chapter 3, Contemplating the Way Forward, second paragraph

Changed "will receive" to "receives" in the last sentence.

Chapter 3, The Elephant in the Room, first paragraph

"One of the most beautiful things to emerge from using the multiple-frame approach to deciding well is the relation between the boundless factors of deciding well and the values that people claim to seek when they seek to link with something infinitely greater than themselves."

was changed to:

"One of the most beautiful things to emerge from deciding well is the coincidence of boundless factors and invariant values."

Chapter 3, The Elephant in the Room, second paragraph

Changed "it, which includes understanding what we call the laws of nature" to "it" in the last sentence.

Merged this paragraph with the preceding paragraph

Chapter 3, The Elephant in the Room, new second paragraph

Changed "it, which includes understanding the Creator's thoughts in creating the laws of nature" to "it" in the last sentence.

Chapter 4, Useful Reminders, entire section

"Believing well calls for us to decide well, which in turn calls for us to pursue all of the boundless factors of deciding well.

"Pursuing the boundless factors of deciding well gives rise to the invariant concept of science as the endless process of refining everyday thinking. This boundlessly pragmatic approach to believing well tells us that not everything that counts can be counted, and not everything that can be counted counts. It also tells us that the models we use to explain what ants do do not change what ants do, but the models we use to explain what we do often change what we do. Mindlessly applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Such foolishness leads to catastrophe.

"Believing well calls for testing beliefs against experience. This includes the set of beliefs that support the multiple-frame approach to deciding well. The next chapter explains how we may test this set of beliefs as a whole."

was changed to:

"From the boundlessly pragmatic view, believing well calls for us to decide well, which in turn calls for us to pursue all of the boundless factors of deciding well. Pursuing these factors well gives rise to the invariant concept of science as the endless process of refining everyday thinking.

"From this multiple-frame view, not everything that counts can be counted, and not everything that can be counted counts. Further, the models we use to explain what ants do do not change what ants do, but the models we use to explain what we do often change what we do. Mindlessly applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Such foolishness leads to catastrophe.

"From this view, believing well calls for testing *all* beliefs against experience. This includes the set of beliefs that support this approach to believing well. The next chapter explains how we may test this set of beliefs as a whole."

Chapter 8, Complete Reasoning, entire section

Changed "statically" to "temporally" in all (7 occurrences).

Changed "dynamically" to "timelessly" in all (3 occurrences, including footnote).

Chapter 8, Summary, first paragraph

Changed "due not only to the entanglement problem in physics, but also the inexhaustibility problem in economics" to "not only in physics (the entanglement problem), but also in economics (the learning problem)" in the second sentence.

Changes in Version 2012.04.25

Chapter 3, Contemplating the Way Forward, second paragraph

Changed "will receive" to "receives" in the last sentence.

Chapter 3, The Elephant in the Room, second and third paragraphs, end

Changed "the multiple-frame approach to deciding well and the wisdom of using it" to "and use the multiple-frame approach to deciding well" in the last sentence (1 occurrence in each paragraph).

Chapter 6, A Common Timeless End, second paragraph, last sentence

"We ought to sacrifice ourselves wisely."

was deleted.

Chapter 7, The Scope of Strategy, third paragraph

Changed "Our grand strategy" to "Our grand strategy of deciding well" in the last sentence.

Chapter 8, Usefulness, fifth paragraph, footnote, last three sentences

"What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain how the whole of potential existence relates to pursuing the Truth. Analyzing parts of potential

existence, such as Nelson Goodman did in *Fact, Fiction, and Forecast* (Cambridge, MA: Harvard University Press, 1983), is not enough."

were changed to:

"What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence (which includes what we currently know). To decide well, we also need to explain how the whole of potential existence (which includes all that we can ever know) relates to pursuing the Truth. Analyzing parts of potential existence using current and currently imagined concepts, such as Nelson Goodman did in *Fact, Fiction, and Forecast* (Cambridge, MA: Harvard University Press, 1983), is not enough."

Chapter 8, Completeness, first paragraph

Changed "set of rules" to "set of currently known and unknown rules" and " based on" to "through" in the second sentence.

Changes in Version 2012.04.27

Chapter 4, *Self-Similarity*, first paragraph

Changed "We may think of science as" to "Refining everyday thinking is" in the first sentence.

Changed "includes" to "produces" in the second sentence.

Chapter 6, A Common Timeless End, second paragraph

Changed "Happiness" to "pursuing Happiness" in the fifth sentence.

Changed "Further, given" to "Given" in the last sentence.

Chapter 7, The Scope of Evolution, last paragraph, end

Added the sentence:

"We ought to take a boundlessly pragmatic view of evolution."

Chapter 8, Usefulness, second paragraph

Changed "rules" to "rules (axioms, principles, laws)" in the second sentence.

Chapter 8, Completeness, first paragraph

Changed "that is complete at the time we measure it *temporally complete*" to "contains all of the rules we need for pursuing the Truth *complete*" in the first sentence.

Changed "temporally complete" to "complete" in all (4 occurrences).

Chapter 8, Completeness, second paragraph

Changed "temporally complete" to "complete" in the first sentence.

Changed "can still" to "ought to" in the second sentence.

Changed "capable of refining itself through experience" to "for pursuing the Truth that contains a complete subset of rules for refining this set of rules (including itself)" in the second sentence.

Changed "*timelessly complete*" to "*reasonably complete*" in the third sentence.

Changed "timelessly complete" to "reasonably complete" in the fourth sentence.

Changed "timelessly complete" to "reasonably complete" in the first sentence of the first footnote.

Changes in Version 2012.04.30

Chapter 1, Choosing Frame Well, last paragraph, end

Added the sentence:

"As we shall see, this calls for a decision process that we can apply to itself an infinite number of times."

Chapter 4, Useful Reminders, first paragraph

Changed "boundlessly pragmatic" to "multiple-frame" in the first sentence.

Chapter 4, Useful Reminders, second paragraph

Changed "this multiple-frame" to "this" in the first sentence.

Chapter 4, Useful Reminders, last paragraph

Changed "*all*" to "all" in the first sentence.

Chapter 7, The Scope of Evolution, first paragraph, first two sentences

"From the view of modern biology, living beings cooperate well in order to compete well. Those that always seek to cooperate before they seek to compete, to look first for win–win solutions to resource problems before they seek to compete over resources, are anomalies."

were changed to:

"From the view of modern biology, living beings cooperate well in order to compete well for resources useful in living well. Those that always seek to cooperate before they seek to compete, to look for win–win solutions to resource problems before they seek to compete over resources, are anomalies."

Chapter 7, The Scope of Evolution, second paragraph

"From the multiple-frame view, living beings compete well in order to cooperate well. Those that seek to compete before they seek to cooperate are the special case of beings that have not yet developed the wisdom to do otherwise. Our grand strategy of deciding well is superior to our national goal."

was changed to:

"From the multiple-frame view, living beings compete well in order to cooperate well in living well. Those that seek to compete over resources before they seek to cooperate in living well are the special case of beings that have not yet developed the wisdom to do otherwise. Our national goal is pursuing the grand strategy of deciding well using the multiple-frame approach to deciding well. Belief in the boundless nature of evolution helps us find ever better ways of living well. In contrast, prevailing beliefs about evolution tend to blind us to better ways of living well."

Chapter 7, The Scope of Evolution, last paragraph

Changed "cooperate well" to "cooperate well in living well" in the second sentence.

Changed "boundlessly pragmatic" to "boundless" in the last sentence.

Chapter 8, Usefulness, title

Changed title to "Reasonable Reason."

Chapter 8, Completeness, title

Changed title to "Reasonable Completeness."

Chapter 8, Reasonable Completeness, last paragraph

Changed "Reason" to "the reason of the multiple-frame approach to deciding well, which we have called Reason," in the fourth sentence.

Changes in Version 2012.05.02

Preface, second to last paragraph, end

Added the sentence:

"We compete well in order to cooperate well in living well."

Chapter 8, Reasonable Reason, title

Changed title to "Beautiful Reason."

Chapter 8, Beautiful Reason, fourth paragraph

Changed "use the multiple-frame approach to deciding well" to "pursue the timeless end of deciding well (Wisdom) by pursuing the boundless factors of deciding well" in the first sentence.

Chapter 8, Reasonable Completeness, title

Changed title to "Complete Reason."

Changes in Version 2012.05.04

Chapter 1, Choosing Frames Well, last paragraph

Changed "useful" to "indispensable" in the fifth sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, third paragraph

Changed "well" to "well with others" in the third sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, last paragraph, second sentence

"Because people who decide well using the multiple-frame approach invent ever better means of calculating more readily than other people, the best means of computing π to a sextillion decimal places is to decide well using the multiple-frame approach."

was changed to:

"People who decide well using the multiple-frame approach invent ever better means of calculating more readily than other people. Hence, the best means of computing π to a sextillion decimal places is to decide well using the multiple-frame approach."

Chapter 3, *Public*, last paragraph, last sentence

"As we do so, we learn to pursue this end using ever fewer non-knowledge resources.[6]"

was changed to:

"Removing these resources creates problems. Solving these problems creates knowledge of how to pursue this end using ever fewer non-knowledge resources.[6]"

Chapter 6, The Farther Reaches of Our Nature, title

Changed title to "Being Needs."

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote, end

Changed "is" to "appears to be" in the last sentence.

Added the sentences:

"As we shall see in the next chapter, we can never prove formally that we have found the best means of deciding well. Hence, we can never prove indispensability in deciding well. The best we can do is to disprove experimentally that the most beautiful tools for deciding well, which are the tools that ring truest with all that we currently know about deciding well, are indispensable in deciding well. We do so by acting as if these tools are indispensable in deciding well."

Changes in Version 2012.05.05

Preface, last paragraph

Changed "reasoning" to "form of reason" and "form of reason" to "form" in the first sentence.

Chapter 1, *Seeing Through Apparent Miracles*, last paragraph

Changed "*know about*" to "*know*" in the fourth sentence.

Chapter 2, A Strategy for Learning Well, first paragraph

Changed "deciding well" to "pursuing the boundless factors of deciding well" in the last sentence.

Chapter 3, *Public Order*, last paragraph, end

Added the sentences:

"Increasing *temporal* public order is good when there is too little of it and bad when there is too much of it. Too little public order is a level of public order that threatens the fabric of civilization, the interwoven networks of knowledge-in-use that bind us together. Too much public order is a level of public order that removes the need for many people to decide well."

Chapter 5, title, first quote, footnote

Added link to Project Gutenberg page <http://www.gutenberg.org/ebooks/18>.

Chapter 5, *Pursue Invariant, not Temporal Order*, second paragraph

Deleted ", the interwoven networks of knowledge that bind us together" from the second sentence.

Chapter 7, The Scope of Evolution, last paragraph, footnote

Changed "holistic" to "boundless" in the last sentence.

Chapter 8, Beautiful Reason, seventh paragraph, footnote, end

Added the sentence:

"They do so by combining logic and dialectics into something more than logic and dialectics."

Changes in Version 2012.05.09

Entire work

Checked and, if necessary, updated Internet references (14 references, 2 updated).

Preface, second to last paragraph, last sentence

"We compete well in order to cooperate well in living well."

was deleted.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph, footnote

"[14] This timeless end is essentially the same as the eighteenth-century concept of happiness used in the preamble to the United States Declaration of Independence (a whole life lived

well). We ought not to confuse it with the prevailing, temporal concept of happiness (a state of well-being).”

was changed to:

“[14] We might also call the timeless end of living well *the Good*. ‘Happiness’ has the advantage of highlighting the temporal nature of the prevailing concept of happiness (a state of well-being).”

Chapter 2, A Strategy for Learning Well, title

Changed title to “A Grander Virtuous Circle.”

Chapter 8, Beautiful Reason, seventh paragraph, footnote

Changed “all of the boundless factors” to “boundless factors” in the last sentence.

Chapter 8, Beautiful Reason, seventh paragraph, footnote

“[4] From a dialectical view based on modern biology, Reasonable programs are dialectical programs that include knowledge of the need to pursue all boundless factors of *living* well. From a Reasonable view, good dialectical programs evolve into Reasonable programs, programs that use ever better approximations of Beauty to avoid the worst of the suffering of learning through experience. They do so by combining logic and dialectics into something more than logic and dialectics.”

was deleted.

Chapter 8, Complete Reason, last paragraph

Changed “reasonably complete” to “reasonably complete *for us*[5]” in the fourth sentence.

“[5] At the heart of Reason is a mystery that concerns how we know to modify sets of rules. Kurt Gödel called this means of knowing *intuition*. Raphael called it *inspiration* (Columbia University Art Humanities Series lecture *The School of Athens* <http://www.youtube.com/watch?v=uOrG6jfBzEU> 7 May 2012). Appendix B of the published version of this work will explain how to explain this means of knowing wisely.”

Changes in Version 2012.05.10

Preface, sixth paragraph

Changed “deciding well as a tool for finding problems in pursuing the timeless end of believing well” to “deciding well” in the first sentence.

Chapter 1, Choosing Frames Well, last paragraph, last sentence

"As we shall see, this calls a decision process that we can apply to itself at any scale for an infinite number of times."

was deleted.

Chapter 1, *Invariant Values*, last paragraph

Changed "by doing in deciding well" to "to decide ever more wisely" in the last sentence.

Chapter 3, *Public Order*, last paragraph, last two sentences

"Too little public order is a level of public order that threatens the fabric of civilization, the interwoven networks of knowledge-in-use that bind us together. Too much public order is a level of public order that removes the need for many people to decide well."

were changed to:

"Too little temporal order threatens the fabric of civilization, the interwoven networks of knowledge-in-use that bind us together. Too much temporal order reduces the ability and need for people to decide well."

Changes in Version 2012.05.12

Chapter 3, The Elephant in the Room, first paragraph

Changed "boundless factors and invariant values" to "invariant and religious values" in the first sentence.

Chapter 3, *Public Entropy*, second paragraph, second footnote

Changed "soldiers in the" to "the" in the fifth sentence.

Chapter 4, Useful Reminders, second paragraph

Changed "this view" to "the multiple-frame view" in the first sentence.

Chapter 4, Useful Reminders, last paragraph

Changed "this view" to "the multiple-frame view" in the first sentence.

Chapter 5, Liberalism, title

Changed title to "Civil Faith."

Chapter 5, Civil Faith, second paragraph

Changed "invariant liberalism" to "this faith" in the first sentence.

Chapter 6, *Schweitzer's Universal Spiritual Need*

Changed title to "*Mystical Oneness*."

Chapter 6, *Mystical Oneness*, first paragraph, last sentence

"Maslow's fully human subjects seek to satisfy this need when they seek Truth, Beauty, and Justice."

was deleted.

Chapter 6, *Worldly Benefits of Detachment*, first paragraph

Changed "modern view" to "view" in the first sentence.

Chapter 8, Complete Reasoning, last paragraph, second footnote

Changed "Raphael" to "Raffaello Sanzio da Urbino (Raphael)" in the third sentence.

Changes in Version 2012.05.14

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph, footnote

Changed "Just as classical mechanics is often a good enough tool for helping us solve problems" to "When we deliberate, as opposed to contemplate," in the third sentence.

Added the following sentence to the end of the footnote:

"However, when we use intuition to make "snap" decisions, we usually benefit from having a broader base of knowledge."

Chapter 1, *Invariant Values*, first paragraph, footnote, last four sentences

"Consider the problem of determining the value of π. We can be more certain that the recursive approach to determining the value of π best solves this problem than we can that we have found the best method of solving it. Now consider the problem of believing well. We can be more certain that the multiple-frame approach to deciding well best solves this problem than we can that we have found the best method of solving it."

were changed to:

"We can be more certain of the recursive approach to determining the value of π than we can be certain of the best method of determining the value of π. Similarly, we can be more certain of the multiple-frame approach to deciding well than we can be certain of the best method of deciding well."

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, last paragraph, footnote

Changed "too crude" to "simple" in the first sentence.

Changes in Version 2012.05.18

Preface, fourth paragraph

Changed "each of these" to "these" in the third sentence.

Preface, fifth paragraph

Changed "invariant" to "boundless" in the third sentence.

Preface, seventh paragraph

Changed "timeless" to "boundless" in the first sentence.

Preface, tenth paragraph

Changed "timeless experiments" to "experiments" in the first sentence.

Preface, twelfth paragraph

Changed "generalized" to "boundless" in the first sentence.

Preface, twelfth paragraph, last sentence

"Deciding well quickens the pace of change, which increases the need for deciding well."

was changed to:

"I end the chapter by comparing the modern and boundless views of biological evolution."

Chapter 1, *The EOQ/RTS Example*, last paragraph

Changed "good products for sale, but also products in the form of knowledge of how to produce ever more wisely" to "goods for sale, but also knowledge of how to produce ever more wisely" in the fifth sentence.

Chapter 1, *Seeing Through Apparent Miracles*, second paragraph, third through fifth sentences

"This "higher being" performs such apparent miracles as speaking to him as if inside his head, describing the contents of a locked cupboard, and appearing from nowhere. To prove that these apparent miracles were not true miracles, the Spacelander carries him through the boundary that separates the second and third dimensions. When he returns home from his journey, he is unable to explain his experiences in Spaceland to his fellow Flatlanders, who cannot grasp what he means when he says "up but not north.""

were changed to:

"To prove the existence of the third dimension, the Spacelander performs such apparent miracles as describing the contents of a locked cupboard and appearing from nowhere. The Flatlander remains skeptical. The Spacelander then lifts the Flatlander out of Flatland. After the Flatlander returns to Flatland, he is unable to explain his experiences in Spaceland to his fellow Flatlanders, who cannot grasp what he means when he says "up but not north.""

Chapter 1, *Ever More Complete Multiple-Frame Models*, last paragraph, footnote

"[16] In theory, each new frame we add to a multiple-frame model of deciding well yields a better model. In practice, the marginal costs of using models that are more complete can outweigh the marginal benefits of using them. When we decide formally, a multiple-frame model of deciding well that includes only living well, believing well, governing ourselves well, and contemplating well is often a good enough tool for helping us find problems to solve. However, when we use intuition to make "snap" decisions, we usually benefit from having a broader base of knowledge."

was deleted.

Chapter 3, *Public Entropy*, first paragraph, footnote

Changed "ever changing" to "ever-changing" in all (2 occurrences).

Chapter 3, *A Decision-Tree Oriented Interpretation of Quantum Mechanics*, entire section

"***A Decision-Tree Interpretation of Quantum Mechanics***
We can imagine an ideal decision-oriented model in which information flows as freely as it does in the modern economic model of perfect competition. In this ideal model, people decide perfectly with respect to all currently available knowledge. In doing so, they act as if they were a single decider facing a single problem, which is the problem that contains all other problems in deciding well. We may think of this model as a single decision tree.[9]

"From the view of modern physics, this decision-tree interpretation of quantum mechanics appears to ignore constraints on deciding well imposed by relativity theory and information theory. In contrast, from the view of decision science, it hides details about the world, such as the constraints imposed by these two theories, inside the decision model. This is consistent with the purpose of these models, which is to help us decide well.

"Consider the problem of whether to invest in a research program that has the goal of communicating at greater than light speed. From the view of modern physics, communicating at greater than light speed is impossible; hence investing in a research program to discover a way of communicating at greater than light speed would be foolish. From the view of decision science, the expected net present value[10] of the benefits of communicating at greater than light speed are small compared to the expected net present value of the cost of the research program; hence investing in such a research program would be foolish *at this time*. From the multiple-frame view, the better solution to the problem of whether to invest in this research program is the decision science solution. It rings true with more of what we currently believe we know about the world."

was changed to:

"We can imagine ideal decision-oriented models in which information flows as freely as it does in modern economic models of perfect competition. In these models, people decide perfectly with respect to all currently available knowledge. In doing so, they act as if they were a single decider facing a single problem, which is the problem that contains all other problems in deciding well. We may think of these models as parts of a single decision tree.[9]

"Consider the problem of whether to invest in a research program that has the goal of communicating at greater than light speed. From the view of modern physics, communicating at greater than light speed is impossible; hence investing in a research program to discover a way of communicating at greater than light speed would be foolish. From the view of decision science, the expected net present value[10] of the benefits of communicating at greater than light speed are small compared to the expected net present value of the cost of the research program; hence investing in such a research program would be foolish *at this time*. From the multiple-frame view, the better solution to the problem of whether to invest in this research program is the decision science solution. It rings true with more of what we currently believe we know about the world."

Chapter 5, Civil Faith, first paragraph, last two sentences

"From the multiple-frame view, we can test the set of beliefs that support boundless pragmatism by testing the set of publicly proclaimed and practiced beliefs of boundless pragmatism. This civil faith calls for us to form governments based on the sovereign right to decide well. Given the key role that liberty plays in deciding well, if this civil faith were expressed as a pledge of allegiance, it would be: "I pledge allegiance to my flag and to the principles for which it stands: liberty and justice for all." We may call this faith *invariant liberalism*."

were merged with the next paragraph and changed to:

"We may call the set of publicly proclaimed and practiced beliefs that supports an approach to governing well its *civil faith*. Given the key role that liberty plays in the multiple-frame approach to governing well, we may its civil faith *invariant liberalism*."

Chapter 5, Civil Faith, second paragraph

Changed "this faith" back to "invariant liberalism" in the first sentence.

Chapter 6, Experiencing the Mysterious, title

Changed title to "Experiencing Mystical Oneness."

Chapter 7, The Scope of Evolution, first paragraph

Changed "that always" back to "living beings who" in the second sentence.

Changed "national goal" back to "national goal of improving our fitness to cope with and shape our environment" in the last sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph, first

"Boyd's grand strategy rings true with modern biology."

was changed to:

"Boyd based his grand strategy on the belief that we naturally seek to "improve our fitness, as an organic whole, to shape and cope with an ever-changing environment.""

Chapter 8, Beautiful Reasoning, seventh paragraph

Changed "selects and "breeds" algorithms" to "searches the set of all possible algorithms for superior algorithms by selecting and "breeding" algorithms" in the first sentence.

Chapter 8, Complete Reasoning, last paragraph

Changed "currently known and unknown" to "(currently known and unknown)" in the second sentence.

Changed "the multiple-frame approach to deciding well, which we have called Reason," to "the multiple-frame approach to deciding well" in the fourth sentence.

Chapter 8, Complete Reasoning, last paragraph, second footnote

Changed "modify sets of rules" to "create ever better tools for reasoning (concepts, rules, and premises)" in the second sentence.

Chapter 8, Complete Reasoning, last paragraph, last footnote, third through last sentences

"Our concept of completeness concerns the supply side of the market for tools for helping us *believe* well. We see conflicts in our belief systems. Now consider the holism of the multiple-frame approach to deciding well. From the multiple-frame view, *the philosophy of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of deciding well*. Our concept of completeness concerns the demand as well as the supply side of the market for tools for helping us *decide* well. We see holes as well as conflicts in our belief systems. For example, we see that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element."

were changed to:

"We see conflicts in our belief systems. Now consider the holism of the multiple-frame approach to deciding well. From the multiple-frame view, *the philosophy of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of deciding well*. We see holes as well as conflicts in our belief systems. For example, we see that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element. Our concept of completeness concerns much more than the supply side of the market for helping us *believe* well. It concerns the supply and demand sides of the market for tools for helping us *decide* well."

Changes in Version 2012.05.19

Chapter 3, *Public Order*, third paragraph

Changed "ability and need" to "need" in the last sentence.

Added the sentence:

"Over time, reducing the need for people to decide well reduces the ability of people to decide well."

Chapter 3, *Public Entropy*, first paragraph

Removed all three sets of parentheses from the first sentence.

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, first paragraph

Changed "deciding well" to "decision science" in the first sentence.

Changes in Version 2012.05.21

Preface, second to last paragraph

Changed "end this chapter" to "end" in the last sentence.

Chapter 8, Beautiful Reason, second paragraph

Changed "*reason* and" to "*reason*. We may also call" in the second sentence.

Chapter 8, Beautiful Reason, fourth paragraph

Changed "frame" to "frames" in the second sentence.

Chapter 8, Beautiful Reason, fifth paragraph, footnote

"By restricting the number of imagined perspectives on the ideal avenue into potential existence, both logic (0) and dialectics (1) tend to blind us to opportunities for learning by doing in deciding well. In contrast, Reason not only helps us see these opportunities, but also helps us judge them. Students of Western thought may better understand the distinction between logic, dialectics, and Reason by studying Ludwig Wittgenstein's conversion from a picture theory of language based on a temporal view of the world to an instrumental theory of language based on the timeless end of living well. What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence (which includes what we currently know). To decide well, we also need to explain how the whole of potential existence (which includes all that we can ever know) relates to pursuing the Truth. Analyzing parts of potential existence using current and currently imagined concepts, such as Nelson Goodman did in *Fact, Fiction, and Forecast* (Cambridge, MA: Harvard University Press, 1983), is not enough."

was changed to:

"Students of Western thought may better understand the distinction between logic, dialectics, and Reason by studying Ludwig Wittgenstein's conversion from a picture theory of language based on a temporal view of the world to an instrumental theory of language based on the timeless end of living well. What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain how the whole of potential existence, which includes all that can be known, relates to pursuing the Truth."

Chapter 8, Complete Reason, first paragraph

Changed "propositions" to "claims" in all (3 occurrences).

Chapter 8, Complete Reason, last paragraph, second footnote

Changed "wisely" to "ever more wisely" in the last sentence.

Changes in Version 2012.05.22

Preface, fourth paragraph

Changed "that help us judge" to "for helping us judge" in the first sentence.

Preface, fourth paragraph, second and third sentences

"We construct these frames by defining the boundless factor and the means to this factor in terms of each other. After we add what we currently know about the means to these factors, we use these frames to judge whether the problems we are considering trying to solve "ring true" with all that we currently know about deciding well."

were changed to:

"We construct these frames by defining the boundless factor and the means to this factor in terms of each other, and then by adding what we currently know about the means to these factors. We can use these frames both to find problems to solve and to judge whether these problems "ring true" with all that we currently know about deciding well."

Chapter 8, Beautiful Reason, fifth paragraph, footnote, last two sentences

"What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us explain actual existence. To decide well, we also need to explain how the whole of potential existence, which includes all that we can ever know, relates to pursuing the Truth."

were changed to:

"What we now call received science, which has its roots in Wittgenstein's picture theory of language, helps us describe actual existence based on what we currently know. To decide well, we need not only to describe actual existence based on what we currently know, but also to describe the whole of potential existence based on all that we can ever know. We need not only bounded descriptions of existence to help us solve given problems, but also boundless descriptions of existence to help us find better problems to solve."

Changes in Version 2012.05.24

Preface, fourth paragraph, second and third sentences

"We construct these frames by defining the boundless factor and the means to this factor in terms of each other, and then by adding what we currently know about the means to these factors. We can use these frames both to find problems to solve and to judge whether these problems "ring true" with all that we currently know about deciding well."

were changed to:

"We can use these models to find problems to solve that "ring true" with all that we currently know about deciding well."

Chapter 6, Being Needs, first paragraph, first two sentences

"One of the major problems in developing means of weeding out untrue, unjust, unethical, or unwise descriptions for helping us find problems to solve is agreeing on metaphysical assumptions about our nature. The most important such assumption concerns whether our minds and bodies are separate and distinct."

were changed to:

"In the first chapter, we defined living well and the timeless end of living well (Happiness) in terms of each other. In the second chapter, we added meaning to this otherwise meaningless pair of concepts by refining beliefs about pursuing Happiness. In the next three chapters, we added more meaning by refining beliefs about pursuing the Beauty, Truth, and Justice. We have yet to address a major problem in refining beliefs about pursuing Happiness, which is the problem of determining whether our minds and bodies are separate and distinct."

Chapter 6, Being Needs, last paragraph

Changed "Truth, Beauty" to "Beauty, Truth" in the last sentence.

Chapter 6, A Common Timeless End, second paragraph

Changed "pursuing Happiness and Wholeness" to "pursuing Happiness and pursuing Wholeness" in the fifth sentence.

Chapter 7, *An Extraordinary Anomaly*, second paragraph

Changed "a grander concept of reason, a concept of reason in which all problems are part of" to "a concept of reason that addresses" in the second sentence.

Changed "ignorance of deciding well" to "ignorance" in the last sentence.

Chapter 7, The Scope of Strategy, last paragraph

Moved this paragraph to the beginning of the next subsection, *A Normal Anomaly*.

Chapter 7, *E-M Theory*, first paragraph

Changed "Tom" to "Thomas" in the last sentence.

Chapter 7, *Timeless OODA Loop Analysis*, first paragraph

Changed "timeless problems" to "the timeless problem of living well" in the first sentence.

Changed "timeless of competing well to be surviving on our own terms" to "timeless end of competing well to be improving our fitness, as an organic whole, to shape and cope with an ever-changing environment" in the third sentence.

Chapter 7, *Timeless OODA Loop Analysis*, second paragraph

Changed "pursuing the timeless end of competing well (Winning)" to "competing well" in the first sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph

Changed "his view" to "this view" in the second sentence.

Chapter 7, The Scope of Evolution, second paragraph, last two sentences

"Belief in the boundless nature of evolution helps us find ever better ways of living well. In contrast, prevailing beliefs about evolution tend to blind us to better ways of living well."

were changed to:

"Modern views of evolution tend to blind us to better ways of living well."

Chapter 7, The Scope of Evolution, last paragraph, last two sentences

"Hence, we ought to explain evolution as a matter of living beings seeking to compete well in order to cooperate well in living well. We ought to take a boundless view of evolution.[17]"

were changed to:

"Hence, we ought to take a boundless view of evolution.[17]"

Chapter 8, Complete Reason, last paragraph, third sentence

"We ought to pursue the Truth using a set of (currently known and unknown) rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules (including itself)."

were changed to:

"We ought to pursue the Truth using a set of rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules.[4]"

"[4] More accurately, we ought to pursue the Truth using a set of *currently known and unknown* rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules *including itself*."

Changes in Version 2012.05.26

Preface, fourth paragraph, end

Added the sentence:

"Applying this means of deciding well to itself yields a new concept of reason, a concept in which the role that beauty plays in deciding well is explicit."

Chapter 1, Setting Words Aright, last paragraph, end

Added the sentences:

"This book also uses the convention of highlighting the first instance of terms and phrases with new meanings. Examples of this include 'concepts' and 'knowledge resource' in the first two paragraphs of this section."

Chapter 2, Invariant Tools for Living Well, last paragraph

Changed "is" to "means" in all (2 occurrences).

Chapter 2, *Pleasure and Pain*, second paragraph, third sentence

"Aristotle described this type of pleasure as losing ourselves in acting.[3]"

"[3] Aristotle, *Nicomachean Ethics*, book 10, chapter 4."

was deleted.

Chapter 2, *Pleasure and Pain*, sixth paragraph, third sentence

"Baruch Spinoza defined this type of pleasure as the transition from a lesser to a greater perfection.[4]"

"[4] Spinoza, Baruch, *Ethics*, (New York: Penguin Putnam, 1996), part III, also available online at Project Gutenberg, <http://www.gutenberg.org/ebooks/3800> (7 May 2012)."

was deleted.

Chapter 2, *Tools for Pursuing Pleasure and Joy*, second paragraph

"From the Western tradition, Spinoza and Aristotle provide us with very different means of living well. Spinoza asks us to look into ourselves. He believed that moral virtue is the ability to address the causes of our emotions rationally, which we develop by learning to understand our needs and the best means of satisfying them. His means of living well fits a contemplative life better than an active one. It is easier to know our needs in a monastery than it is in a trading pit. In contrast, Aristotle believed that moral virtue is the habit of wanting the right things, which we develop by acting as if we want the right things. We discover these habits by observing successful people. His disciplined means of living well fits an active life better than a contemplative one. Spinoza inspires Einsteins; Aristotle inspires Alexanders."

was deleted.

Chapter 3, *Overcoming Constraints in Deciding Well*, fourth paragraph

Changed "relies on" to "relies on people pursuing" in the last sentence.

Chapter 3, *Public Entropy*, second paragraph, footnote

Changed "Studying" to "Contemplating" in the first sentence.

Chapter 4, *Academic Fields*, last paragraph

"From the multiple-frame view, the whole of science is nothing more than the process of refining everyday thinking."

was deleted.

Chapter 5, *Lower Trade Barriers*, first paragraph, footnote, first sentence

"Compare this to Proposition 35, Corollary 1 of the fourth book of Spinoza's *Ethics*: "There is no individual thing in nature, which is more useful to man, than a man who lives in obedience to reason.""

was deleted.

Chapter 6, Being Needs, title

Changed title to "A Hole in Happiness."

Chapter 6, A Hole in Happiness, second paragraph

Changed "If we seek what is true based on what we know" to "From a logical view" in the first sentence.

Chapter 6, A Hole in Happiness, third paragraph

"If we seek what is useful in deciding well, we can reconcile these two belief systems by finding a common timeless end."

was changed to:

"From the multiple-frame view, we can reconcile these two belief systems by deciding well using a concept of deciding well that recognizes our need to become part of something infinitely larger than ourselves."

Chapter 6, A Hole in Happiness, forth paragraph

Inserted the section title "*Being Needs*."

Chapter 6, A Common Timeless End, last paragraph

Changed "a multiple-frame view" to "the multiple-frame view" in the last sentence.

Chapter 8, Complete Reason, last paragraph, last footnote

Changed "market for helping us" to "market for tools for helping us" in the second to last sentence.

Changes in Version 2012.05.28

Chapter 3, *Decision-Oriented Interpretations of Quantum Mechanics*, title

Changed title to "*Forward-Looking Science.*"

Chapter 4, A Crude Look at the Whole, first paragraph, last footnote

"[10] Given the self-similarity of deciding well, we may speculate that the release of stress from these networks follows a power-law distribution."

was changed to:

"[10] Given the self-similarity of deciding well, we may hypothesize that releases of stress from these networks create power-law distributions. This is consistent with the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot (Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence*, New York: Basic Books, 2004, chapter VIII).

Chapter 7, The Scope of Evolution, last paragraph, footnote

"[17] People who seek empirical evidence supporting one or the other of these views would do well to study the power-law distributions of wealth and income discovered by Vilfredo Pareto and the power-law distribution of changes in commodity prices discovered by Benoît Mandelbrot (Mandelbrot, Benoît, *The Misbehavior of Markets: A Fractal View of Financial Turbulence*, New York: Basic Books, 2004, chapter VIII). Power-law distributions are the result of some self-similar process or processes. From the reductionist view of modern biology, it is not clear what this process or these processes might be. From the boundless view of this work, it is clear that these distributions are the result of how we choose to act based on what we currently know."

was deleted.

Changes in Version 2012.05.29

Preface, fourth paragraph, last sentence

"Applying this means of deciding well to itself yields a new concept of reason, a concept in which the role that beauty plays in deciding well is explicit."

was changed to:

"Underlying this process of deciding well is a new concept of reason, a concept in which beauty plays an explicit role."

Preface, new ninth paragraph

Changed "constraints" to "beauty" in the first sentence.

Chapter 8, Beautiful Reason, sixth paragraph, last sentence

"In computability/recursion theory terms, the problem of formally proving the best form of reason for pursuing the Truth is *unsolvable*."

was deleted.

Changes in Version 2012.05.31

Preface, first paragraph

Changed "relentlessly questioned" to "questioned relentlessly" in the second sentence.

Preface, eighth paragraph

Added the following sentence:

"This includes waste related to our less than perfectly useful descriptions of the world."

Preface, ninth paragraph, last two sentences

"I go on to explain how we can refine deciding well. This includes explaining why seeking to create or extend good times by lowering the quality of decisions is as shortsighted as seeking to prevent all forest fires."

was changed to:

"I go on to explain how we can refine deciding well and why deciding well creates fractal patterns in our knowledge in use. Evidence of these fractal patterns includes power-law distributions in wealth, income, and commodity price changes."

Chapter 3, *Public Order*, last paragraph, last two sentences

"Too much temporal order reduces the need for people to decide well. Over time, reducing the need for people to decide well reduces the ability of people to decide well."

were changed to:

"Too much temporal order reduces the need for people to decide well, which, over time, reduces the ability of people to decide well."

Chapter 3, *Public Entropy*, last paragraph, footnote, first sentence

"For more about the process of inducing the creation of knowledge useful in pursuing timeless ends well, see Appendix A."

was changed to:

"In keeping with the self-referential theme of this work, we can use Ohno's strategy for learning how to build vehicles ever more wisely as a metaphor for the invariant strategy for learning how to decide ever more wisely. Removing ambiguity from beautiful links between

beliefs is like removing work-in-process inventory from elastic links between production processes. At the limit of the former, beautiful links become logical. At the limit of the latter, elastic links become rigid. The most obvious way to remove ambiguity from this metaphor is to use the concept of entropy to reduce these two strategies to a common form."

Chapter 3, *Public Entropy*, second paragraph, footnote

"[7] Note that the term 'world' here means what we commonly call the universe. This use of the term 'world' allows us to reserve the term 'universe' for the set of parallel worlds created in the many-worlds interpretation of quantum mechanics."

was deleted.

Chapter 3, *Forward-Looking Science*, second paragraph

Changed "universe" to "universe of worlds" in the eighth sentence.

Chapter 3, *Forward-Looking Science*, last paragraph, footnote, last sentence

"A more beautiful measure would use a risk-preference function to reduce uncertain to certain cash flows and a yield-curve function to reduce future to present cash flows."

was changed to:

"More beautiful measures use a risk-preference function rather than the expected value function to reduce uncertain to certain cash flows and a yield-curve rather than a simple interest rate to discount future cash flows."

Chapter 4, *Learning by Doing*, last paragraph

Changed "truism" to "maxim" in the first sentence.

Chapter 4, *The Explicit Experiment*, second to last paragraph

Changed "who" to "a disillusioned, thrice-wounded veteran of the Union Army, who" in the last sentence before the quote.

Chapter 7, *An Extraordinary Anomaly*, first paragraph

Changed "universe" to "world (universe)" in the second sentence.

Appendix A, Less is More, first paragraph, first two sentences

"Modern production systems aim at the temporal end of producing efficiently. The Toyota system aims at the timeless end of producing well."

were changed to:

"Modern production systems aim at producing efficiently. The Toyota system aims producing wisely."

Changes in Version 2012.06.05

Preface, fourth paragraph, last sentence

"Underlying this process of deciding well is a new concept of reason, a concept in which beauty plays an explicit role."

was moved to the beginning of the fifth paragraph.

Preface, ninth paragraph

"In "Believing Well," I explain how we can refine everyday thinking. I go on to explain how we can refine deciding well and why deciding well creates fractal patterns in our knowledge in use. Evidence of these fractal patterns includes power-law distributions in wealth, income, and commodity price changes."

was changed to:

"In "Believing Well," I outline the process of refining everyday thinking, which includes the process of refining this process."

Chapter 1, *Seeing Through Apparent Miracles*, sixth paragraph

Changed "explain" to "communicate" in the first sentence.

was deleted.

Chapter 4, Refining Everyday Thinking, third paragraph, Venn diagram

Moved the Venn diagram to between the second and third paragraphs.

Chapter 4, Refining Everyday Thinking, last three paragraphs

"From the multiple-frame view, we refine our descriptions of the world by testing how well they perform their roles in decision-making. We refine the set of descriptions of the world (S_1) by weeding out descriptions that fail to predict well.[2] What remains is the set of descriptions that we use to predict (S_2). We also refine the set of descriptions of the world (S_1) by weeding out descriptions that fail to help us find problems to solve well. What remains is the set of descriptions that we use to explain parts of the world (S_3):

"Some parts of the world appear simple enough for us to use a single description to predict and explain ($S_2 \cap S_3$). Within these islands of apparent simplicity, we can test the descriptions that we use to explain by how well they help us to predict. When the descriptions that we use to explain predict well, we say that we have found the truth about this part of the world. If we are wrong about how simple this part of the world is, acting on what we believe to be the truth will yield results that we do not expect. At best, such actions cause nothing more than minor unintended consequences. At worst, they embed mistakes that lead to major catastrophes into our networks of knowledge-in-use.

"Other parts of the world appear too complex for us to use a single description to predict and explain. Within these seas of apparent complexity, we can test the descriptions that we use to predict by how well they help us predict, and test the descriptions that we use to explain by how well they help us find problems to solve. Our descriptions that explain may do nothing more than tell us that we cannot predict what we would like to predict. This is useful information. For example, if our current understanding of weather forecasting tells us that no one can predict the weather in the Indian Ocean two weeks from now, we ought to plan for more than smooth sailing."

"[2] Note that we judge the usefulness of these descriptions within bounds. Newtonian mechanics is good for predicting the behavior of large objects moving at low speeds, but poor at predicting the behavior of very small objects or objects moving at very high speeds."

were changed to:

"We choose descriptions of the world to help us predict within our chosen problems (S_2). We also choose descriptions of the world to help us choose problems to solve (S_3). In both cases, choosing well is an art. It is a matter of judging the ring of truth based on what we currently know about the world. *Beauty plays a role not only in how we create tools for helping us decide, but also in how we use these tools*.

"We test the descriptions that we use to predict by how well they help us predict, and test the descriptions that we use to explain by how well they help us find problems to solve. Our descriptions that explain may do nothing more than tell us that we cannot predict what we would like to predict. This is useful information. For example, if our current understanding of weather forecasting tells us that no one can predict the weather in the Indian Ocean two weeks from now, we ought to plan for more than smooth sailing."

Chapter 4, *Self-Similarity,* second paragraph, first two sentences

"From any given level of abstraction, we can describe correlations between events, but cannot explain the causation of events. We can only explain causation from a lower level of abstraction."

were changed to:

"On any given level of abstraction, we can describe the relations between events, but not the causes of events. To explain the causes of events, we need to view the world from a lower level of abstraction."

Chapter 4, *Self-Similarity*, second paragraph, last sentence

"The further we are from these means, the greater is the potential for catastrophic releases of pent-up stress from our networks of knowledge-in-use."

was deleted.

Chapter 4, *Self-Similarity*, last paragraph

Changed "*doing so, we embed much of*" to "*addressing this problem, we embed*" in the last sentence.

Chapter 4, *Learning by Doing*, third paragraph

"The problem here concerns the modern economic accounting system, which seeks to measure what we currently want rather than what we truly need to live well. From the modern economic view, the problem of measuring the value of services is limited, and the problem of measuring the value of changes in quality is manageable. In contrast, from the multiple-frame view, the problem of measuring the value of services is universal, and the problem of measuring the value of changes in quality is impossibly hard."

was demoted to a footnote to the last paragraph and changed to:

"From the modern economic view, the problem of measuring the value of services is limited; the problem of measuring the value of changes in quality is manageable; and national income accountants gather information useful in helping people satisfy their current wants. In contrast, from the multiple-frame view, the problem of measuring the value of services is universal; the problem of measuring the value of changes in quality is impossibly hard; and national statisticians gather information useful in helping people live ever more wisely."

Chapter 4, *A Crude Look at the Whole*, first paragraph

Changed "In deciding imperfectly, we" to "We" in the fifth sentence.

Chapter 4, *Academic Fields*, entire subsection

Moved this subsection to the end of the Refining Deciding Well section.

Chapter 4, Refining Deciding Well, title

Changed title to "Refining Refining Everyday Thinking."

Chapter 4, Refining Refining Everyday Thinking, first two paragraphs

"The invariant concept of science described above calls for us to refine the models we use to help us predict how people will decide and the models we use to explain deciding well. We refine the models we use to help us predict how people will decide by weeding out all models that are not clear, concise, and *logical*. What remains is a set of precise models that we use to predict how people will decide. We further refine this set by weeding out models that fail to meet our (evolving) standards for helping us predict what will happen. What remains is a set of refined models that we use to predict how people will decide.[3]

"We refine the models we use to help us explain deciding well by weeding out all models that are not clear, concise, and *beautiful*. What remains is a set of precise descriptions that we use to explain deciding well. We further refine this set by weeding out models that fail to meet our (evolving) standards for helping us find problems to solve. The rub is that we do not know exactly what it is that we ought to seek."

"[3] Milton Friedman defined positive economic science as "a body of tentatively accepted generalizations about economic phenomena that can be used to predict the consequences of changes in circumstances" (Friedman, Milton, "The Methodology of Positive Economics," *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953, p. 39). Communication across frames is only partial. The distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) is not the same as the distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories). Hidden in theories that describe the world as it is in the process of becoming is a description of what drives the system forward. From the multiple-frame view, this driver is the teleonomic program of all living things to live well, hence to pursue all of the boundless factors of deciding well."

were changed to:

"We may refine the process of refining everyday thinking by applying the process of refining everyday thinking to itself. This calls for refining the models we use to help us predict how people will decide. We refine these models by weeding out all models that are not clear, concise, and *logical*. What remains is a set of precise models that we use to predict how people will decide. We further refine this set by weeding out models that fail to meet our (evolving) standards for helping us predict what will happen. What remains is a set of refined models that we use to predict how people will decide.[3]

"Refining the process of refining everyday thinking also calls for refining the models we use to explain deciding well. We refine these models by weeding out all models that are not clear, concise, and *beautiful*. What remains is a set of precise descriptions that we use to explain deciding well. We further refine this set by weeding out models that fail to meet our (evolving) standards for helping us find problems to solve. The rub is that we do not know exactly what it is that we ought to seek."

"[3] Milton Friedman defined positive economic science as "a body of tentatively accepted generalizations about economic phenomena that can be used to predict the consequences of changes in circumstances" (Friedman, Milton, "The Methodology of Positive Economics," *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953, p. 39). The modern economic distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) is not the same as the multiple-frame distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories). Hidden in theories that describe the world as it is in the process of becoming is a description of the teleonomic program that drives all living things to live well, not the prescription that all living things ought to live well."

Chapter 7, *E-M Theory*, second paragraph

Changed "a disaster" to "as big a disaster as Robert McNamara's F-111 Aardvark" in the fourth sentence.

Chapter 8, Beautiful Reason, last paragraph

Changed "Reason" to "the Reasonable concept" in the third sentence.

Changed "Reason" to "this concept" in the fourth sentence.

Changed "Reason" to "it" in the fifth sentence.

Chapter 8, Complete Reason, first paragraph

Changed "formally prove" back to "prove" in the second sentence.

Appendix A, Less is More, first paragraph, footnote

"[4] There is a deeper "less is more" story here. It is that ever-leaner production leads to ever more complexity in our networks of knowledge-in-use. Understanding how information enters and leaves these networks ought to become as important to people who study people as understanding how information enters and leaves black holes has become to people who study physics."

was deleted.

Changes in Version 2012.06.07

Preface, twelfth paragraph

Changed "explain why we ought to replace our current concept of reason with a boundless form of" to "refine" in the first sentence.

Chapter 1, Choosing Frames Well, last paragraph, footnote, last sentence

"Indispensability in deciding well makes intellectual tools something we discover rather than invent."

was changed to:

"What makes this approach possible is a concept of reason that allows us to link *beautifully* beliefs that we cannot currently link *logically*. This new concept of reason provides us with a much better means of weeding out "ugly" research programs. It also allows us to avoid the well-known problem that occurs when we apply logical processes to themselves, for instance, when we base processes for believing well on the ultra-empiricist claim that we should dismiss all claims that we cannot prove empirically, which is a claim that we cannot prove empirically."

Chapter 3, Public Entropy, second paragraph

"As we learn to decide ever more wisely, we learn to work together ever more wisely. The process of learning to work together ever more wisely is not continuous. Imagine a battalion of raw recruits. Now imagine that we begin to replace raw recruits one at a time with highly trained and seasoned soldiers. Each replacement may have little effect, some effect, or a large effect on the ability of the battalion to act as a unit. Physical analogues of the largest effects include transitions to superconductivity and superfluidity.[5]"

"[5] Contemplating what happens to people in the infinitely long run is like studying what happens in physics at near absolute zero temperature. People working together perfectly act as if they were a single person deciding perfectly, much as weakly interacting bosons at their lowest energy state act as if they were a single boson."

was demoted to a footnote in the fourth paragraph of *Forward-Looking Science* and changed to:

"[7] As we learn to decide ever more wisely, we learn to work together ever more wisely. The process of learning to work together ever more wisely is not continuous. Imagine a battalion of raw recruits. Now imagine that we begin to replace raw recruits one at a time with highly trained and seasoned soldiers. Each replacement may have little effect, some effect, or a large effect on the ability of the battalion to act as a unit. Physical analogues of the largest effects include transitions to superconductivity and superfluidity. People working together perfectly act as if they were a single person deciding perfectly, much as weakly interacting bosons at their lowest energy state act as if they were a single boson."

Chapter 4, *Learning by Doing*, third paragraph

Changed "national accounting" to "accounting" in the first sentence.

Changes in Version 2012.06.08

Preface, eighth paragraph, last sentence

"This includes waste related to our less than perfectly useful descriptions of the world."

was deleted.

Chapter 1, Choosing Frames Well, first paragraph

Changed "the ambiguity of" to "ambiguity within" in the third sentence.

Changed "ambiguity within these structures" to "ambiguity" in the fourth sentence.

Chapter 1, Choosing Frames Well, first paragraph

Changed "perceiving the world" to "conceiving the world (reducing our sensations of the world to concepts)" in the last sentence.

Chapter 1, Choosing Frames Well, second paragraph

Changed "reduce our sensations to concepts" to "conceive the world" in the first sentence.

Chapter 1, Choosing Frames Well, last paragraph, footnote, fifth sentence

Changed "As we shall see, this" to "This" and "much better" to "more formal" in the fourth sentence.

Changed "allows us to avoid" to "provides us with a means of solving" in the fifth sentence.

Chapter 1, Useful Frames, first paragraph, footnote, last two sentences

"[6] In his book *Ten Philosophical Mistakes* (New York: Macmillan, 1985, p. 137), Mortimer Adler uses the term 'normative' rather than 'timeless' to express this concept of an end unbounded in time. The term 'normative' emphasizes that we owe it to ourselves (ought) to pursue such ends. In contrast, the term 'timeless' emphasizes that the process of pursuing such ends is not bounded in time."

was deleted.

Chapter 4, Refining Refining Everyday Thinking, footnote, second through last sentences

"[3] Milton Friedman defined positive economic science as "a body of tentatively accepted generalizations about economic phenomena that can be used to predict the consequences of changes in circumstances" (Friedman, Milton, "The Methodology of Positive Economics," *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953, p. 39).The modern economic distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) is not the same as the multiple-frame distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories). Hidden in theories that describe the world as it is in the process of becoming is a description of the teleonomic program that drives all living things to live well, not the prescription that all living things ought to live well."

was deleted.

Chapter 4, *A Crude Look at the Whole*, first paragraph, last footnote

Changed "releases of stress from these networks create power-law distributions" to "these networks are fractal and releases of stress from them follow a power law" in the first sentence.

Changed "*Misbehavior*" to "*(Mis)behavior*" in the last sentence.

Changes in Version 2012.06.09

Chapter 1, Choosing Frames Well, first paragraph

Changed "perceiving the world" to "conceiving the world (reducing our sensations of the world to concepts)" in the last sentence.

Chapter 1, Choosing Frames Well, second paragraph

Changed "reduce our sensations to concepts" to "conceive the world" in the first sentence.

Chapter 1, Values, third paragraph

Changed "values" to "these values" in the last sentence.

Chapter 1, Values, fourth paragraph

Changed ", but" to ". However," in the last sentence.

Chapter 1, *Steps for Building Multiple-Frame Models*, first paragraph

Changed "two" to "three" in the first sentence.

Added the sentence: "The third is adding what we currently believe we know about pursuing this boundless factor to this frame."

Chapter 2, Consumption, first paragraph

Changed "We live well by consuming " to "Living well consumes" in the first sentence.

Chapter 2, *Chicago Screwdrivers,* first paragraph

Added the footnote:

"[3] Communication across frames is only partial. We may use invariant models to predict future turbulence in the flow of economic resources. We may also use these models to help us find problems to solve. We base the former on the belief that all living beings seek to live well. We base the latter not only on this belief, but also on the belief that we *ought* to live well. There is little need to distinguish between what Milton Friedman called positive and normative economics (Friedman, Milton, "The Methodology of Positive Economics," *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953)."

Chapter 2, *Three Common Mistakes,* second paragraph

Changed "second" to "third" in the first sentence.

Changed "As we shall see, this" to "This" in the last sentence.

Moved paragraph to the end of the subsection.

Chapter 2, *Three Common Mistakes,* new second paragraph

Changed "third" to "second" in the first sentence.

Changed "In the long run, competing" to "Competing" in the last sentence.

Chapter 3, Pursuing the Ring of Truth, second paragraph

Changed "making it part of our multiple-frame model" to "adding what we currently believe we know about contemplating well to it, which includes what we currently believe we know about pursuing other boundless factors of deciding well" in the last sentence.

Chapter 3, Contemplating the Way Forward, third paragraph, second sentence

"The best we can do is to find a recursive process that will yield ever better approximations of them."

was deleted.

Chapter 3, *Overcoming Constraints in Deciding Well,* second paragraph

Changed "mathematics" to "modern mathematics" in the first sentence.

Chapter 3, The Elephant in the Room, last paragraph

Changed "untestable" to "unfalsified" in the second sentence.

Chapter 4, Refining Everyday Thinking, fourth paragraph

Changed "how we create" to "creating" and "how we use" to "using" in the last sentence.

Chapter 4, Refining Everyday Thinking, last paragraph, last three sentences

"Our descriptions that explain may do nothing more than tell us that we cannot predict what we would like to predict. This is useful information. For example, if our current understanding of weather forecasting tells us that no one can predict the weather in the Indian Ocean two weeks from now, we ought to plan for more than smooth sailing."

were changed to:

"Descriptions that explain may do nothing more than tell us that we cannot predict what we would like to predict. If we know that no one can predict the weather ten days from now, we ought to plan for more than smooth sailing."

Chapter 4, *Recursivity,* first paragraph

Changed "statement" to "belief" in the fifth sentence.

Changed "description" to "belief" in the last sentence.

Chapter 4, *Recursivity,* last paragraph

Changed "know" to "observe" in the third sentence.

Chapter 4, Refining Refining Everyday Thinking, fifth paragraph

Changed "all previous generations of human" to "our ancestors" in the fourth sentence.

Chapter 4, *Learning by Doing*, second paragraph

Changed "Workers prefer fixed to flexible" to "People prefer fixed to variable" in the sixth sentence.

Chapter 4, Useful Reminders, last paragraph

Changed "this approach" to "the multiple-frame approach" in the second sentence.

Chapter 5, *The Explicit Experiment*, second paragraph

Changed "scholars" to "historians" in the third sentence.

Changed "an eighteenth-century" to "Franklin's" in the fifth sentence.

Chapter 5, *The Explicit Experiment*, fifth paragraph

Changed "disillusioned" to "disenthralled" in all (1 occurrence).

Chapter 6, A Hole in Happiness, title

Changed title to "A Hole in Pursuing Happiness."

Chapter 6, A Hole in Pursuing Happiness, first paragraph

Changed "refining beliefs about" to "defining concepts useful in" in the second sentence.

Changed "in refining beliefs about" to "in" in the third sentence.

Chapter 6, *Mystical Oneness*, third paragraph

Changed "practicable" to "worldly" in the third sentence.

Chapter 6, *Worldly Benefits of Detachment*, last paragraph

Changed "stream of words" to "stream of consciousness" in the second to last sentence.

Chapter 8, Beautiful Reason, second paragraph

Changed "Models of the world that we use to predict and explain" to "The models we use to describe the world" in the first sentence.

Changed "rules (axioms, principles, laws)" to "rules" in the second sentence.

Chapter 8, Beautiful Reason, fifth paragraph

"When we pursue the timeless end of deciding well (Wisdom) by pursuing the boundless factors of deciding well, we seek not only to find the best solution to given problems, but also the best problems to solve in pursuing Wisdom. Reason concerns not only the frames we use to solve given problems, but also the frames that we use to find problems to solve in pursuing Wisdom. Excellence in finding problems to solve in pursuing Wisdom calls for models that are ambiguous with respect to the timeless ends of all boundless factors of deciding well and

the means of pursuing these ends. We may call the set of rules that we use to relate beliefs well within these frames *the rules of Reason*.[3]"

was changed to:

"When we pursue the timeless end of deciding well by pursuing the boundless factors of deciding well, we seek not only to find the best solution to given problems, but also the best problems to solve. Reason concerns not only the frames we use to solve given problems, but also the frames that we use to find problems to solve. Excellence in finding problems to solve calls for models that are ambiguous with respect to the timeless ends of all boundless factors of deciding well and the means of pursuing these ends. We may call the set of rules that we use to relate beliefs well within these frames *the rules of Reason*.[3]"

Chapter 8, Beautiful Reason, sixth paragraph

Changed "these forms" to "these three forms" and "the Truth" to "the timeless end of believing well (the Truth)" in the first sentence.

Changes in Version 2012.06.11

Preface, fourth paragraph

Changed "deciding well for helping us choose problems to solve" to "deciding well" in the last sentence.

Preface, fifth paragraph, first sentence

Moved sentence to the end of the fourth paragraph.

Chapter 1, Choosing Frames Well, last paragraph, footnote, last three sentences

"What makes this approach possible is a concept of reason that allows us to link *beautifully* beliefs that we cannot currently link *logically*. This new concept of reason provides us with a more formal means of weeding out "ugly" research programs. It also provides us with a means of solving the well-known problem that occurs when we apply logical processes to themselves, for instance, when we base processes for believing well on the ultra-empiricist claim that we should dismiss all claims that we cannot prove empirically, which is a claim that we cannot prove empirically."

were deleted.

Chapter 2, Chicago Screwdrivers, first paragraph, footnote

"[3] Communication across frames is only partial. We may use invariant models to help us predict future turbulence in the flow of economic resources. We may also use these models to help us find problems to solve. We base the former on the belief that all living beings seek to live well. We base the latter not only on this belief, but also on the belief that we *ought* to live well. There is little need to distinguish between what Milton Friedman called positive and normative economics (Friedman, Milton, "The Methodology of Positive Economics," *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953)."

was deleted.

Chapter 3, Contemplating the Way Forward, last paragraph

Changed "*timeless end*" to "timeless end" in the fourth sentence.

Changed "*transcendental end*" to "transcendental end" in the seventh sentence.

Chapter 8, Complete Reason, first paragraph, fourth through seventh sentences

"First, pursuing the Truth is an endless process. Second, for any set of rules for pursuing the Truth, we will either discover or never discover the Truth. Third, if we discover the Truth, we prove that the set of rules for pursuing the Truth is complete. Fourth, if we never discover the Truth, we never prove that the set of rules for pursuing the Truth is complete."

was changed to:

"First, for any set of rules for pursuing the Truth, we will either discover or never discover the Truth. Second, if we discover the Truth, we prove that the set of rules for pursuing the Truth is complete. Third, if we never discover the Truth, we never prove that the set of rules for pursuing the Truth is complete. Fourth, pursuing the Truth is an endless process."

Changes in Version 2012.06.13

Chapter 4, Self-Similarity, first paragraph

"Refining everyday thinking is the process of ridding ourselves of ever more ignorance about the world. This ignorance produces not only poor predictions, but also poor explanations of causation."

was changed to:

"Again, we use descriptions of the world to predict and explain. A prediction is knowledge of what is apt to happen. Predictions help us to assign probabilities to uncertain events, which helps us to evaluate alternatives. Explanations help us to understand how our actions may change the world, which helps us to formulate alternatives. Better predictions help us become

more efficient and better explanations help us become more effective. *The distinction between efficiency and effectiveness depends on the scale of the problem we choose.*"

Chapter 4, Useful Reminders, title and first paragraph

"**Useful Reminders**
From the multiple-frame view, believing well calls for us to decide well, which in turn calls for us to pursue all of the boundless factors of deciding well. Pursuing these factors well gives rise to the invariant concept of science as the endless process of refining everyday thinking."

were changed to:

"**Testing Invariant Science as a Whole**"

Chapter 4, Testing Invariant Science as a Whole, new first paragraph

"From the multiple-frame view, not everything that counts can be counted, and not everything that can be counted counts. Further, the models we use to explain what ants do do not change what ants do, but the models we use to explain what we do often change what we do. Mindlessly applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Such foolishness leads to catastrophe."

was appended to the end of the preceding subsection and changed to:

"However useful modern biological models are in helping us recognize our needs, we should never use them to explain our behavior. Models that we use to explain what ants do do not change what ants do, but the models that we use to explain what we do change often what we do. Mindlessly applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Such foolishness leads to catastrophe.

"Finally, we ought never to forget the sign above Einstein's desk at the Institute for Advanced Study: *Not everything that counts can be counted, and not everything that can be counted counts.*"

Changes in Version 2012.06.15

Acknowledgments, first paragraph

Changed "high school" to "public high school" in the first sentence.

Acknowledgments, second paragraph

Changed "modern economic" to "economic" in the tenth sentence.

Preface, sixth paragraph

Changed "complex" to "complex adaptive" in the second sentence.

Preface, seventh paragraph

Changed "boundless" to "timeless" and "modern economic" to "marginalist economic" in the first sentence.

Preface, second to last paragraph

Changed "comparing the modern and boundless views of" to "redefining" in the last sentence.

Preface, last paragraph

Changed "complex" to "complex adaptive" in the first sentence.

Chapter 1, Setting Words Aright, last paragraph

Changed "new" to "unfamiliar" in the second to last sentence.

Chapter 1, Values, fifth paragraph

Changed "the Europeans" to "they" in the second to last sentence.

Chapter 2, Invariant Tools for Deciding Well, second paragraph

Changed "Modern economics" to "Marginalist economics" in first sentence.

Changed "modern economics" to "marginalist economics" in second sentence.

Added the following footnote to the first sentence:

"[2] Marginalist economics is a collection of tools for *describing the world as it currently is*. The Chicago school distinguishes itself from other marginalist schools by distinguishing between tools for *describing the world as it currently is* ("positive economics") and prescribing the world as it ought to be ("normative economics"). The "recursionist" approach to economics put forth in this work competes against the Austrian and Marxist schools in *describing the world as it is in the process of becoming* and *prescribing the world as it ought to be*. Note that the difference between tools for *describing the world as it is in the process of becoming* and tools for *prescribing the world as it ought to be* is the reasonable claim that we *ought* to live well."

Chapter 2, Invariant Tools of Deciding Well, third paragraph

Changed "modern economics" to "marginalist economics" in first sentence.

Chapter 2, *Chicago Screwdrivers*, first paragraph

Changed "modern economics" to "marginalist economics" in third sentence.

Changed "modern economics" to "marginalist economics" in fifth sentence.

Chapter 2, Profit, first paragraph

Changed "modern economics" to "marginalist economics" in first sentence.

Chapter 5, Civil Faith, first paragraph

Changed "hometown" to "boyhood home" in third sentence.

Chapter 7, *Timeless OODA Loop Analysis*, last paragraph

Changed "formulate" to "help formulate" in the first sentence.

Chapter 7, The Scope of Evolution, entire section, including title

Changed "evolution" to "biological evolution" in all (3 occurrences).

Chapter 4, Testing Invariant Science as a Whole, new first paragraph

"We ought to pursue the Truth using a set of rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules.[4]"

"[4] More accurately, we ought to pursue the Truth using a set of *known and unknown* rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules *including itself*."

was changed to:

"We ought to pursue the Truth using a set of *known and unknown* rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules *including itself*."

Chapter 8, Complete Reason, last paragraph, new second footnote

Deleted "(Raphael)" from the third sentence.

Chapter 8, Summary, first paragraph

Changed "entanglement problem" to "entanglement and observer problems" in the second sentence.

Changes in Version 2012.06.16

Acknowledgments, first paragraph

Changed "high school" to "public high school" in the first sentence.

Preface, fourth paragraph

Changed "in which beauty plays an explicit role" to "that calls for us to address our ignorance beautifully" in the last sentence.

Chapter 1, Values, sixth paragraph

Changed "the meaning of 'rain' or their rule" to "their rule or the meaning of 'rain'" in the last sentence.

Chapter 2, Invariant Tools for Living Well, last paragraph, footnote

Changed "As a result, their concept of 'multiplex view' does not ring true with the invariant strategy/perennial philosophy/natural reasoning" to "Their concept does not ring true with the natural reasoning" in the last sentence.

Chapter 3, Pursuing the Ring of Truth, second paragraph

Changed "According to our model" to "Following the steps" in the first sentence.

Chapter 3, The Elephant in the Room, first paragraph

Changed "inevitably discover" to "discover" and "well" to "well, which appears to be as indispensable to deciding well as mathematics and logic" in the last sentence.

Chapter 3, The Elephant in the Room, second paragraph

Changed "inevitably discover" to "discover" and "well" to "well, which appears to be as indispensable to deciding well as mathematics and logic" in the last sentence.

Chapter 4, *Self-Similarity*, first paragraph, second sentence

"A prediction is knowledge of what is apt to happen."

was deleted.

Chapter 4, Testing Invariant Science as a Whole, title

Deleted "as a Whole."

Chapter 8, Complete Reasoning, last paragraph, first footnote

Changed "Wisdom" to "the Truth" in the last sentence.

Chapter 8, Complete Reasoning, last paragraph, second footnote

Changed "premises" to "arguments" in the first sentence.

Changes in Version 2012.06.18

Chapter 2, Invariant Tools for Living Well, last paragraph, footnote, last sentence

"Their concept does not ring true with the natural reasoning put forth in this work."

was reduced to a clause appended to the last sentence:

", which emerges from the demand side."

Chapter 4, Refining Everyday Thinking, end

Added the paragraph:

"The whole of science is nothing more than the endless process of refining everyday thinking. We may call this process *invariant science*."

Chapter 4, Refining Refining Everyday Thinking, third and fourth paragraphs

"From the multiple-frame view, we ought to seek what we need to decide well. Defining what we ought to seek as something other than those things that we need to decide well leads us to embed mistakes into, or reinforce mistakes in, our networks of knowledge-in-use; that is, into our markets, technologies, legal systems, languages, and cultures. The greatest danger is in public policy. We tend to discover and correct our private mistakes. In contrast, policymakers often fail to discover and correct their mistakes. A classic example is the mercantilist concept of wealth as precious metal coins and bullion, which tended to blind policymakers to Adam Smith's virtuous circle of the division of labor and the expansion of market size. Similarly, the modern concept of wealth as those things that people want and the resources to produce those things that people want tends to blind policymakers to the virtuous circle of good people and good products.

"Just as Taiichi Ohno envisioned a corporate research program based on refining knowledge of producing in batches well, we can envision a public research program for refining our knowledge of deciding well. One way that we can refine this knowledge is to weed out all

models that are not useful to people in all circumstances. For example, we can weed out all models that concern only our bodies, only our minds, and only our spirits from the set of theories that we use to define what we need to live well.[3] To think of ourselves as animals, as computers, or as angels, rather than as people, is certain to embed major mistakes into our networks of knowledge-in-use. We ought to consider our bodies, minds, and spirits.[4]"

were changed to:

"***A Strategy for Learning***
From the multiple-frame view, we ought to seek what we need to decide well. Defining what we ought to seek as something other than those things that we need to decide well leads us to embed mistakes into, or reinforce mistakes in, our networks of knowledge-in-use; that is, into our markets, technologies, legal systems, languages, and cultures. Just as Taiichi Ohno envisioned a corporate research program based on refining knowledge of producing in batches well, we can envision a public research program for refining knowledge of deciding well.

"One way that we can refine this knowledge is to weed out all models that are not useful to people in all circumstances. For example, we can weed out all models that concern only our bodies, only our minds, and only our spirits from the set of theories that we use to define what we need to live well.[3] To think of ourselves as animals, as computers, or as angels, rather than as people, is certain to embed major mistakes into our networks of knowledge-in-use. We ought to consider our bodies, minds, and spirits.[4]"

Chapter 4, A Strategy for Learning, last paragraph

Changed "are incompatible" to "do not ring true" in the first sentence.

Chapter 4, *Learning by Doing*, first two paragraphs

"We can improve our ability to decide well by understanding our failures. There are many ways to seek this knowledge. We can look for what we did or did not do. Did we waste resources, fail to find the best problem to solve, or fail to solve the problem? We can look for the factors of deciding well that we lacked. Did we lack wisdom, freedom, trust, capital, or time? We also can look for common patterns in our failures.

"One such pattern concerns trading problems that give rise to the uneven flow of resources. The uneven flow of resources wastes time and other resources. Smoothing this flow often calls for trading. Mistrust and ignorance of better means of trade often constrain us from making such trades. Distributors fail to share knowledge about their customers with their suppliers for fear of losing business. Workers fail to tell their bosses about foolish procedures for fear of losing work. People prefer fixed to variable pay, which leads to layoffs during slow times. We have yet to discover and solve many other trading problems that give rise to uneven flow."

were moved to the end of the third paragraph of the previous subsection and changed to:

"Yet another way we can refine our knowledge of deciding well is to understand our failures. There are many ways to seek this knowledge. We can look for what we did or did not do. Did we waste resources, fail to find the best problem to solve, or fail to solve the problem? We can look for the factors of deciding well that we lacked. Did we lack wisdom, freedom, trust, capital, or time? We also can look for common patterns in our failures. For example, we can look for trading problems that give rise to the uneven flow of resources. The uneven flow of resources wastes time and other resources. Smoothing this flow often calls for trading. Mistrust and ignorance of better means of trade often constrain us from making such trades. Distributors fail to share knowledge about their customers with their suppliers for fear of losing business. Workers fail to tell their bosses about foolish procedures for fear of losing work. People prefer fixed to variable pay, which leads to layoffs during slow times. We have yet to discover and solve many other trading problems that give rise to uneven flow."

Chapter 4, *Learning by Doing*, title and new first paragraph

"***Learning by Doing***
Another such pattern concerns using temporal tools to find temporal problems to solve. Perhaps the best example of this is the modern economic accounting system. Imagine a pill that makes people decide better. Releasing this product would change how people decide to live. Some parts of the economy would shrink and other parts would grow. Resources would flow from the shrinking parts to the growing ones. The immediate effect would be a fall in aggregate production and a rise in unemployment. Modern economic science would portray one of the greatest advances in human history as a disaster."

were changed to:

"***Modern Macroeconomic Mistakes***
We tend to discover and correct our private mistakes. In contrast, policymakers tend not to discover and correct their mistakes. A classic example is the mercantilist concept of wealth as precious metal coins and bullion, which tended to blind policymakers to Adam Smith's virtuous circle of the division of labor and the expansion of market size. Similarly, the modern concept of wealth as those things that people want and the resources to produce those things that people want tends to blind policymakers to the grander virtuous circle of good people and good products.

"Consider modern economic accounting. Imagine a pill that makes people decide better. Releasing this product would change how people decide to live. Some parts of the economy would shrink and other parts would grow. Resources would flow from the shrinking parts to the growing ones. The immediate effect would be a fall in aggregate production and a rise in unemployment. Modern economic science would portray one of the greatest advances in human history as a disaster."

Chapter 4, *A Crude Look at the Whole*, title and new first sentence

"***A Crude Look at the Whole***
When we decide well, we create economic stress, the need to reallocate resources."

were changed to:

"Further, consider modern macroeconomic policies. When we decide well, we create economic stress, the need to reallocate resources."

Chapter 4, *Modern Macroeconomic Mistakes*, last paragraph, last sentence

"To ignore this frozen stress is not only to live in a fool's paradise, but also to bequeath the habits of living in a fool's paradise to future generations."

was deleted.

Chapter 4, *Academic Fields*, last paragraph

"Finally, we ought never to forget the sign above Einstein's desk at the Institute for Advanced Study: *Not everything that counts can be counted, and not everything that can be counted counts.*"

was deleted.

Changes in Version 2012.06.20

Preface, third paragraph, second sentence

"Over time, we collectively learn that there exist universally useful and inexhaustible factors of deciding well that we can never have in excess."

was changed to:

"Over time, we collectively learn that the timeless end of believing well (the truth) is a universally useful and inexhaustible factor of deciding well that we can never have in in excess. We also learn that there exist other universally useful and inexhaustible factors of deciding well that we can never have in in excess."

Preface, fourth paragraph, second sentence

Inserted the sentence:

"By providing us with a coherent means of integrating many views of the world, these models overcome the worst of the problems that arise from reducing our sensations of the world to concepts."

Chapter 4, *Modern Macroeconomic Mistakes*, fifth paragraph

Changed "complexity" to "*deterministic chaotic* and *complex adaptive systems*" in the first sentence.

Chapter 4, *Modern Macroeconomic Mistakes*, last paragraph

Changed "retard progress and increase the probability of catastrophes" to "slow progress and worsen turbulence" in the last sentence.

Chapter 4, *Academic Fields*, last paragraph, last two sentences

"However useful modern biological models are in helping us recognize our needs, we should never use them to explain our behavior. Models that we use to explain what ants do do not change what ants do, but the models that we use to explain what we do often change what we do. Mindlessly applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Such foolishness leads to catastrophe."

was deleted.

Chapter 7, The Scope of Biological Evolution, second paragraph, end

Added the sentences:

"Further, applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. To wit, the models that we use to explain what ants do never change what ants do, but the models that we use to explain what we do often change what we do. Ignoring this two-way relation both slows progress and worsens turbulence."

Chapter 8, Complete Reason, last paragraph

Changed "*known and unknown*" to "all not yet discarded" in the second sentence.

Chapter 8, Complete Reason, last paragraph, second footnote, last sentence

Inserted the sentence:

"Regardless of our personal beliefs about the nature of this mysterious element, addressing our ignorance beautifully can help us reason ever more wisely."

Changes in Version 2012.06.22

Title page of Acrobat version

Revised wording of the Internet/working version warning.

Entire document

Checked and updated reference dates on all external links.

Acknowledgments, last paragraph

Dropped middle names and relation clauses.

Preface, third paragraph

"According to this model, when we decide well, we learn ever more about deciding well. Over time, we collectively learn that the timeless end of believing well (the truth) is a universally useful and inexhaustible factor of deciding well that we can never have in excess. We also learn that there exist other universally useful and inexhaustible factors of deciding well that we can never have in excess. Further, we learn that the endless pursuits of all of these "boundless factors" intertwine to form a single endless pursuit:"

was appended to the second paragraph and changed to:

"We overcome these constraints by learning ever more about deciding well.

"Over time, we collectively learn that the timeless end of believing well (the truth) is one of many universally useful and inexhaustible factors of deciding well that we can never have in excess. We also learn that the endless pursuits of all of these "boundless factors" intertwine to form a single endless pursuit:"

Preface, fourth paragraph, first sentence

"By providing us with a coherent means of integrating many views of the world, these models overcome the worst of the problems that arise from reducing our sensations of the world to concepts."

was deleted.

Preface, fourth paragraph

Changed "process of deciding well" to "complex adaptive process" and "address our ignorance beautifully" to "define and digest our ignorance" in the last sentence.

Preface, fifth paragraph

Changed "concept of reason with a concept based on the multiple-frame approach to deciding well" to "concepts of reason with a new concept" in the first sentence.

Chapter 1, Useful Frames, second paragraph, fifth sentence

"A formal decision *event* consists of formulating alternatives, evaluating alternatives, choosing an alternative, and implementing the chosen alternative. To decide well is to decide perfectly."

was changed to:

"A formal decision *event* consists of formulating solutions to the given problem, evaluating these solutions, choosing a solution, and implementing the chosen solution."

Chapter 1, Useful Frames, last paragraph

Changed "various solutions" to "solutions" in the fourth sentence.

Deleted the fifth sentence: "To decide well is *not* to decide perfectly."

Chapter 1, *Seeing Through Apparent Miracles*, last paragraph

Changed "frame" to "view" in the first and fourth sentences (2 occurrences).

Chapter 1, *Steps for Building Multiple-Frame Models*, first paragraph

Changed "frame" to "bare frame" in the last sentence.

Chapter 1, *Ever More Complete Multiple-Frame Models*, first paragraph, footnote

Changed "*the Good*" to "*the Good*, *Well-being*, *Welfare*, or *Eudaemonia*" in the first sentence.

Chapter 1, Values, second paragraph, last sentence

Reversed the order of the definitions.

Chapter 2, Invariant Tools for Deciding Well, last paragraph, footnote

Changed "emerges from" to "is on" in the last sentence.

Chapter 2, *Three Common Mistakes*, last paragraph

Changed "product quality" to "tangible product quality" in the first sentence.

Chapter 2, *Three Common Mistakes*, last paragraph, second sentence

"This belief leads us to believe that teak is teak regardless of its source."

was changed to:

"For example, it makes no difference whether a rare coin was stolen, a designer handbag was produced off the books, or teak was smuggled out of a rainforest."

Chapter 2, Production, first paragraph

"Production is the intended result of producing well. From the temporal view, people *do not* intend to learn through experience, to push back their "production-possibility" frontiers. Production does not include what people learn through experience. In contrast, from the multiple-frame view, we *do* intend to learn through experience, to push back our "efficiency" frontiers. Production includes what we learn through experience."

was changed to:

"Production is the intended result of producing well. From the temporal view, production does not include what people learn through experience. People do not intend to learn through experience, to push back their "production-possibility" frontiers. In contrast, from the multiple-frame view, production includes what we learn through experience. We intend to learn through experience, to push back our "efficiency" frontiers."

Chapter 3, Pursuing the Ring of Truth, second paragraph

Changed "skeletal frame" to "bare frame" in the second sentence.

Chapter 3, Pursuing the Ring of Truth, third paragraph

Changed "this skeletal frame" to "the frame of contemplating well" in the first sentence.

Chapter 3, *Forward-Looking Science*, first paragraph

Changed "decision science" to "deciding well" in the first sentence.

Chapter 3, *Forward-Looking Science*, last paragraph

Changed "view of decision science" to "multiple-frame view" in the third sentence.

Changed "From the multiple-frame view, the" to "The" in the fourth sentence.

Chapter 4, *Self-Similarity*, second paragraph

Changed "view of the Copenhagen class of interpretations of quantum mechanics" to "Copenhagen view" in the third sentence.

Changed "view of the decision class" to "multiple-frame view" in the fifth sentence.

Chapter 4, Refining Refining Everyday Thinking, last paragraph

Changed "precise descriptions" to "beautiful descriptions" in the third sentence.

Chapter 4, *Modern Macroeconomic Mistakes*, fourth paragraph, footnote, end

Added the sentence:

"This is consistent with the historical inverse relation between the rate of unemployment and the rate of inflation commonly known as the Phillips curve."

Chapter 4, *Modern Macroeconomic Mistakes*, fourth paragraph

Changed "We" to "From the multiple-frame view, we" in the seventh sentence.

Chapter 5, *The Explicit Experiment*, fourth paragraph

Changed "the Union Army" to "Lincoln's Army of the Potomac" in the last sentence.

Chapter 5, *Pursue Invariant, not Temporal Order*, first paragraph, footnote, last two sentences

"Central bankers should not bury the problems that disrupt the smooth flow of resources. They should not hide these problems from the people best able to address them."

were changed to:

"Central bankers should neither bury the problems that disrupt the smooth flow of resources, nor shield the people best able to address these problems."

Chapter 6, *Heroic Death*, last paragraph

Changed "ourselves" to "ourselves and others" in the first sentence.

Chapter 7, *Boyd's Grand Strategy*, first paragraph

Changed "products, which he called ingredients" to "products" in the second sentence.

Chapter 7, *Boyd's Grand Strategy*, last paragraph

Changed "premise that we naturally" to "modern biological belief that we" in the first sentence.

Chapter 7, *Boyd's Grand Strategy*, first paragraph, last footnote, last sentence

"Note that Boyd conceived deciding well as a recursive process, a process in which the products of one cycle become the ingredients of the next cycle."

was changed to:

"Note that Boyd called these products *ingredients*. This is consistent with his belief that deciding well is a recursive process, a process in which the products of one cycle become the ingredients of the next cycle."

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote, last two sentences

"The best we can do is to disprove experimentally that the most beautiful tools for deciding well, which are the tools that ring truest with all that we currently know about deciding well, are indispensable in deciding well. We do so by acting as if these tools are indispensable in deciding well."

were changed to:

"However, we can seek to disprove experimentally that the tools that ring truest with all that we currently know about deciding well are indispensable in deciding well by acting as if these tools are indispensable in deciding well."

Chapter 7, The Scope of Biological Evolution, second paragraph, fifth sentence

"To wit, the models that we use to explain what ants do never change what ants do, but the models that we use to explain what we do often change what we do."

was deleted.

Chapter 8, title, second quote

""So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." — *Gregory Chaitin*2"

was deleted.

Chapter 8, Beautiful Reason, second paragraph, second and third sentences

"We may call excellence in relating beliefs *reason*. We may also call the rules that we use to help us relate beliefs well *the rules of reason*."

were changed to:

"We may call excellence in relating beliefs *reason* and the rules that we use to help us relate beliefs well *the rules of reason*."

Chapter 8, Beautiful Reason, second paragraph, last sentence

"Excellence in relating beliefs depends on the type of end we choose to pursue."

was moved to the beginning of the next paragraph.

Chapter 8, Beautiful Reason, sixth paragraph, first sentence

Added the following footnote:

"[3] The inspiration for this approach was an observation that mathematician Gregory Chaitin made in the introductory remarks of a lecture he gave at the Carnegie Melon University's School of Computer Science on March 2, 2000: "So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." A video of this lecture is available online at <http://www.youtube.com/watch?v=HLPO-RTFU2o> (22 June 2012)."

Chapter 8, Complete Reason, last paragraph, second footnote

Changed "mysterious element" to "element" and "addressing our ignorance beautifully" to "defining our ignorance ever more completely" in the fourth sentence.

Changed "published version" to "final version" and "element" to "mysterious element" in the last sentence.

Changes in Version 2012.06.26

Chapter 2, *Tools for Pursuing Pleasure and Joy*, first paragraph, first sentence

"Pursuing the virtuous circle of pleasure and joy calls for tools for helping us to choose paths forward."

was changed to:

"To pursue the virtuous circle of pleasure and joy well, we need tools for helping us choose paths forward."

Chapter 2, *Tools for Pursuing Pleasure and Joy*, second paragraph

Changed "also needs" to "needs" in the first sentence.

Chapter 3, Pursuing the Ring of Truth, third paragraph

Changed "helps us decide" to "helps us to decide" in the first sentence.

Chapter 3, *Public Entropy*, last paragraph

Changed "EOQ" to "EOQ/RTS" in the second sentence.

Chapter 8, Complete Reason, second paragraph, last footnote

"[6] Consider the holism of W. V. O. Quine. From Quine's view, *the philosophy of science is philosophy enough*. We see conflicts in our belief systems. Now consider the holism of the multiple-frame approach to deciding well. From the multiple-frame view, *the philosophy of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of deciding well*. We see holes as well as conflicts in our belief systems. For example, we see that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element. Our concept of completeness concerns much more than the supply side of the market for tools for helping us *believe* well. It concerns the supply and demand sides of the market for tools for helping us *decide* well."

was changed to:

"[6] Consider the holism of W. V. O. Quine. Our concept of completeness concerns the supply side of the market for tools for helping us *believe* well. We see conflicts in our belief systems. *The philosophy of science is philosophy enough*. Now consider the completeness of the multiple-frame approach to deciding well. Our concept of completeness concerns the supply and demand sides of the market for tools for helping us *decide* well. We see holes as well as conflicts in our belief systems. For example, we see that Morton White was right to criticize Quine's philosophy for being too narrow and that Jaegwon Kim was right to criticize it for not having a normative element. *The science of science is philosophy enough if and only if science includes the interwoven pursuits of all boundless factors of deciding well*."

Changes in Version 2012.06.30

Preface, first paragraph, first sentence

"In the fall quarter of 1978, I took George Leland Bach's MBA course in ethics."

was changed to:

"In 1949, George Leland Bach became the founding dean of the Graduate School of Industrial Administration at the Carnegie Institute of Technology. He envisioned a school based on management science. Thirteen years later, he left what some have called the first modern school of management to take a job at Stanford University, where he taught an undergraduate level course in economics and a graduate level course in ethical management. In the fall quarter of 1978, I took his course in ethics."

Preface, fourth paragraph

Changed "process" to "process of finding and solving problems" and "new" to "more complete" in the last sentence.

Chapter 1, Values, last paragraph

Changed "models" to "models for helping us find problems to solve" in the last sentence.

Chapter 1, *Steps for Building Strategic Models*, first paragraph

Changed "models" to "models for helping us find problems to solve" in the first sentence.

Chapter 1, *Invariant Values*, first paragraph

Changed "decide ever more" to "live ever more" in the last sentence.

Chapter 2, Invariant Tools for Living Well, last paragraph, footnote

Deleted ", which is on the demand side" in the last sentence.

Chapter 2, *Tools for Pursuing Pleasure and Joy*, last paragraph

Changed "danger of" to "danger in" in the second sentence.

Chapter 3, Pursuing the Ring of Truth, second paragraph

Changed "models" to "models for helping us find problems to solve" in the first sentence.

Chapter 7, *Timeless OODA Loop Analysis*, first paragraph

Changed "scales" to "scales up to and including nations" in the last sentence.

Chapter 7, The Scope of Biological Evolution, first paragraph

Changed "seek" to "*always* seek" in the second sentence.

Chapter 7, The Scope of Biological Evolution, second paragraph

Changed "both slows" to "slows" in the last sentence.

Chapter 7, The Scope of Biological Evolution, last paragraph

Changed "Hence, we" to "We" in the last sentence.

Chapter 8, Complete Reasoning, last paragraph

Changed "We" to "Together we" in the second sentence.

Chapter 8, Complete Reasoning, last paragraph, last footnote, second to last sentence

Changed "see" to "find" in the third and seventh sentences (2 occurrences).

Changed "Morton White was right to criticize Quine's philosophy for being too narrow" to "Quine's philosophy is too narrow (Morton White's problem)" and "that Jaegwon Kim was right to criticize it for not having a normative element" to "that it lacks a normative element (Jaegwon Kim's problem)" in the eighth sentence.

Chapter 8, Summary, first paragraph

Changed "disadvantage of" to "danger in" in the second sentence.

Changed "invariant values" to "values independent of beliefs and circumstances" in the fifth sentence.

Changed "timeless" to "invariant" in the last sentence.

Changes in Version 2012.07.06

Preface, first paragraph

Deleted ", where he taught an undergraduate level course in economics and a graduate level course in ethical management" from the third sentence.

Changed "course in ethics" to "MBA core course in ethical management" in the fourth sentence.

Preface, fourth paragraph

Changed "define and digest" to "define, decompose, and discard" in the last sentence.

Chapter 3, *Forward-Looking Science*, first paragraph

Changed "act" to "appear to act" in the fourth sentence (2 occurrences).

Chapter 3, *Forward-Looking Science*, second paragraph

Changed "acting" to "appearing to act" in the seventh sentence (2 occurrences).

Chapter 3, *Forward-Looking Science*, third paragraph

Changed "acting" to "appearing to act" in the second sentence (2 occurrences).

Chapter 3, The Elephant in the Room, first paragraph

Changed "logic" to "logic are" in the last sentence.

Chapter 3, The Elephant in the Room, second paragraph

Changed "logic" to "logic are" in the last sentence.

Chapter 4, Refining Everyday Thinking, second paragraph

Changed "linking" to "the process of relating" in the second sentence.

Chapter 4, Refining Everyday Thinking, last paragraph

"The whole of science is nothing more than the endless process of refining everyday thinking. We may call this process *invariant science*."

was changed to:

"We may call the endless process of refining everyday thinking *invariant science*."

Chapter 4, *Recursivity*, first paragraph, end

Added the sentence:

"The models we use to describe the behavior of ants do not change what ants do, but the models we use to describe our behavior tend to change what we do."

Chapter 4, Refining Refining Everyday Thinking, title

Changed title from "Refining Refining Everyday Thinking" to "Refining Invariant Science."

Chapter 4, *Modern Macroeconomic Mistakes*, title

Changed title from "*Modern Macroeconomic Mistakes*" to "*Modern Policy Mistakes*."

Chapter 4, *Academic Fields*, first paragraph

Changed "prescription for" to "description of and prescription for" in the second sentence.

Chapter 5, *The Explicit Experiment*, second paragraph, footnote, last sentence

"We can see Franklin's continued belief in his great political experiment in his famous reply to the woman who asked him what the secret meetings that we now call the Constitutional Convention produced: "A republic, if you can keep it.""

was changed to:

"Franklin's famous reply to the woman who asked him what the secret meetings that we now call the Constitutional Convention produced ("A republic, if you can keep it.") rings true with the belief that Franklin made this crucial change."

Chapter 5, *Lower Trade Barriers*, first paragraph, footnote

Changed "technology" to "high technology" in the last sentence.

Chapter 6, *Experiencing Mystical Oneness*, last paragraph

Changed "sacrifice safety or health in order to conserve scarce resources" to "conserve scarce resources by sacrificing safety or health" in the first sentence.

Chapter 6, A Common Timeless End, second paragraph

"From a materialist view, we become part of something infinitely larger than ourselves in order to live well. Linking well is subordinate to living well. From a dualist view, we live well in order to become part of something infinitely larger than ourselves. Living well is subordinate to linking well. From both views, poverty may force us to choose between living well and linking well, between pursuing Happiness and pursuing Wholeness. Deciding well makes it ever less probable that we will need to make this choice. Given that the emotions arising from our need for mystical oneness can easily overwhelm our reason, we ought to err on the side of living well."

were changed to:

"Although the creation of a frame for linking well helps us better understand living well, it does not tell us whether we ought to link well in order to live well or live well in order to link well. From both views, poverty may force us to choose between living well and linking well, between pursuing Happiness and pursuing Wholeness. Deciding well makes it ever less probable that we will need to make this choice."

Chapter 6, A Common Timeless End, last paragraph, first sentence

"From a logical view, the belief that linking well is subordinate to living well conflicts with the belief that living well is subordinate to linking well."

was changed to:

"From a logical view, the belief that we ought to link well in order to live well conflicts with the belief that we ought to live well in order to link well."

Chapter 7, The Scope of Biological Evolution, second paragraph, last two sentences

"Modern views of biological evolution tend to blind us to better ways of living well. Further, applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Ignoring this two-way relation slows progress and worsens turbulence."

were changed to:

"Applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Ignoring this two-way relation slows progress and worsens turbulence."

Chapter 8, Beautiful Reason, fifth paragraph

Changed "frames" to "coherent sets of frames" in the last sentence.

Chapter 8, Complete Reason, last paragraph, second sentence

"We ought to collectively pursue the Truth using a set of all not yet discarded rules for pursuing the Truth that contains a complete subset of rules for refining this set of rules *including itself*."

was changed to:

"Individually, we ought to pursue the Truth based on the rules that ring true with what we currently know about pursuing the Truth. Collectively, we ought to collectively pursue the Truth using the set of all possible rules for pursuing the Truth, which includes all possible rules for refining the set of all possible rules for pursuing the Truth."

Chapter 8, Complete Reason, last paragraph

Changed "complete *for us*" to "complete" in the second to last sentence.

Chapter 8, Complete Reason, last paragraph, second footnote

Changed "create" to "discover or invent" in the first sentence.

Chapter 8, Complete Reason, last paragraph, second footnote, third sentence

"Raffaello Sanzio da Urbino called it *inspiration* (Columbia University Art Humanities Series lecture *The School of Athens* <http://www.youtube.com/watch?v=uOrG6jfBzEU> 22 June 2012)."

was changed to:

"Others have called it *inspiration*."

Chapter 8, Complete Reason, last paragraph, last footnote

Changed ". For example" to ", e.g." in the sixth and seventh sentences.

Changes in Version 2012.07.07

Changes in response to edit of preface and first chapter by Patrika Vaughn.

Preface, first paragraph

Inserted paragraph break after the fifth sentence.

Preface, new third paragraph, second sentence

"They confuse taking the next step toward seeking the truth and taking the next step toward seeking wisdom with seeking the truth and wisdom."

was changed to:

"They conflate the temporal and the timeless. In pursuing the truth, they confuse taking the next step toward seeking the truth with seeking the truth. In pursuing wisdom, they confuse taking the next step toward seeking wisdom with seeking wisdom."

Preface, new sixth paragraph

Deleted "which is the view of believing well ever more wisely," from the third sentence.

Chapter 1, Setting Words Aright, last paragraph, first two sentences

"Deciding ever more wisely calls for distinguishing between terms and concepts, between containers for meaning and meanings. This book uses the convention of surrounding terms with single quotation marks and concepts with double quotation marks."

was changed to:

"Deciding ever more wisely calls for distinguishing between concepts and terms, between meanings and containers for meaning. This book uses the convention of surrounding concepts with double quotation marks and terms with single quotation marks."

Changes in Version 2012.07.12

Preface, second to last paragraph

Changed "redefining" to "expanding the scope of" in the last sentence.

Chapter 3, *Public Entropy*, end

Added the following paragraph:

"Reasonably complete reasoning concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. It is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing the Truth."

Chapter 3, The Elephant in the Room, second paragraph

Deleted ", which appears to be as indispensable to deciding well as mathematics and logic are" from the last sentence.

Chapter 3, The Elephant in the Room, third paragraph

Deleted ", which appears to be as indispensable to deciding well as mathematics and logic are" from the last sentence.

Chapter 4, Refining Everyday Thinking, second paragraph and Venn diagram

Replaced subset subscript labels (1, 2, 3) with more descriptive labels (*d*, *p*, *e*).

Chapter 4, Refining Everyday Thinking, last four paragraphs

"We use descriptions of the world to predict and explain. A prediction is knowledge of what is apt to happen. An explanation is knowledge of why things happen as they do. Predictions and explanations help us in different ways. Predictions help us to assign probabilities to uncertain events, which helps us to evaluate alternatives. Explanations help us to understand how our actions may change the world, which helps us to formulate alternatives. Better predictions help us become more *efficient* and better explanations help us become more *effective*.

"We choose descriptions of the world to help us predict within our chosen problems (S_2). We also choose descriptions of the world to help us choose problems to solve (S_3). In both cases, choosing well is an art. It is a matter of judging the ring of truth based on what we currently know about the world. *Beauty plays a role not only in creating tools for helping us decide, but also in using these tools.*

"We test the descriptions that we use to predict by how well they help us predict, and test the descriptions that we use to explain by how well they help us find problems to solve. The descriptions we use to explain may do nothing more than tell us that we cannot predict what we would like to predict. If we know that no one can predict the weather ten days from now, we ought to plan for more than smooth sailing.

"The whole of science is nothing more than the endless process of refining everyday thinking. We may call this process *invariant science*."

were changed to:

"We use descriptions of the world to predict. A prediction is knowledge of what is apt to happen. Predictions help us to assign probabilities to uncertain events, which helps us to evaluate alternatives. We refine the descriptions that we use to predict by how well they help us predict. Members of the set of refined descriptions that help us predict (S_P) help us become more efficient.

"We also use descriptions of the world to explain the world. An explanation is knowledge of why things happen as they do. Explanations help us to understand how our actions may change the world, which helps us to formulate alternatives. We refine the descriptions that we use to explain by how well they help us find problems to solve. Members of the set of refined descriptions that help us explain (S_E) help us become more effective."

Chapter 4, *Recursivity* and *Self-Similarity* subsections

Switched order of these two subsections. Removed italics from the second to last sentence in the last paragraph of the *Recursivity* subsection.

Chapter 4, *Academic Fields*, end

Added the one sentence paragraph:

"*Invariant science* would be the endless process of refining everyday thinking."

Chapter 4, *A Strategy for Learning*, title

Changed title to "*Refining Deciding Well*."

Chapter 4, *Academic Fields*, entire subsection.

Moved this subsection back to the end of Refining Everyday Thinking section (behind the *Self-Similarity* subsection).

Chapter 4, *Modern Policy Mistakes*, fourth paragraph

Changed "From a multiple-frame view, we" to "We" in the sixth sentence.

Chapter 4, *Modern Policy Mistakes*, fifth paragraph

Deleted "*deterministic chaotic* and" from the first sentence.

Changed ""frozen accidents"" to "*frozen accidents*" in the first sentence.

Chapter 8, Complete Reasoning, last paragraph, first footnote

"[4] Reasonably complete reasoning concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. It is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing the Truth."

was deleted.

Chapter 8, Complete Reasoning, last paragraph, last footnote

Changed "Quine" to "Quine's holistic approach to believing well" in the first sentence.

Changed "*believe*" to "believe" in the second sentence.

Changed "deciding" to "believing" in the fifth sentence.

Changes in Version 2012.07.14

Acknowledgments, fifth paragraph

Changed "ponder the many ways in which we cope with what we don't know about what we don't know" to "revisit the modern economic problem of learning" in the third sentence.

Changed "met" to "got to know" in the fourth sentence.

Chapter 3, *Forward-Looking Science*, fourth paragraph

Changed "a single decision tree" to "this universal problem's decision-tree model" in the last sentence.

Chapter 4, *Academic Fields*, fourth paragraph

Changed "they" to "we" and "consciousness" to "our consciousness" in the last sentence.

Chapter 4, *Academic Fields*, fifth paragraph

Changed "*sciences* include" to "*sciences* would include" in the second sentence (2 occurrences).

Changes in Version 2012.07.17

Chapter 1, Values, fifth paragraph

Changed "discovery and exploration" to "exploration" in the fifth sentence.

Chapter 3, *Public Entropy*, second paragraph, footnote

Changed "beautiful" to "ambiguous" in the second and third sentences (2 occurrences).

Chapter 4, *Self-Similarity*, second paragraph

Changed "view" to "view of physics" in the fourth sentence.

Chapter 5, *The Explicit Experiment*, last paragraph

Changed "theistic rather than natural" to "theistic" in the fifth sentence.

Chapter 6, *Mystical Oneness*, second paragraph

Changed "union" to "union of self with the infinite Being" in the third sentence.

Changed "union of self with the infinite Being" to "union" in the fourth sentence.

Chapter 8, Beautiful Reason, seventh paragraph, second through fourth sentences

"The logical approach to pursuing the Truth does not use this technique. The dialectical approach can use it to pursue a timeless end. The Reasonable approach uses it to pursue the timeless end of deciding well, which calls for using it to pursue boundless factors of deciding well."

were changed to:

"We cannot use this technique with the logical approach to pursuing the Truth. We can use it with the dialectical approach to pursue a single timeless end. We can also use it with the Reasonable approach to pursue the timeless end of deciding well, which calls for using it to pursue boundless factors of deciding well."

Chapter 8, Summary, first paragraph

Changed "in physics" to "in philosophy (the induction problem) and in physics" in the second sentence.

Chapter 8, Summary, last paragraph

Deleted the first sentence:

"Perfection of means and confusion of ends seem to characterize our age."

Merged the paragraph to the first paragraph.

Appendix A, Producing Ever More Wisely, first paragraph

Changed "Toyota's *kaizen*" to "Taiichi Ohno's" in the last sentence.

Changes in Version 2012.07.20

Acknowledgments, fourth paragraph

Changed "lecture" to "lecture in Chicago" and "Japanese factories practicing just-in-time manufacturing" to "factories practicing just-in-time manufacturing in Japan" in the last sentence.

Acknowledgments, fifth paragraph

Changed "got to know" to "made friends with" in the fourth sentence.

Changed ""from the heart" for the *Harvard Business Review/Economist* magazine audience." to ""from the heart."" in the sixth sentence.

Preface, first paragraph

Changed "Thirteen years later" to "In 1962" and "school of management to take a job" to "business school to take a teaching job" in the second sentence.

Changed "fall quarter" to "fall" in the third sentence.

Chapter 4, *Academic Fields*, fourth paragraph

Changed "our consciousness from the study of quantum mechanics" to "consciousness from the study of quantum mechanics, hence would see more clearly such things as the conflict between the absolute time of quantum mechanics (entangled states of the world) and the relativistic time of Einstein's theory of invariance" in the last sentence.

Chapter 7, *A Normal Anomaly*, last paragraph

Changed "deck" to "standard deck" in the last sentence.

Chapter 7, *An Extraordinary Anomaly*, first paragraph

Changed "world (universe)" to "universe" in the last sentence.

Chapter 7, *Temporal OODA Loop Analysis*, title

Deleted "*Temporal*" from the title.

Chapter 7, *Temporal OODA Loop Analysis*, first two paragraphs

"In 1975, Boyd retired from the Air Force as a full colonel. He planned to refine his ideas about combat and develop his ideas about how and why people learn. Fellow defense reformer Pierre Sprey encouraged him to develop his ideas on maneuver warfare. Given his great ability to relate ideas, Boyd saw how each of these three issues fitted into the larger problem of how best to decide well more quickly than competitors.

"Boyd grasped that deciding well was a self-similar process based on a decision cycle. In his decision cycle, we observe the world, orient ourselves in the world, decide on a course of action, and act. Boyd called this observe–orient–decide–act decision cycle an *OODA loop*."

were changed to:

"After retiring from the Air Force in 1975, Boyd grasped that deciding well was a self-similar process based on a decision cycle. In his decision cycle, we observe the world, orient ourselves in the world, decide on a course of action, and act. He called this observe–orient–decide–act decision cycle an *OODA loop*."

Chapter 7, *Timeless OODA Loop Analysis*, title

Deleted title. Merged subsection into the prior subsection.

Chapter 7, *OODA Loop Analysis*, last paragraph, footnote, last three sentences

"Boyd's strategy involved breaking down Saddam Hussein's "moral–mental–physical capacity to adapt or endure." Among other things, this involved creating the cognitive

dissonance experienced by the subjects of Bruner and Postman's experiment. Boyd learned of this experiment from Kuhn's description of it in *The Structure of Scientific Revolutions*."

were inserted after the first sentence of the paragraph in the paragraph and changed to:

"This strategy involved breaking down Saddam Hussein's "moral–mental–physical capacity to adapt or endure" by creating the cognitive dissonance experienced by the subjects of Bruner and Postman's experiment."

Chapter 7, *Boyd's Grand Strategy*, last paragraph, footnote

Changed "evolution" to "biological evolution" in the third sentence.

Changes in Version 2012.07.26

Preface, first paragraph

Changed "George" to "University of Chicago trained-economist George" in the first sentence.

Chapter 1, Useful Frames, first paragraph, third through last sentences

"Some ends concern processes. Because processes have no bounds in time, we may call these *timeless ends*. Playing basketball well is a timeless end. Other ends concern events. Because events have bounds in time, we may call these *temporal ends*. Winning a basketball game is a temporal end. In pursuing the timeless end of deciding well, we need frames to help us find problems to solve. We may call these *timeless frames*. We also need frames to help us solve problems that have temporal ends. We may call these *temporal frames*."

were changed to:

"Some ends concern events. Because events have bounds in time, we may call these *temporal ends*. Winning a basketball game is a temporal end. Other ends concern processes. Because processes have no bounds in time, we may call these *timeless ends*. Playing basketball well is a timeless end. In pursuing the timeless end of deciding well, we need frames to help us solve problems that have temporal ends. We may call these *temporal frames*. We also need frames to help us find problems to solve. We may call these *timeless frames*."

Chapter 2, Invariant Tools for Living Well, second paragraph, footnote

Removed all italics from the footnote.

Chapter 5, *The Explicit Experiment*, fourth paragraph, last footnote, end

Added the sentences:

"Holmes was the least idealistic member of the first generation of what we now call the pragmatic school of philosophy. For more on this, read Louis Menand's *The Metaphysical Club* (New York: Farrar, Straus and Giroux, 2002)."

Chapter 6, A Common Timeless End, second paragraph

"Although the creation of a frame for linking well helps us better understand living well, it does not tell us whether we ought to link well in order to live well or live well in order to link well. From both views, poverty may force us to choose between living well and linking well, between pursuing Happiness and pursuing Wholeness. Deciding well makes it ever less probable that we will need to make this choice."

was changed to:

"However useful creating a frame for linking well may be in helping us better understand living well, it does not tell us whether we ought to link well in order to live well or live well in order to link well. As a practical matter, we only need to choose between these two when we lack the resources to pursue both living well and linking well. Pursuing the timeless end of deciding well provides us with the resources to pursue both living well and linking well. Deciding well makes it ever less probable that we will need to choose between living well and linking well."

Chapter 7, *OODA Loop Analysis*, last paragraph

Changed "cognitive dissonance" to "dissonance" in the second sentence.

Chapter 8, Beautiful Reason, third paragraph

Changed "completely unambiguous" to "unambiguous" in the fourth sentence.

Chapter 8, Beautiful Reason, fifth paragraph, footnote

Changed "its roots" to "roots" in the second sentence.

Chapter 8, Beautiful Reason, seventh paragraph

"We can imagine finessing this problem of never knowing the Truth by using a programming technique that searches the set of all possible algorithms for superior algorithms by selecting and "breeding" algorithms based on their fitness in pursuing timeless ends. We cannot use this technique with the logical approach. We can use it with the dialectical approach to pursue a single timeless end. We can also use it with the Reasonable approach to pursue the timeless end of deciding well, which calls for using it to pursue boundless factors of deciding well. Although the Reasonable approach may appear to be the best for pursuing the Truth, proving that it is the best still calls for knowing the Truth. However useful this finesse may appear to be in pursuing the Truth, it is not useful in helping us formally prove which form of reason is best for pursuing the Truth."

was reduced to a footnote of the sixth paragraph.

Chapter 8, Complete Reason, second paragraph, first footnote

Changed "discover or invent" to "find and choose" in the first sentence.

Changes in Version 2012.07.30

Acknowledgments, fifth paragraph

Changed ""from the heart."" to ""from the heart" about learning in economics" in the sixth sentence.

Chapter 1, Values, sixth paragraph, footnote, last sentence

"For more about these two approaches to language, see the last chapter."

was deleted.

Chapter 3, Public Entropy, last paragraph

"The reasoning underlying this approach concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing Beauty."

was moved to the end of the *Forward Looking Science* subsection and changed to:

"The reasoning underlying this approach to pursuing the Truth concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing Beauty."

Chapter 4, Refining Invariant Science, first paragraph, fourth sentence

"What remains is a set of precise models that we use to predict how people will decide."

was deleted.

Chapter 4, Refining Invariant Science, second paragraph, third sentence

"What remains is a set of beautiful descriptions that we use to explain deciding well."

was deleted.

Chapter 5, *Promote Savings for Welfare*, second paragraph, footnote

"[15] Ideally, private charities would drive the government out of the welfare business. The government safety-net program, like a militia, would remain available for emergencies."

was deleted.

Chapter 7, *OODA Loop Analysis*, last paragraph

Changed "Saddam Hussein's" to "the enemy's" in the second sentence.

Chapter 8, title, quote

""1 The world is everything that is the case. ...
2 What is the case, the fact, is the existence of atomic facts. ...
7 Whereof one cannot speak, thereof one must be silent."
— *Ludwig Wittgenstein*[1]"

"[1] Wittgenstein, Ludwig *Tractatus Logico-Philosophicus* (New York, Cosimo Classics, 2010), principal propositions 1, 2, and 7. This is the C. K. Ogden translation, which is available online at Project Gutenberg, <http://www.gutenberg.org/ebooks/5740> (22 June 2012)."

was changed to:

"So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." — *Gregory Chaitin*[1]"

"[1] Introductory remarks of a lecture given given by Gregory Chaitin at the Carnegie Melon University's School of Computer Science on March 2, 2000. A video of this lecture is available online at <http://www.youtube.com/watch?v=HLPO-RTFU2o> (30 July 2012)."

Chapter 8, Beautiful Reason, fifth paragraph, footnote

"[3] Students of Western thought may better understand the distinction between logic, dialectics, and Reason by studying Ludwig Wittgenstein's conversion from a picture theory of language

based on a temporal view of the world to an instrumental theory of language based on the timeless end of living well. What we now call received science, which has roots in Wittgenstein's picture theory of language, helps us describe actual existence based on what we currently know. To decide well, we need not only to describe actual existence based on what we currently know, but also to describe the whole of potential existence based on all that we can ever know. We need not only bounded descriptions of existence to help us solve given problems, but also boundless descriptions of existence to help us find better problems to solve."

was deleted.

Chapter 8, Beautiful Reason, sixth paragraph, first footnote

"[4] The inspiration for this thought experiment was an observation that mathematician Gregory Chaitin made in the introductory remarks of a lecture he gave at the Carnegie Melon University's School of Computer Science on March 2, 2000: "So if you look back at the history of the beginning of this century you'll see papers by logicians studying the foundations of mathematics in which they had programming languages. Now you look back and you say this is clearly a programming language! If you look at Turing's work, you see, of course, there's a machine language. If you look at papers by Alonzo Church, you see the lambda calculus, which is a functional programming language. If you look at Gödel's original paper, you see what to me looks like LISP. It's very close to LISP. It begs to be rewritten in LISP." A video of this lecture is available online at <http://www.youtube.com/watch?v=HLPO-RTFU2o> (22 June 2012)."

was deleted.

Chapter 8, Beautiful Reason, sixth paragraph, footnote

Changed "approach" to "thought experiment" in the first sentence.

Chapter 8, Complete Reason, second paragraph, second and third sentences

"Individually, we ought to pursue the Truth using the rules that ring true with all that we currently know about pursuing the Truth. Collectively, we ought to pursue the Truth using the set of all possible rules for pursuing the Truth, which includes all possible rules for refining the set of all possible rules for pursuing the Truth."

were changed to:

"In theory, we collectively ought to pursue the Truth using the set of all possible rules for pursuing the Truth, which includes all possible rules for refining the set of all possible rules for pursuing the Truth. We may call such a set of rules *reasonably complete*."

Changes in Version 2012.08.06

Chapter 1, Values, sixth paragraph, footnote, end

Added the sentence:

"Received science (logical empiricism) has roots in this thoroughly temporal concept of language."

Chapter 3, *Forward-Looking Science*, first paragraph

Changed "two objects" to "objects" in the fifth sentence.

Chapter 3, *Forward-Looking Science*, second paragraph, third through last sentences

"The first of these contains explanations that claim we should not waste resources trying to explain how quantum-level objects behave. We may call this the *Copenhagen class*. The second contains explanations that claim that we will be able to find hidden variables that explain how these objects behave. We may call this the *hidden-variables class*. The third contains explanations that claim that every time one of these objects irreversibly transitions from appearing to act as a wave to appearing to act as a particle, the world splits into a world in which the transition occurs and into another world in which it does not occur. Thus, everything that could have happened since the beginning of time has actually happened somewhere in the universe of worlds. We may call this the *many worlds class*."

were changed to:

"These are the *Copenhagen class*, the *hidden variables class*, and the *many worlds class*.

"The defining characteristic of the Copenhagen class is the belief that we may know either the wave-like or the particle-like characteristics of objects on the quantum level, but that we can never know both. Hence, we will never be able to describe the behavior of these objects with certainty.

"The defining characteristic of the hidden variables class is the belief that we will eventually be able to describe the behavior of these objects with certainty. This is to say that we lose nothing in reducing the whole into parts and that we do not have free will.

"The defining belief of the many worlds class is that every time one of these objects irreversibly transitions from appearing to act as a wave to appearing to act as a particle, the world splits into a world in which the transition occurs and into another world in which it does not occur. Thus, everything that could have happened since the beginning of time has actually happened somewhere in the universe of worlds."

Changes in Version 2012.08.08

Acknowledgments, last paragraph

Changed "(1942–46)" to " (1942–6)" in the fourth sentence.

Chapter 1, Choosing Frames Well, first paragraph

Changed "conceiving the world (reducing our sensations of the world to concepts)" to "reducing our sensations of the world to concepts" in the last sentence.

Chapter 1, Choosing Frames Well, first paragraph

Changed "conceive the world" to "reduce our sensations of the world to concepts" in the first sentence.

Chapter 3, *Forward-Looking Science*, third paragraph

Changed "The defining characteristic" to "A defining belief"; "characteristics" to "aspects"; and "both" to "both at the same time" in the first sentence.

Chapter 3, *Forward-Looking Science*, fourth paragraph

Changed "The defining characteristic" to "A defining belief" in the first sentence.

Changed "This is to say" to "Hence," and "that we" to "we" in the last sentence.

Chapter 3, *Forward-Looking Science*, fifth paragraph

Changed "The" to "A" and "that" to "the belief that" in the first sentence.

Changed "Thus" to "Hence" in the last sentence.

Chapter 3, *Forward-Looking Science*, seventh paragraph

Changed "ideal models" to "models" in the first sentence.

Chapter 7, The Scope of Game Theory, first paragraph

Changed "cooperate (C) or defect (D)" to "cooperate or defect" in the last sentence.

Chapter 7, *A Normal Anomaly*, first paragraph, block quote

Changed "D" to "D [defect]" and "C" to "C [cooperate]" in the second sentence.

Chapter 7, *E-M Theory*, first paragraph

Changed "manual on aerial combat eventually used by air forces around the world" to "widely-used manual on aerial combat" in the third sentence.

Chapter 7, *OODA Loop Analysis*, third paragraph

Changed "next" to "later" in the first sentence.

Chapter 8, Complete Reason, last paragraph, first footnote, second and third sentences

"Kurt Gödel called this mysterious element *intuition*. Others have called it *inspiration*."

were deleted.

Changes in Version 2012.08.18

Chapter 3, *Public Entropy*, first paragraph

Changed "wealth" to "resources" in the third sentence.

Chapter 8, Summary, first paragraph, last paragraph

"We shall not grow wiser before we learn that much that we have done was very foolish."

was deleted.

Changes in Version 2012.08.25

Chapter 7, The Scope of Biological Evolution, last paragraph, end

Added the sentences:

"If we are trying to solve a given problem, we ought to choose whichever level of biological evolution best helps us predict within the bounds of our problem, whether it be on the level of the organism, the gene, or the collective (colony or society). On the other hand, if we are trying to find a problem to solve, we ought to choose the explanation that best helps us pursue the timeless end of deciding well."

Chapter 8, Beautiful Reason, sixth paragraph, footnote

Changed "a programming technique" to "an object-oriented (as opposed to procedural) programming technique" in the first sentence.

Changes in Version 2012.08.28

Chapter 7, The Scope of Biological Evolution, last paragraph, end

Added the paragraphs:

"All living beings seek to order their (internal and external) environment to suit their needs. They do so by taking order into their environment and by discarding disorder from it. For the world as a whole, the amount of order decreases over time. Hence, the source of order that makes life as we know it possible is the order at the beginning of the world. The odds against our world being as ordered as it appears to have been in the beginning are in the realm that mathematicians consider to be practically infinite.[17]

"From an atheistic view, we were very lucky to have been born into a world conducive to life. From a theistic view, we were very lucky to have been born into a world created to be conducive to life. From the multiple-frame view, we may never know for certain whether the world was created. However, we can know for certain that we ought to pay for the privilege of being born into a world conducive to living our life well by paying forward the debt we owe to the living beings that made possible living our life well. We best do so by pursuing the transcendental end of zero public entropy."

"[17] Mathematician Roger Penrose estimated the odds against our universe being as ordered as it appears to have been at the big bang to be at least ten-to-the-ten-to-the one-hundred-and-twenty-third power to one against. He made this estimate in a lecture titled "Before the Big Bang? A New Perspective on the Weyl Curvature Hypothesis" to the Newton Institute at Oxford University on November 7th, 2006. A video of this lecture is available online at <http://www.newton.ac.uk/webseminars/pg+ws/2005/gmr/gmrw04/1107/penrose/index.html> (28 August 2012)."

Changes in Version 2012.08.30

Chapter 2, *Chicago Screwdrivers*, first paragraph, end

Added the footnote:

"[4] Note the similarities between this distinction and Milton Friedman's distinction between positive and normative science (*Essays in Positive Economics*, Chicago: University of Chicago Press, 1953). Communication across frames is only partial. The distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) is not the same as the distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories). Hidden in theories that describe the world as it is in

the process of becoming is a description of a prescriptive program, which is that living things are programmed to pursue the timeless end of living well. Biologists call this a teleonomic program."

Chapter 4, *Refining Deciding Well*, second paragraph

Changed "theories" to "models" in the second sentence.

Chapter 6, A Common Timeless End, second paragraph

Changed "or link" to "or to link" in the first sentence.

Chapter 7, *An Extraordinary Anomaly*, last paragraph, end

Added the paragraph:

"Deciding well calls for all of us to decide like fully human beings; hence to judge actions by invariant values and people by the content of their character as revealed by their actions."

Chapter 7, The Scope of Biological Evolution, last paragraph

"From an atheistic view, we were very lucky to have been born into a world conducive to life. From a theistic view, we were very lucky to have been born into a world created to be conducive to life. From the multiple-frame view, we may never know for certain whether the world was created. However, we can know for certain that we ought to pay for the privilege of being born into a world conducive to living our life well by paying forward the debt we owe to the living beings that made possible living our life well. We best do so by pursuing the transcendental end of zero public entropy."

was changed to:

"From a theistic view, we were very lucky to have been born into a world created to be conducive to life. From an atheistic view, we were very lucky to have been born into a world conducive to life. From the multiple-frame view, we may never know for certain whether our world was created, one of a practically infinite number of accidental worlds, or something else. However, we can know with great certainty that we ought to pay for the privilege of being born into a world conducive to living our life well by paying forward the debt we owe to the living beings that made possible living our life well. We best do so by pursuing the timeless end of zero public entropy."

Chapter 8, Beautiful Reason, sixth paragraph, footnote

Changed "an object-oriented (as opposed to procedural) programming technique" back to "a programming technique" in the first sentence.

Chapter 8, Complete Reason, last paragraph, first footnote

"At the heart of reason is a mystery that concerns how we find and choose ever better tools for reasoning (concepts, rules, and arguments). Regardless of our personal beliefs about the nature of this element, defining our ignorance ever more completely can help us reason ever more wisely. Appendix B of the final version of this work will explain how to explain this mysterious element ever more wisely."

was deleted.

Changes in Version 2012.09.12

Preface, end

Added the paragraph:

"To decide well, we need not only to describe actual existence based on what we currently know, but also to describe the whole of potential existence based on all that we can ever know. We need not only bounded descriptions of existence to help us solve given problems, but also boundless descriptions of existence to help us find better problems to solve. The complex approach to deciding well put forth in this work provides us with not only bounded descriptions of existence to help us solve given problems, but also with coherent sets of boundless descriptions of existence to help us find better problems to solve. These coherent sets concern the world not as it currently is, but rather as it is in the process of becoming. They concern not the world as we find it, but rather the world as we may form it."

Chapter 1, Values, fifth paragraph

Changed "Europeans" to "the English" in the fourth sentence.

Changed "Europeans" to "the English" in the fifth sentence.

Changed "Europeans" to "English" in the tenth sentence.

Chapter 2, *Chicago Screwdrivers*, first paragraph, footnote, first three sentences

"Note the similarities between this distinction and Milton Friedman's distinction between positive and normative science (*Essays in Positive Economics*, Chicago: University of Chicago Press, 1953). Communication across frames is only partial. The distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) is not the same as the distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories)."

were changed to:

"Communication across frames is only partial. The distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) as described by Milton Friedman in his book *Essays in Positive Economics* (Chicago: University of Chicago Press, 1953) is not the same as the distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories)."

Chapter 3, *Forward-Looking Science,* third through fifth paragraphs

Changed "defining belief" to "defining feature" in the first sentence of all three paragraphs (3 occurrences).

Chapter 5, *Pursue Invariant, not Temporal Order*, first paragraph, footnote

"For example, the best monetary policy is the one that best helps us to decide well. If a government has chosen a central banking system, central bankers should promote deciding well over macroeconomic stability in all but the direst of circumstances. Central bankers face two major choices. They must choose whether to control the supply or the price of money. They must also choose whether to act with or without warning. Of the four policies created by these two choices, the one that is least harmful to deciding well is to control the money supply by means of actions declared far in advance. Central bankers should neither bury the problems that disrupt the smooth flow of resources, nor shield the people best able to address these problems."

was promoted to the body of the text and changed to:

"To counter this, central bankers should promote deciding well over macroeconomic stability in all but the direst of circumstances. They should neither bury the problems that disrupt the smooth flow of resources, nor shield the people best able to address these problems."

Chapter 7, The Scope of Biological Evolution, third paragraph

"As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways that are most useful to intelligent beings bound to live well in the flow of time. We ought to take a boundless view of biological evolution. If we are trying to solve a given problem, we ought to choose whichever level of biological evolution best helps us predict within the bounds of our problem, whether it be on the level of the organism, the gene, or the collective (colony or society). On the other hand, if we are trying to find a problem to solve, we ought to choose the explanation that best helps us pursue the timeless end of deciding well."

was appended to the previous paragraph and changed to:

"As intelligent beings bound to live well in the flow of time, we ought to describe the world in ways that are most useful to intelligent beings bound to live well in the flow of time. We ought to take a boundless view of biological evolution."

Chapter 7, The Scope of Biological Evolution, last paragraph

Changed "very lucky" to "lucky" in the first sentence.

Changed "very lucky" to "extremely lucky" in the second sentence.

Chapter 8, Beautiful Reason, fourth paragraph, end

Added the footnote:

"[2] More accurately, these are *the rules of modern dialectics*. In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio following Tommaso Inghirami's program for the decoration for the study housing the library of Pope Julius II. Appendix B of the published version of this work will discuss how most modern art historians missed the forest for the trees."

Changes in Version 2012.09.14

Preface, last paragraph

"To decide well, we need not only to describe actual existence based on what we currently know, but also to describe the whole of potential existence based on all that we can ever know. We need not only bounded descriptions of existence to help us solve given problems, but also boundless descriptions of existence to help us find better problems to solve. The complex approach to deciding well put forth in this work provides us with not only bounded descriptions of existence to help us solve given problems, but also with coherent sets of boundless descriptions of existence to help us find better problems to solve. These coherent sets concern the world not as it currently is, but rather as it is in the process of becoming. They concern not the world as we find it, but rather the world as we may form it."

was inserted between the sixth and seventh paragraphs of the *Forward-Looking Science* subsection of the third chapter and changed to:

"To decide well, we need not only bounded descriptions of existence to help us solve given problems, but also boundless descriptions of existence to help us find better problems to solve. The complex approach to deciding well put forth in this work provides us with not only bounded descriptions of existence to help us solve given problems, but also with coherent sets of boundless descriptions of existence to help us find better problems to solve. These coherent sets concern the world not as it currently is, but rather as it is in the process of becoming. They concern not the world as we find it, but rather the world as we may form it."

Chapter 2, Chicago Screwdrivers, first paragraph, footnote

"[4] Communication across frames is only partial. The distinction between theories that describe the world as it is (positive theories) and theories that prescribe the world as it ought to be (normative theories) as described by Milton Friedman in his book *Essays in Positive Economics* (Chicago: University of Chicago Press, 1953) is not the same as the distinction between theories that describe the world as it is (temporal theories) and theories that describe the world as it is in the process of becoming (timeless theories). Hidden in theories that describe the world as it is in the process of becoming is a description of a prescriptive program, which is that living things are programmed to pursue the timeless end of living well. Biologists call this a teleonomic program."

was deleted. (This footnote largely duplicates the second footnote.)

Chapter 7, The Scope of Biological Evolution, second paragraph, fourth and fifth sentences

"Applying the tools of the true sciences to the public sciences ignores the two-way relation between the world and our beliefs about the world. Ignoring this two-way relation slows progress and worsens turbulence."

were deleted.

Chapter 7, The Scope of Biological Evolution, last paragraph

Changed "timeless" to "transcendental" in the last sentence.

Inserted the following sentence before the last sentence:

"We best do so by deciding well using the multiple-frame approach to deciding well."

Chapter 8, Beautiful Reason, fifth paragraph, end

Added the footnote:

"[3] Reason, so conceived, helps us find not only conflicts but also holes in our belief systems. Consider the completeness of W. V. O. Quine's holistic approach to believing well. Our concept of completeness concerns the supply side of the market for tools for helping us believe well. We find conflicts in our belief systems. *The philosophy of science is philosophy enough*. Now consider the completeness of the multiple-frame approach to believing well. Our concept of completeness concerns the supply and demand sides of the market for tools for helping us *decide* well. We find holes as well as conflicts in our belief systems, e.g., we see that Quine's philosophy is too narrow (Morton White's problem) and that it lacks a normative element (Jaegwon Kim's problem). *The science of science is philosophy enough if and only if science includes all of the interwoven pursuits of the boundless factors of deciding well*."

Chapter 8, Complete Reason, last paragraph, last sentence

"It helps us find not only conflicts but also holes in our belief systems.[4]"

"[4] Consider the completeness of W. V. O. Quine's holistic approach to believing well. Our concept of completeness concerns the supply side of the market for tools for helping us believe well. We find conflicts in our belief systems. *The philosophy of science is philosophy enough*. Now consider the completeness of the multiple-frame approach to believing well. Our concept of completeness concerns the supply and demand sides of the market for tools for helping us *decide* well. We find holes as well as conflicts in our belief systems, e.g., we see that Quine's philosophy is too narrow (Morton White's problem) and that it lacks a normative element (Jaegwon Kim's problem). *The science of science is philosophy enough if and only if science includes all of the interwoven pursuits of the boundless factors of deciding well.*"

was deleted.

Changes in Version 2012.09.15

Acknowledgments, fifth paragraph

Deleted "about learning in economics" from the sixth sentence.

Chapter 6, Experiencing Mystical Oneness, second paragraph

"Many dualistic religions claim that we need to experience mystical oneness during life in order to reach the ultimate end of Bliss, eternal mystical oneness with the infinite Being. From the multiple-frame view, the pursuits of these two ends both support each other and compete for scarce resources, especially for time."

was changed to:

"***Pursuing Eternal Oneness***
Many dualistic religions claim that we need to experience mystical oneness during life in order to reach the ultimate end of Bliss, eternal mystical oneness with the infinite Being. From a logical view, pursuing eternal mystical oneness conflicts with pursuing the timeless end of living well. From the multiple-frame view, these two pursuits both support each other and compete for scarce resources, especially for time."

Chapter 6, Experiencing Mystical Oneness, last paragraph

Changed "Bliss" to "eternal mystical oneness" in the fourth sentence.

Deleted the footnote:

"[9] From Maslow's view, healthy religions balance Dionysian and Apollonian means to religious experience. Maslow, Abraham H., *Religions, Values, and Peak Experiences* (New York: Viking, 1970), preface."

Chapter 7, OODA Loop Analysis, second paragraph, fourth and fifth sentences

"He concluded that F-86 pilots were able to overcome the E-M weaknesses of their airplanes by using tools that allowed them to decide faster than their opponents. These tools included bubble canopies, g-suits, and hydraulic controls."

were changed to:

"He concluded that F-86 pilots were able to overcome the E-M weaknesses of their airplanes by using knowledge that allowed them to decide faster than their opponents. This knowledge was in the form of such tools as bubble canopies, g-suits, hydraulic controls, and better tactical rules. It was also in the form of tacit (intuitive) knowledge, which Boyd described using the German term 'Fingerspitzengefühl' ("feeling in the fingertips")."

Chapter 8, Beautiful Reason, fourth paragraph, footnote, last sentence

"Appendix B of the published version of this work will discuss how most modern art historians missed the forest for the trees."

was changed to:

"Most modern art historians have missed the forest for the trees. They have missed the role that the unity of virtues plays in communicating holy wisdom, hence the role that octagons play in unifying this masterpiece."

Changes in Version 2012.09.18

Chapter 1, Values, fourth paragraph

Changed "reasonably believe" to "formally prove" in the last sentence.

Chapter 8, Beautiful Reason, fourth paragraph, footnote, last sentence

"They have missed the role that the unity of virtues plays in communicating holy wisdom, hence the role that octagons play in unifying this masterpiece."

was changed to:

"They have missed the role that the unity of virtues plays in discovering ever more complete forms of reason, hence the role that octagons play in unifying this masterpiece. From the multiple-frame view, squares represent geometrical, mathematical, and logical reasoning; circles represent complete reasoning (Holy Wisdom); and octagons represent the beautiful reasoning of pursing the boundless factors of deciding well. The most important octagon is the faux oculus at the center of the ceiling. Above this oculus, four putti hold up and another four

tether down a symbol of the natural mission of discovering ever more Holy Wisdom. The next most important octagons are those intermixed with squares in the coffered barrel ceiling toward which Plato points. Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand. As an afterthought, Raffaello added a brooding Heraclitus, who both leans against and writes on a block of marble that may be the first in an octagonal successor to Donato Bramante's planned basilica. For more about this, see Appendix B of the published version of this work."

Changes in Version 2012.09.22

Chapter 3, *Forward-Looking Science*, sixth paragraph, footnote

Changed "dialectics" to "modern dialectics" in the first sentence.

Chapter 8, Beautiful Reason, fourth paragraph

Changed "*the rules of dialectics*, after the dialectic" to "*the rules of modern dialectics*, after the modern interpretation of the" in the last sentence.

Chapter 8, Beautiful Reason, fourth paragraph, footnote, first four sentences

"More accurately, these are *the rules of modern dialectics*. In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio following Tommaso Inghirami's program for the decoration for the study housing the library of Pope Julius II. Most modern art historians have missed the forest for the trees. They have missed the role that the unity of virtues plays in discovering ever more complete forms of reason, hence the role that octagons play in unifying this masterpiece."

were changed to:

"Reason, so conceived, does not consider the unity of the virtues. In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio in the decoration for the study housing the library of Pope Julius II. Most modern art historians have missed the role that the unity of virtues plays in discovering ever more complete forms of reason, hence the role that octagons play in unifying this masterpiece."

Chapter 8, Beautiful Reason, fourth paragraph, footnote, second to last sentence

"As an afterthought, Raffaello added a brooding Heraclitus, who both leans against and writes on a block of marble that may be the first in an octagonal successor to Donato Bramante's planned basilica."

was deleted.

Chapter 8, Beautiful Reason, fourth paragraph, footnote

Changed "this" to "this architecture of knowledge" in the last sentence.

Changes in Version 2012.09.24

Chapter 3, *Forward-Looking Science*, fourth paragraph, last sentence

"Hence, we lose nothing in reducing the whole into parts and we do not have free will."

was changed to:

"Hence, we do not have free will. Further, we can reduce the whole into parts. Hence, the hidden variables that explain what we currently perceive as entanglement are local."

Changes in Version 2012.09.26

Chapter 3, *Public Entropy*, last paragraph

Changed "ever fewer" to "fewer" in the last sentence.

Chapter 6, *Worldly Benefits of Detachment*, second paragraph, last four sentences

"Imagine a medical doctor at an airliner crash site performing triage. In choosing to be at the crash site doing triage, she has embraced the world. To do her best at this terrible task, she must detach herself from her work and the results of her work. She must act as if she is in this world but not of it."

were changed to:

"Imagine being a medical doctor at an airliner crash site performing triage. In choosing to be at the crash site doing triage, we have embraced the world and life. To do our best at this terrible task, we must detach ourselves from our work and the results of our work. We must act as if we are in this world but not of it."

Chapter 6, A Common Timeless End, second paragraph, second and third sentences

"As a practical matter, we only need to choose between these two when we lack the resources to pursue both living well and linking well. Pursuing the timeless end of deciding well provides us with the resources to pursue both living well and linking well."

were changed to:

"As a practical matter, we only need to choose between living well and linking well when we lack the resources to pursue both. Pursuing the timeless end of deciding well provides us with the resources to pursue both."

Chapter 7, The Scope of Game Theory, first paragraph, footnote, end

Added the sentence:

"This book is a collection of essays from Hofstadter's "Metamagical Themas" column in *Scientific American* magazine, which succeeded Martin Gardner's long-running "Mathematical Games" column. 'Metamagical themas' is an anagram of 'mathematical games.'"

Chapter 7, *A Normal Anomaly*, first paragraph, footnote, last two sentences

"Martin Gardner was author of the *Scientific American* Mathematical Games column, which preceded Hofstadter's Metamagical Themas column. 'Metamagical themas' is an anagram of 'mathematical games.'"

were deleted.

Chapter 7, *OODA Loop Analysis*, second paragraph

Changed "tacit (intuitive)" to "tacit" in the sixth sentence.

Chapter 7, The Scope of Biological Evolution, second paragraph, third sentence

Added the sentences:

"Further, recent discoveries show us that what happens to us may change not only how our genes work, but also how our descendants' genes work. The line between genetic and cultural evolution is not distinct as most modern evolutionary biologists would have us believe."

Changes in Version 2012.09.29

Chapter 1, Choosing Frames Well, first paragraph, third sentence

"Over time, we reduce ambiguity within these structures."

was changed to:

"Over time, we refine these structures by removing ambiguity from them."

Chapter 1, *The EOQ/RTS Example*, sixth paragraph

Changed "smoothly" to "efficiently" in the fifth sentence.

Chapter 7, The Scope of Biological Evolution, third paragraph

Changed "seek to order their (internal and external) environment" to "naturally seek to order their bodies and environments" in the fifth sentence.

Chapter 8, Beautiful Reason, fourth paragraph, footnote, last four sentences

"The most important octagon is the faux oculus at the center of the ceiling. Above this oculus, four putti hold up and another four tether down a symbol of the natural mission of discovering ever more Holy Wisdom. The next most important octagons are those intermixed with squares in the coffered barrel ceiling toward which Plato points. Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand. For more about this architecture of knowledge, see Appendix B of the published version of this work."

were changed to:

"The most important octagon is the faux oculus at the center of the ceiling, which is formed by the composite of two Platonic theses, the timeless unity of virtues (circular scenes framed by grotesque borders linked by floral roundels) and the temporal elements (twin "hourglass" scenes from Greek myth and Roman history that represent earth, water, air and fire, which, together with the central octagon, form a Greek cross). Above this oculus, four putti hold up and another four tether down a circle containing a symbol of the papacy, a scene that represents the natural mission of discovering ever more about both Holy Wisdom (the timeless unity of the virtues) and the animating force of the world (the quintessential element). The next most important octagons are those intermixed with squares in the coffered barrel ceiling toward which Plato points. Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand. For more about this renaissance architecture of knowledge, see Appendix B of the published version of this work."

Changes in Version 2012.10.10

Chapter 2, Invariant Tools for Living Well, last paragraph, footnote

"[3] Earlier versions of this work used the term 'multiplex view,' which came from biologist Jack Cohen and mathematician Ian Stewart's book *Figments of Reality: The Evolution of the Curious Mind* (Cambridge, England: Cambridge University Press, 1997), in which they

describe the evolution of intelligence as a recursive process. Regrettably, they missed the symmetry of deciding well."

was changed to:

"[3] Earlier versions of this work used the term 'multiplex view,' which came from biologist Jack Cohen and mathematician Ian Stewart's book about the co-evolution of minds and environments, *Figments of Reality: The Evolution of the Curious Mind* (Cambridge, England: Cambridge University Press, 1997). Regrettably, the authors overlooked the way that the inexhaustibility of knowledge useful in living well creates symmetry in deciding well."

Chapter 3, Pursuing the Ring of Truth, fourth paragraph

Changed "a coherent whole" to "an ever more coherent whole" in the second sentence.

Chapter 3, Contemplating the Way Forward, last two paragraphs

"Complete knowledge of some recursive objects will always transcend our knowledge of them. The mathematical constant π, which is the ratio of the circumference to the diameter of a Euclidean circle, is one such object. Many recursive processes will yield ever better approximations of π. We can use what we believe is the best of these processes to create a recursive program for producing ever better approximations of π. We may call the ever better approximates of π the *timeless end* of this program. The form of this end is a number. We may also call complete knowledge of π the *transcendental end* of this program. The form of this end is also a number.

"Wisdom, which is the knowledge that allows a being to decide perfectly, is another transcendental recursive object. Many recursive processes will yield ever better approximations of Wisdom. We can use what we believe is the best of these processes to create a recursive program for producing ever better approximations of Wisdom. We may call the ever better approximates of Wisdom the timeless end of this program. The form of this end is a set of partial descriptions of the world. These descriptions ought to be as simple as possible, but not simpler; and the set of descriptions ought to be as small as possible, but not smaller.[2] We may also call complete knowledge of Wisdom the transcendental end of this program. The form of this end is the most useful form for a perfectly wise being in deciding well."

"[2] The inspiration for this belief about the need for economy in deciding well was Albert Einstein's theory of knowledge: "Physical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world. In our endeavor to understand reality we are somewhat like a man trying to understand the mechanism of a closed watch. He sees the face and the moving hands, even hears its ticking, but he has no way of opening the case. If he is ingenious he may form some picture of a mechanism which could be responsible for all the things he observes, but he may never be quite sure his picture is the only one which could explain his observations. He will never be able to compare his picture with the real mechanism and he cannot even imagine the possibility or the meaning of

such a comparison. But he certainly believes that, as his knowledge increases, his picture of reality will become simpler and simpler and will explain a wider and wider range of his sensuous impressions. He may also believe in the existence of the ideal limit of knowledge and that it is approached by the human mind. He may call this ideal limit the objective truth" (Einstein, Albert, *The Evolution of Physics: From Early Concepts to Relativity and Quanta*, New York: Simon and Schuster, 2008, p. 31)."

were changed to:

"Complete knowledge of some recursive objects will always transcend our knowledge of them. The mathematical constant π, which is the ratio of the circumference to the diameter of a Euclidean circle, is one such object. Many recursive processes will yield ever better approximations of π. We can use what we believe is the best of these processes to create a recursive program for producing ever better approximations of π. We may call the ever better approximates of π the *timeless end* of this program and complete knowledge of π the *transcendental end* of this program.

"Wisdom, which is the knowledge that allows a being to decide perfectly, is another transcendental recursive object. Many recursive processes will yield ever better approximations of Wisdom. We can use what we believe is the best of these processes to create a recursive program for producing ever better approximations of Wisdom. We may call the ever better approximates of Wisdom the timeless end of this program and complete knowledge of Wisdom the transcendental end of this program."

Chapter 3, *Overcoming Constraints in Deciding Well*, first paragraph

"The process of computing the value of π as mathematicians define this process differs from the process of deciding well in a profound way. The process of refining the process of computing the value of π is not part of the process of computing the value of π. In contrast, the process refining the process of deciding well is part of the process of deciding well. Nevertheless, we can draw some conclusions about overcoming constraints in deciding well from the much simpler case of overcoming constraints in computing the value of π."

was changed to:

"The process of computing the value of π as mathematicians define this process differs profoundly from the process of pursuing Wisdom.[2] Nevertheless, we can draw some conclusions about overcoming constraints in pursuing Wisdom from the much simpler case of overcoming constraints in computing the value of π as mathematicians define this process."

Chapter 3, *Overcoming Constraints in Deciding Well*, last paragraph, end

Added the footnote:

"[2] We can never solve the problem of computing the value of π. In the words of Dwight Eisenhower, "If a problem cannot be solved, enlarge it." We can enlarge the problem of

computing the value of π by including the problem of choosing the best means of computing the value of π. In short, we change the problem from computing π to computing π *well*. From a modern view, this change takes us from the realm of mathematics to some higher, more arcane realm, e.g., metamathematics. From the multiple-frame view, it takes us from the realm of mathematics to the realm of science. We best address the problem of computing π (well) by pursuing the timeless end of deciding well. Following this line of thinking, there is little difference between computing the value of π and pursuing Wisdom. The timeless end of computing π (well) is a complex structure of knowledge rather than a simple number. Further, refining the process of computing the value of π (well) is part of the process of computing the value of π (well).”

Chapter 3, *Public Entropy*, first paragraph, footnote, last six sentences

“Note that public entropy concerns not only physical but also mental order. Deciding well is not only a matter of doing the right things, but also of doing them efficiently. Lowering the informational entropy of the sets of mental models that we use to do the right things is one way of increasing efficiency. Another is ensuring that we have only the knowledge each of us needs to decide well within our individual circumstances. In a world of ever-changing circumstances, each of us needs to know how to adapt well to ever-changing circumstances. Each of us needs to know the invariant strategy for deciding well.”

were deleted.

Chapter 3, *Public Entropy*, last paragraph

“We can use the concept of public entropy to help us find problems to solve. As we saw in the EOQ/RTS example, the concepts that we use to frame our problems tend to blind us to finding better problems to solve in pursuing timeless ends. We can overcome this blindness by removing ever more non-knowledge resources from the process of pursuing our chosen timeless end. Removing these resources creates problems. Solving these problems creates knowledge of how to pursue this end using fewer non-knowledge resources.[5]”

“[5] In keeping with the self-referential theme of this work, we can use Ohno’s strategy for learning how to build vehicles ever more wisely as a metaphor for the invariant strategy for learning how to decide ever more wisely. Removing ambiguity from ambiguous links between beliefs is like removing work-in-process inventory from elastic links between production processes. At the limit of the former, ambiguous links become logical. At the limit of the latter, elastic links become rigid. The most obvious way to remove ambiguity from this metaphor is to use the concept of entropy to reduce these two strategies to a common form.”

was changed to:

“Public entropy concerns not only the waste we use in acting, but also the waste we use in deciding how to act. In what we currently call the sciences, we ought to choose concepts that help us build clear and concise models of the world we sense. In Einstein’s words:

"Physical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world. In our endeavor to understand reality we are somewhat like a man trying to understand the mechanism of a closed watch. He sees the face and the moving hands, even hears its ticking, but he has no way of opening the case. If he is ingenious he may form some picture of a mechanism which could be responsible for all the things he observes, but he may never be quite sure his picture is the only one which could explain his observations. He will never be able to compare his picture with the real mechanism and he cannot even imagine the possibility or the meaning of such a comparison. But he certainly believes that, as his knowledge increases, his picture of reality will become simpler and simpler and will explain a wider and wider range of his sensuous impressions. He may also believe in the existence of the ideal limit of knowledge and that it is approached by the human mind. He may call this ideal limit the objective truth."[5]

"Extending this prescription to the whole of science, we ought to want a set of partial descriptions of the world, each member of which contains instructions for how we ought to use it. These descriptions and instructions ought to be as simple as possible, but not simpler; and the set of these descriptions and instructions ought to be as small as possible, but not smaller.

"In considering waste in managing the knowledge we use to decide how to act, we must consider waste not only in storing and transmitting information, but also in communicating and using it. In general, we do not communicate well. We do not tell all we need to tell to help others decide well. In turn, we do not hear all that we need to hear from others to decide well. Without adequate instructions about how to use partial descriptions of the world well, we tend to confuse these descriptions with reality. Too many of us think of atoms as little solar systems, of gravity as a centripetal force, and of wealth as consumer goods and the resources to produce consumer goods.

"We can use the concept of public entropy to help us see science not only as a source of partial descriptions of the world, but also as a means of linking these partial descriptions into an ever more coherent whole that we can use to find ever better problems to solve.[6] We can begin by using this concept to relate the current basis of modern science, quantum mechanics, to deciding well."

"[5] Einstein, Albert, *The Evolution of Physics: From Early Concepts to Relativity and Quanta* (New York: Simon and Schuster, 2008), p. 31."

"[6] Removing ambiguity from ambiguous links between beliefs in belief systems is like removing work-in-process inventory from elastic links between production processes in the Toyota production system. At the limit of the former, ambiguous links become logical. At the limit of the latter, elastic links become rigid. In both cases, we remove waste from the process of deciding well."

Chapter 3, *Forward-Looking Science*, first paragraph, first sentence

"We can also use the concept of public entropy to relate the current basis of modern science, quantum mechanics, to deciding well."

was deleted.

Chapter 3, *Forward-Looking Science*, third paragraph

Changed "Hence" to "Following this line of thinking" in the last sentence.

Chapter 3, *Forward-Looking Science*, fourth paragraph

"A defining feature of the hidden variables class is the belief that we will eventually be able to describe the behavior of these objects with certainty. Hence, we do not have free will. Further, we can reduce the whole into parts. Hence, the hidden variables that explain what we currently perceive as entanglement are local."

was changed to:

"A defining feature of the hidden variables class is the belief that we will eventually be able to describe the behavior of these objects with certainty, which implies that the hidden variables that explain what we currently perceive as entanglement are local. Following this line of thinking, we do not have free will."

Chapter 3, *Forward-Looking Science*, fifth paragraph

Changed "Hence" to "Following this line of thinking" in the last sentence.

Chapter 3, *Forward-Looking Science*, sixth paragraph, footnote

"[7] As we shall also see, current reason is either too limiting (logic) or simple (modern dialectics) to help us think clearly about ideal paths forward, hence about the source of power-law distributions in the public sciences, especially those related to turbulence/catastrophes."

was deleted.

Chapter 3, *Forward-Looking Science*, second to last paragraph

Changed "world" to "world, which includes our current uncertainty about the world" in the last sentence.

Chapter 3, *Forward-Looking Science*, last paragraph

"The reasoning underlying this approach to pursuing the Truth concerns not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who

discovered the primer for the alien plans explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing Beauty."

was moved behind the fifth paragraph of the Beautiful Reason section of the last chapter and changed to:

"The rules of Reason concern not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into a coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer needed to understand the alien message explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing Beauty."

Chapter 4, *Academic Fields*, first paragraph

Changed "eighties" to "1980s" in the third sentence.

Chapter 5, *The Explicit Experiment*, second last paragraph, last footnote

Changed "on this" to "about this group" in the last sentence.

Chapter 8, Beautiful Reason, fourth paragraph, footnote

Changed "masterpiece" to "High Renaissance masterpiece" in the last sentence.

Changed "Plato points" to "Plato points in the fresco now known as *The School of Athens*" in the third to last sentence.

Changed "architecture" to "structure" in the last sentence.

Chapter 8, Beautiful Reason, new sixth paragraph

Changed "timeless end of believing well (the Truth)" to "Truth" and "a coherent whole" to "an ever more coherent whole" in the first sentence.

Chapter 8, Complete Reason, both paragraphs

"We may call a set of rules for pursuing the Truth that contains all of the rules we need for pursuing the Truth *complete*. We can never prove a set of rules for pursuing the Truth to be both logically consistent and complete. Consider the following claims. First, for any set of rules for pursuing the Truth, we will either discover or never discover the Truth. Second, if we discover the Truth, we prove that the set of rules for pursuing the Truth is complete. Third, if we never discover the Truth, we never prove that the set of rules for pursuing the Truth is complete. Fourth, pursuing the Truth is an endless process. From these four claims, it follows

that we can never prove a set of rules for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the claim that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of rules is complete.

"The fact that we can never prove a set of rules for pursuing the Truth to be both logically consistent and complete does not mean that we ought not to pursue the Truth. In theory, we collectively ought to pursue the Truth using the set of all possible rules for pursuing the Truth, which includes all possible rules for refining the set of all possible rules for pursuing the Truth. We may call such a set of rules *reasonably complete*. So conceived, the reason of the multiple-frame approach to deciding well appears to be reasonably complete."

were changed to:

"We may call a set of rules for pursuing the Truth that contains all of the rules we need for pursuing the Truth *complete*. We can never prove a set of rules for pursuing the Truth to be both logically consistent and complete.[5] This does not mean that we ought not to pursue the Truth. In theory, we collectively ought to pursue the Truth using the set of all possible rules for pursuing the Truth, which includes all possible rules for refining the set of all possible rules for pursuing the Truth. We may call such a set of rules *reasonably complete*. So conceived, the rules of Reason appear to be reasonably complete."

"[5] Consider the following claims. First, for any set of rules for pursuing the Truth, we will either discover or never discover the Truth. Second, if we discover the Truth, we prove that the set of rules is complete. Third, if we never discover the Truth, we never prove that the set of rules is complete. Fourth, pursuing the Truth is an endless process. From these four claims, it follows that we can never prove a set of rules for pursuing the Truth to be both logically consistent and complete. If we discover the Truth, we prove false the claim that pursuing the Truth is an endless process. If we never discover the Truth, we never prove the set of rules is complete."

Changes in Version 2012.10.20

Chapter 3, *Public Entropy*, second to last paragraph

"In considering waste in managing the knowledge we use to decide how to act, we must consider waste not only in storing and transmitting information, but also in communicating and using it. In general, we do not communicate well. We do not tell all we need to tell to help others decide well. In turn, we do not hear all that we need to hear from others to decide well. Without adequate instructions about how to use partial descriptions of the world well, we tend to confuse these descriptions with reality. Too many of us think of atoms as little solar systems, of gravity as a centripetal force, and of wealth as consumer goods and the resources to produce consumer goods."

was reduced to a footnote and changed to:

"[6] In considering waste in managing the knowledge we use to decide how to act, we must consider waste not only in storing and transmitting information, but also in communicating and using it. In general, we do not communicate well. We do not tell all we need to tell to help others decide well. In turn, we do not hear all that we need to hear from others to decide well. Without adequate instructions about how to use partial descriptions of the world well, we tend to confuse these descriptions with reality. Too many of us think of atoms as little solar systems, of gravity as a centripetal force, and of wealth as consumer goods and the resources to produce consumer goods. For more about this, see Appendix B."

Chapter 3, *Public Entropy*, last paragraph

Changed "the current basis of modern science, quantum mechanics," to "quantum mechanics" in the last sentence.

Added the following sentence to the end of the footnote: "For more about inducing the creation of useful knowledge, see Appendix A."

Chapter 3, *Forward-Looking Science*, last paragraph

Changed "we know about the world, which includes our current uncertainty about the world" to "we know *and do not yet know* about the world" in the last sentence.

Chapter 4, *Recursivity*, last paragraph

Changed "*In addressing*" to "*When we address*" in the last sentence.

Chapter 5, *The Explicit Experiment*, last paragraph

Changed "non-theistic" to "non-religious (temporal)" in the second sentence.

Chapter 5, Good Policies, first paragraph

"From the multiple-frame view, governing ourselves well is a matter of deciding well. We are not able to express much useful knowledge. Only people closest to problems can use the knowledge that they are not able to express. To use this knowledge, people closest to problems need to be free to decide what to do.[11] The following aphoristic actions help policymakers govern free people well."

"[11] Hayek, Friedrich A., "The Use of Knowledge in Society," *American Economic Review*, Vol. 35, No. 4, Sept 1945, pp. 519–30, reprinted in *The Essence of Hayek* (Stanford: Hoover Institution Press, 1984), p. 211. For a deeper understanding of this issue, read the works of Michael Polanyi starting with *The Tacit Dimension* (Chicago: University of Chicago Press, 2009)."

was changed to:

"From the multiple-frame view, governing ourselves well calls for deciding well, which in turn calls for sharing knowledge well. For a given stock of knowledge about how to share knowledge well, only people who have the useful knowledge that they cannot share can use this knowledge. To use such "tacit" knowledge well, people closest to problems need to be free to decide what to do.[11] The following aphoristic actions help policymakers govern free people well."

"[11] Modern economists and philosophers of science will recognize this as the tacit knowledge problem first described by Michael Polyani. Advances in our tools for telling well (e.g., expert systems, fractal geometry, and inexpensive information processing) have made much formerly untellable knowledge tellable. The question is increasingly not whether we can make currently untellable knowledge tellable, but whether it is currently wise to do so. For more about this, see Appendix B."

Chapter 7, *OODA Loop Analysis*, second paragraph

Changed "tacit knowledge" to "experience" in the sixth sentence.

Chapter 7, The Scope of Biological Evolution, third paragraph, footnote

Changed "to the Newton Institute at Oxford University" to "at Oxford University's Newton Institute" in the last sentence.

Chapter 7, The Scope of Biological Evolution, last paragraph, last two sentences

"We best do so by deciding well using the multiple-frame approach to deciding well. We best do so by pursuing the transcendental end of zero public entropy."

were changed to:

"We best do so by pursuing the transcendental end of zero public entropy, which calls for us to pursue the boundless factors of deciding well."

Chapter 8, Beautiful Reason, fourth paragraph, footnote

"[2] Reason, so conceived, does not consider the unity of the virtues. In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio in the decoration for the study housing the library of Pope Julius II. Most modern art historians have missed the role that the unity of virtues plays in discovering ever more complete forms of reason, hence the role that octagons play in unifying this High Renaissance masterpiece. From the multiple-frame view, squares represent geometrical, mathematical, and logical reasoning; circles represent complete reasoning (Holy Wisdom); and octagons represent the beautiful reasoning of pursing the boundless factors of deciding well. The most important octagon is the faux oculus at the center of the ceiling, which is formed by the composite of two Platonic theses, the timeless unity of virtues (circular scenes framed by grotesque borders linked by floral roundels) and the temporal

elements (twin "hourglass" scenes from Greek myth and Roman history that represent earth, water, air and fire, which, together with the central octagon, form a Greek cross). Above this oculus, four putti hold up and another four tether down a circle containing a symbol of the papacy, a scene that represents the natural mission of discovering ever more about both Holy Wisdom (the timeless unity of the virtues) and the animating force of the world (the quintessential element). The next most important octagons are those intermixed with squares in the coffered barrel ceiling toward which Plato points in the fresco now known as *The School of Athens*. Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand. For more about this renaissance structure of knowledge, see Appendix B of the published version of this work."

was changed to:

"[2] Reason, so conceived, does not consider the unity of the virtues. In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio in the decoration for the study housing the library of Pope Julius II. For more about this, see Appendix B."

Appendix B

Added the online stub for Appendix B and associated links to it:

Telling Well

"Patterns change faster than thought."

The published version of this work will include a three-part appendix that addresses the role of art in pursuing Wisdom. The first part defines this role. The second addresses the art of the *Stanza della Segnatura*. The last addresses the art of this work. What follows is a sample that concerns the long history of beautiful reasoning in Western thought.

Most modern art historians recognize the role of squares and circles in unifying the decoration of the *Stanza della Segnatura*. Few, if any, recognize the role of octagons. From the multiple-frame view, squares represent modern reason (geometry, mathematics, and logic); circles Wisdom; and octagons the reasoning of pursing the boundless factors of deciding well.

The most important octagon is the faux oculus at the center of the ceiling, which is the result of combining the timeless pursuit of the unity of virtues (Holy Wisdom) and the four temporal elements.="pragmatism_appendix_b_footnote_1.html">[1] Above this oculus, four putti hold up and another four putti tether down a circle containing a symbol of the papacy. This Tantalean

image represents discovering ever more about not only Holy Wisdom, but also the timeless fifth element.

The next most important octagons are those intermixed with squares in the coffered barrel vault toward which Plato points in the fresco now known as *The School of Athens*.[2] Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand.

[1] An image of the *Stanza della Segnatura* ceiling is available online at <http://en.wikipedia.org/wiki/File:Raphael_-_Ceiling_of_the_Selling_Room.jpg> (15 October 2012). To download this image, click anywhere on it. To enlarge the downloaded image, click anywhere on it. Use the scroll bars to navigate around the enlarged image. Click it again to return to the original downloaded image. The four circles containing women represent poetry, philosophy, justice, and theology. The four hourglass composites of scenes from Greek myth and Roman history represent earth, water, air and fire. Together with the central oculus, these four composites form a Greek cross.

[2] An image of the *The School of Athens* is available online at <http://en.wikipedia.org/wiki/File:Sanzio_01.jpg> (15 October 2012). To download this image, click anywhere on it. To enlarge the downloaded image, click anywhere on it. Use the scroll bars to navigate around the enlarged image. Click it again to return to the original downloaded image.

Changes in Version 2012.10.23

Appendix B, heading quote

""Patterns change faster than thought.""

was changed to:

""If you want to find out anything from the theoretical physicists about the methods they use, I advise you to stick closely to one principle: don't listen to their words, fix your attention on their deeds. To him who is a discoverer in this field, the products of his imagination appear so necessary and natural that he regards them, and would like to have them regarded by others, not as creations of thought but as given realities." — *Albert Einstein*[1]"

"[1] Introductory remarks of a lecture titled "On the Methods of Theoretical Physics" given at Oxford University on June 10, 1933. Published in *Mein Weltbild* (Amsterdam: Querido Verlag, 1934)."

Changes in Version 2012.10.25

Chapter 8, Beautiful Reason, fifth paragraph, footnote

"[3] Reason, so conceived, helps us find not only conflicts but also holes in our belief systems. Consider the completeness of W. V. O. Quine's holistic approach to believing well. Our concept of completeness concerns the supply side of the market for tools for helping us believe well. We find conflicts in our belief systems. *The philosophy of science is philosophy enough*. Now consider the completeness of the multiple-frame approach to believing well. Our concept of completeness concerns the supply and demand sides of the market for tools for helping us *decide* well. We find holes as well as conflicts in our belief systems, e.g., we see that Quine's philosophy is too narrow (Morton White's problem) and that it lacks a normative element (Jaegwon Kim's problem). *The science of science is philosophy enough if and only if science includes all of the interwoven pursuits of the boundless factors of deciding well.*"

was moved back to the end of the first paragraph of the Compete Reason section and changed to:

"[5] Consider the completeness of W. V. O. Quine's holistic approach to believing well. Our concept of completeness concerns the supply side of the market for tools for helping us believe well. We find conflicts in our belief systems. *The philosophy of science is philosophy enough*. Now consider the completeness of the multiple-frame approach to believing well. Our concept of completeness concerns the supply and demand sides of the market for tools for helping us *decide* well. We find holes as well as conflicts in our belief systems, e.g., we see that Quine's philosophy is too narrow (Morton White's problem) and that it lacks a normative element (Jaegwon Kim's problem). *The science of science is philosophy enough if and only if science includes all of the interwoven pursuits of the boundless factors of deciding well.*"

This restores change made in 2012.09.14.

Changes in Version 2012.10.27

Acknowledgments, third paragraph

Changed "decision-making" to "making decisions" in the last sentence.

Chapter 1, Choosing Frames Well, third paragraph

Changed "but" to "and" in the fifth sentence.

Chapter 3, *Overcoming Constraints in Deciding Well*, last paragraph, footnote

Changed "change" to "can change" in the third sentence.

Chapter 3, *Forward-Looking Science*, third paragraph

Changed "these" to "individual quantum-level" in the last sentence.

Chapter 3, *Forward-Looking Science*, first paragraph

Changed "common-sense" to "commonsense" in the fourth sentence.

Chapter 3, *Forward-Looking Science*, fourth paragraph

Changed "these" to "individual quantum-level" in the first sentence.

Chapter 3, *Forward-Looking Science*, sixth paragraph

Changed "quantum-level" to "quantum level" in the third sentence.

Chapter 5, *The Explicit Experiment*, last paragraph

Changed "and non-religious (temporal) through long" to "rather than religious through" in the second sentence.

Chapter 8, Beautiful Reason, fifth paragraph

"The rules of Reason concern not only the rules we use to bind beliefs together into coherent models of the world, but also the rules we use to bind these models together into an ever more coherent whole. Such reasoning is alien to modern science, but not to modern art. In the movie based on Carl Sagan's novel *Contact*, the person who discovered the primer needed to understand the alien message explained the key insight that led to this discovery: "An alien intelligence is going to be more advanced and that means efficiency functioning on multiple levels and in multiple dimensions." Such is the efficiency of pursuing Beauty."

was deleted.

Chapter 8, Beautiful Reason, new sixth paragraph, footnote

Changed "dialectical" to "modern dialectical" in the third sentence.

Changes in Version 2012.10.31

Appendix B, heading quote

""If you want to find out anything from the theoretical physicists about the methods they use, I advise you to stick closely to one principle: don't listen to their words, fix your attention on their deeds. To him who is a discoverer in this field, the products of his imagination appear so

necessary and natural that he regards them, and would like to have them regarded by others, not as creations of thought but as given realities." — *Albert Einstein*[1]"

"[1] Introductory remarks of a lecture titled "On the Methods of Theoretical Physics" given at Oxford University on June 10, 1933. Published in *Mein Weltbild* (Amsterdam: Querido Verlag, 1934)."

was changed back to:

""Patterns change faster than thought.""

Changes in Version 2012.11.06

Chapter 1, Useful Frames, first paragraph

Changed "need frames" to "benefit from frames" in all (2 occurrences).

Chapter 4, *Modern Policy Mistakes*, fourth paragraph, last footnote

Deleted "and releases of stress from them follow a power law" from the first sentence.

Chapter 6, A Common Timeless End, first paragraph

Changed "living well" to "living well in terms of one another" in the first sentence.

Appendix B, second paragraph, last sentence

"Few, if any, recognize the role of octagons. From the multiple-frame view, squares represent modern reason (geometry, mathematics, and logic); circles Wisdom; and octagons the reasoning of pursing the boundless factors of deciding well."

was deleted.

Appendix B, last paragraph

Changed "squares" to "squares, which represent geometry, mathematics, and logic" in the second sentence.

Changes in Version 2012.11.12

Chapter 1, last subsection

"***Invariant Values***
An obvious benefit of this multiple-frame approach to deciding well, hereafter referred to simply as *the multiple-frame approach*, is that it allows us to use more of what we currently know about the world than any single-frame approach does.[15] A less obvious benefit is that it extends the invariance of pursuing the timeless end of living well to pursuing all boundless factors of deciding well. Regardless of our current beliefs and circumstances, living well calls for deciding well, hence for pursuing all boundless factors of deciding well. To pursue other than these values is to blind ourselves to the full range of opportunities for learning to live ever more wisely."

was changed to:

"**Beautiful Reason and Reasonable Beauty**
From the view of this multiple-frame approach to deciding well, hereafter referred to simply as *the multiple-frame approach*, expanding the scope of the problems we face helps us find better problems to solve. When we expand the scope of these problems to the limits of imagination, a structure of values independent of beliefs and circumstances emerges. Understanding the process by which we best progress toward these invariant ends can help us progress ever more readily.[15]

"The process by which we best progress towards these invariant ends involves distinguishing between the models we use to help us solve given problems, the best of which are those of modern science, and those we use to help us find problems to solve, the best of which concern pursuing the boundless factors of deciding well.

"In using the first type of model, we choose to ignore what we do not know about how what happens outside model domains affect what happens inside model domains. We can see this most clearly in the *ceteris paribus* assumption in marginalist economic models. In effect, we pretend to know more than we can ever possibly know in order to build logically consistent models that predict well within a given domain. If we are intellectually honest, we admit that these models can never be complete. There can never be a theory of everything. There can only be strategies for learning everything, which includes learning ever more about strategies for learning everything.

"In using the second type of model, we explicitly include what we do not currently know into our models of the world. In effect, we choose to address the problem that contains all other problems in pursuing the timeless end of deciding well. We divide this universal problem into infinitely large parts, each of which concerns how best to pursue a boundless factor of deciding well. We then use these infinitely large, partial models of the universal problem to help us find and judge problems to solve. If a problem rings true with all of these parts, we have found a beautiful problem to solve, a problem that is consistent with all that we currently know about pursuing the timeless end of deciding well.

"In choosing to use the second type of model, we choose to use our brains logically to address a problem that is too complex to address using logic alone. We may call this way of thinking about problems too complex to address using logic alone *beautiful reason*. Underlying

beautiful reason is a concept of beauty based on the logical relations between the pursuits of boundless factors of deciding well. We may call this concept *reasonable beauty*. Such beauty is alien to modern science, but not to modern art. In the movie based on astronomer Carl Sagan's book, *Contact*, billionaire industrialist S. R. Hadden said that the key to translating the alien message was realizing that our current way of reasoning is not the best: "An alien intelligence is going to be more advanced and that means efficiencies functioning on multiple dimensions and in multiple dimensions." Such are the efficiencies of pursuing Beauty."

Appendix A, *Inducing the Creation of Knowledge*, end

Added the following subsection:

"***Looking Forward***
The Toyota strategy for learning how to produce ever more leanly does not depend on any particular machine tool technology. When Ohno envisioned his means of producing ever more leanly, there were no automated milling machines or robots. Today, these tools fit so neatly into the Toyota system that they might have emerged from it. In the near future, additive manufacturing tools (3D printers) will begin to replace traditional tools. As they do, Toyota factories will become ever leaner."

Appendix A, Less is More, end

Added the following paragraph:

"From a modern view of producing well, the ideal end of producing well is a single machine that can produce *efficiently* any material good. From the multiple-frame view, the ideal end of producing well is a process for producing *(ever more) wisely* what we need to live well. The economics of producing well concerns not only of how we make pins (Smith) and who truly owns the pins we make (Marx and the marginalist revolutionaries), but also why we make pins. Producing well calls for us to decide well, which in turn calls for us to produce well. *The timeless end of producing well is a boundless factor of deciding well*."

Changes in Version 2012.12.07

Preface, fourth paragraph

Changed "these constraints" to "them" in the last sentence.

Chapter 1, Beautiful Reason and Reasonable Beauty, title

Changed title to "**Timeless Reason**."

Chapter 1, Timeless Reason, fourth paragraph

Changed "parts" to "partial models" in the last sentence.

Chapter 1, Beautiful Reason, last paragraph

"In choosing to use the second type of model, we choose to use our brains logically to address a problem that is too complex to address using logic alone. We may call this way of thinking about problems too complex to address using logic alone *beautiful reason*. Underlying beautiful reason is a concept of beauty based on the logical relations between the pursuits of boundless factors of deciding well. We may call this concept *reasonable beauty*. Such beauty is alien to modern science, but not to modern art. In the movie based on astronomer Carl Sagan's book, *Contact*, billionaire industrialist S. R. Hadden said that the key to translating the alien message was realizing that our current way of reasoning is not the best: "An alien intelligence is going to be more advanced and that means efficiencies functioning on multiple dimensions and in multiple dimensions." Such are the efficiencies of pursuing Beauty."

was changed to:

"In choosing to use the second type of model, we choose to address problems that are too complex to address using temporal (rational/modern) reason alone. We may call this way of thinking about problems too complex to address using temporal reason alone *timeless reason*.

"Timeless reason concerns the strategy we use to address problems too complex to address using temporal reason alone. In building models of the world, we face problems. The most basic of these problems is the problem of whether the problem we believe is best is indeed best. Dwight Eisenhower provided us with a solution to this problem: "If a problem cannot be solved, enlarge it." If we follow this simple maxim to its logical conclusion, we end with the problem that contains all other problems in deciding well. Our problem then becomes one of how best to address this universal problem.

"We do not have the knowledge we need to build a formal model of this universal problem. The best we can do is to build a model that provides us with a strategy for addressing it. As we shall see, such a grand strategy ought to provide us with the ability to peer into and discern the inner nature of things, the internal drive to think and take action without being urged, the power to adjust or change in order to cope with new or unforeseen circumstances, and the power to perceive or create interaction of apparently disconnected events or entities in a connected way.[16] The strategy for learning put forth in this work provides us with ever more of this knowledge.

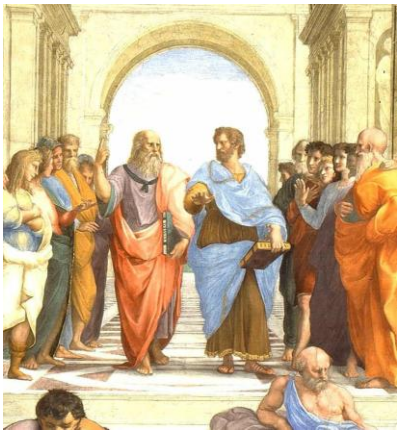
"**Timeless Beauty**
Underlying this multiple-frame concept of reason is a concept of beauty based on the logical relations between the pursuits of boundless factors of deciding well. Such beauty is alien to modern science, but not to modern art. In the movie based on astronomer Carl Sagan's book, *Contact*, billionaire industrialist S. R. Hadden said that the key to translating the alien message was realizing that our modern way of reasoning is not the best: "An alien intelligence is going to be more advanced and that means efficiencies functioning on multiple dimensions and in multiple dimensions." Such are the efficiencies of pursuing Beauty.

"We can also find this timeless concept of beauty in pre-modern art. Perhaps the most striking example comes from the decoration of the *Stanza della Segnatura*, a room originally intended to serve as the private library of Pope Julius II, the Renaissance warrior who aspired to create a Christian empire based on what he and his advisors believed were the timeless values of classical Greece and Rome.

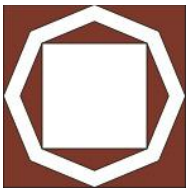
"Most modern art historians recognize the role of squares and circles in unifying the decoration of the *Stanza della Segnatura*. Few, if any, recognize the equally important role of octagons. The most important octagon is the faux oculus at the center of the ceiling, which is the result of combining two Platonic ideas, the unity of virtue and the four elements:[17]

Above this oculus, four putti hold up and another four putti tether down a circle that contains a symbol of the papacy. This Tantalean image represents discovering ever more about both Wisdom and the world.

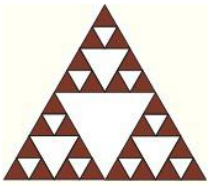
"The next most important octagon is that on which Plato and Aristotle stand in the fresco now known as *The School of Athens*:[18]



In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand, as represented by the pattern on the floor beneath their feet:



"A symbol for following this advice would combine elements of the symbol for the reasoning on which Plato and Aristotle stand with those of the symbol for pursuing Wisdom and worldly knowledge on the ceiling. Ironically, a means of combining these two symbols lies beneath our feet as we look up at them in the *Stanza della Segnatura*. We find this means in a crude version of a self-similar pattern known to Roman artisans since the late eleventh century:[19]



"Using this pattern as a model, we can imagine a self-similar pattern that combines the simplicity of the floor symbol with the dynamism of the ceiling symbol:

"As a symbol for the Renaissance, compare this image to Leonardo da Vinci's *Vitruvian Man*:

"In as much as *Vitruvian Man* became a political banner for temporal reason ("Man is the measure of all things, of things which are, that they are, and of things which are not, that they are not."), we likely would have been better off with the timeless symbol of octagons and squares. To pursue Wisdom well, we must beware of the foolish use of such temporal symbols as *Vitruvian Man* and of such temporal beliefs as the Protagorean sophistry that we associate with it.

"[16] *Patterns of Conflict*, 2005 Defense in the National Interest revision, slide #144. This slide presentation is available online in the Boyd archive section of Project White Horse, <http://www.projectwhitehorse.com/boydsarchive.htm> (30 November 2012)."

"[17] A high resolution image of the *Stanza della Segnatura* ceiling is available online at <http://upload.wikimedia.org/wikipedia/commons/9/90/Raphael_-_Ceiling_of_the_Selling_Room.jpg> (30 November 2012). The four circles containing women represent poetry, philosophy, jurisprudence, and theology. The four hourglass composites of scenes from Greek myth and Roman history represent earth, water, air and fire. Together with the central oculus, these four composites form a Greek cross. The center of this cross represents both *Hagia Sophia* (Holy Wisdom) and *quintessence* (the mysterious fifth element)."

"[18] A high resolution image of *The School of Athens* is available online at <http://upload.wikimedia.org/wikipedia/commons/9/94/Sanzio_01.jpg> (30 November 2012). In the decoration of the *Stanza della Segnatura*, octagons represent the pursuit of Wisdom and circles represent the rational reasoning of geometry, mathematics, and logic. The octagon embedded in the square represents the rationale for pursuing Wisdom. The square embedded in the octagon represents the need for rational reasoning in pursuing Wisdom. For more about the art of the *Stanza della Segnatura*, see Appendix B."

"[19] Conversano, E., Tedeschini Lalli, L., "Sierpinski Triangles in Stone on Medieval Floors in Rome," *Aplimat - Journal of Applied Mathematics,* Vol. IV (2011), No. IV, pp. 113–122, available online at <http://www.journal.aplimat.com/volume_4_2011/Journal_volume_4/Number_4/Conversano_Tedeschini.pdf> (30 November 2012)."

Chapter 3, *Overcoming Constraints in Deciding Well*, last paragraph, footnote, first two sentences

"We can never solve the problem of computing the value of π. In the words of Dwight Eisenhower, "If a problem cannot be solved, enlarge it.""

were deleted.

Chapter 4, *Academic Fields*, fourth paragraph, end

Added the sentence:

"The true sciences would include mathematics as the science of patterns."

Chapter 6, Experiencing Mystical Oneness, first paragraph, footnote

Changed reprint reference from paperback (Three Rivers Press, 1995) to hardcover (Modern Library, 1994). Removed page numbers from reprint information. Used Modern Library translation.

Chapter 8, Rules of Reason, fourth paragraph, footnote, last two sentences

"In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of the virtues, an idea beautifully captured by Raffaello Sanzio in the decoration for the study housing the library of Pope Julius II. For more about this, see Appendix B."

were changed to:

"In Plato's early-to-middle transitional dialogue *Protagoras*, Socrates argues for the unity of virtue."

Appendix A, *Looking Forward*, entire subsection

"***Looking Forward***
The Toyota strategy for learning how to produce ever more leanly does not depend on any particular machine tool technology. When Ohno envisioned his means of producing ever more leanly, there were no automated milling machines or robots. Today, these tools fit so neatly into the Toyota system that they might have emerged from it. In the near future, additive manufacturing tools (3D printers) will begin to replace traditional tools. As they do, Toyota factories will become ever leaner."

was moved from the end of the **Temporal Details** section to the end of the **Producing Ever More Leanly** section.

Appendix A, Less is More, last paragraph

Changed "live well *(ever more)*" to "live" in the second sentence.

Removed italics from the last sentence: "The timeless end of producing well is a boundless factor of deciding well."

Appendix B, all paragraphs

"The published version of this work will include a three-part appendix that addresses the role of art in pursuing Wisdom. The first part defines this role. The second addresses the art of the *Stanza della Segnatura*. The last addresses the art of this work. What follows is a sample that concerns the long history of beautiful reasoning in Western thought.

"Most modern art historians recognize the role of squares and circles in unifying the decoration of the *Stanza della Segnatura*. Few, if any, recognize the role of octagons. From the multiple-frame view, squares represent modern reason (geometry, mathematics, and logic); circles Wisdom; and octagons the reasoning of pursing the boundless factors of deciding well.

"The most important octagon is the faux oculus at the center of the ceiling, which is the result of combining the timeless pursuit of the unity of virtues (Holy Wisdom) and the four temporal elements.[1] Above this oculus, four putti hold up and another four putti tether down a circle

containing a symbol of the papacy. This Tantalean image represents discovering ever more about not only Holy Wisdom, but also the timeless fifth element.

"The next most important octagons are those intermixed with squares in the coffered barrel vault toward which Plato points in the fresco now known as *The School of Athens*.[2] Beneath Plato and Aristotle's feet, octagons both contain and are contained in squares. In pointing up, Plato tells us to aspire to a more refined form of the reasoning on which he and Aristotle stand."

"[1] An image of the *Stanza della Segnatura* ceiling is available online at <http://en.wikipedia.org/wiki/File:Raphael_-_Ceiling_of_the_Selling_Room.jpg> (15 October 2012). To download this image, click anywhere on it. To enlarge the downloaded image, click anywhere on it. Use the scroll bars to navigate around the enlarged image. Click it again to return to the original downloaded image. The four circles containing women represent poetry, philosophy, justice, and theology. The four hourglass composites of scenes from Greek myth and Roman history represent earth, water, air and fire. Together with the central oculus, these four composites form a Greek cross."

"[2] An image of the *The School of Athens* is available online at <http://en.wikipedia.org/wiki/File:Sanzio_01.jpg> (15 October 2012). To download this image, click anywhere on it. To enlarge the downloaded image, click anywhere on it. Use the scroll bars to navigate around the enlarged image. Click it again to return to the original downloaded image."

were changed to:

"The printed version of this work will include a three-part appendix that addresses the role of art in pursuing Wisdom. The first part defines this role. The second addresses the art of the *Stanza della Segnatura*. The last addresses the art of this work."

Changes in Version 2012.12.17

In printed copy, converted all footnotes and blocked quotes to single spacing. Also converted all blocked quotes to from Times New Roman 10 point to Arial 9 point font.

On website, eliminated download option.

Chapter 4, *Academic Fields*, fourth paragraph, last sentence

Added the footnote:

"[2] For more about mathematics as the science of patterns, see Appendix C."

Added the following appendix:

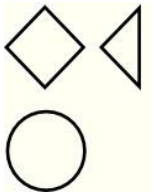
Appendix C

The Science of Patterns

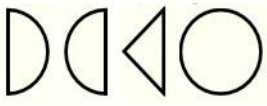
"Philosophy is written in this all-encompassing book that is constantly open before our eyes, that is the universe; but it cannot be understood unless one first learns to understand the language and knows the character in which it is written. It is written in mathematical language, and its characters are triangles, circles and other geometrical figures; without these it is humanly impossible to understand a word of it, and one wanders around pointlessly in a dark labyrinth."
— *Galileo Galilei*[1]

A Modern Intelligence Test

Imagine two series of objects that transform themselves according to the same set of rules. We are given the first series of objects and the first object in the second series:

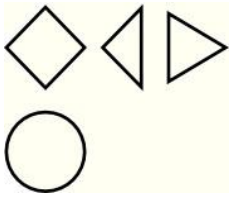


Following the way that the first object transforms into the second object in the top row, which of the following objects will the object in the bottom row transform into?



According to the reason of the designers of modern intelligence quotient (IQ) tests, the correct answer is the second object.

Now consider what happens when we include another object in the first series:

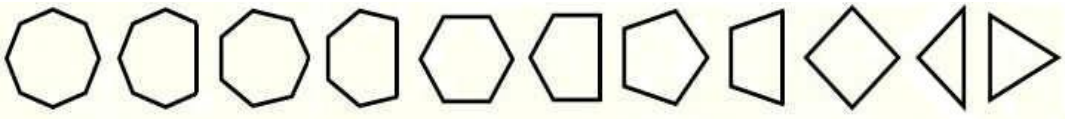


Here the reason of modern IQ test designers appears to fall apart. Given that the second object in the bottom row is the second candidate, none of the four candidates appears to make sense for

the third object. From the view of the modern IQ test designers, the third object appears to be an *anomaly*, an object that conflicts with their current beliefs about the world.

We may begin our search for other transformation processes by considering what we currently know about the three top-row objects. If we have studied geometry, we know that all three are *convex polygons*, polygons with interior angles less than or equal to 180 degrees. They are also *cyclic polygons*, polygons that have circumscribing circles, circles that contain all of vertices of the polygon that they surround. Further, all three appear to have circumscribing circles of the same size. We also know that the first and third objects are *regular polygons*, polygons that are both *equilateral* (all sides are equal in length) and *equiangular* (all interior angles are equal in degree). Both of these objects also appear to have a vertex on the rightmost point of their circumscribing circle. Finally, we know that the second object looks like the first without the vertex on the rightmost point of its circumscribing circle.

From these observations, we can imagine a transformation process that uses two steps. The first step transforms a polygon having a point on the rightmost point of its circumscribing circle by replacing this point and connecting sides with a line segment that connects the adjacent vertices. The second step transforms a polygon not having a vertex on the rightmost point of its circumscribing circle into a regular polygon having the same number of sides and a vertex on the rightmost point of its circumscribing circle. To confirm that this transformation process can explain this three-object sequence, we can apply it to an octagon that has a vertex on the rightmost point of its circumscribing circle:



As expected, this two-step process yields the top-row sequence.

This solution to the three-object problem lacks what mathematicians call rigor. One way that we might provide this rigor is to program our generating process into a computer using an object-oriented programming language. This calls for imagining a language for representing objects that such a program can use to transform and display objects.

We might choose to represent objects in the way that we classify them. For example, we would represent regular polygons as regular polygons and irregular polygons as irregular polygons. A full representation of polygons calls for including their number of sides. Using this scheme, we might represent regular polygons as collections consisting of the character R and an integer for the number of sides and irregular polygons as collections consisting of the character I and an integer for the number of sides. Using this internal (programming) language, the eleven-object sequence starting with a hexagon would be:

R8, I7, R7, I6, R6, I5, R5, I4, R4, I3, R3

Our polygon transformation methods would be:

For R objects: change the character to I, subtract 1 from the integer, and return.
For I objects: change the character to R and return.

We would also need to program methods for displaying objects. Assuming that we want to display our objects as geometric figures rather than as strings, we encounter a small efficiency problem. In order to display irregular polygons properly, the display method for irregular polygons must recreate the representation of the preceding regular polygon.[2]

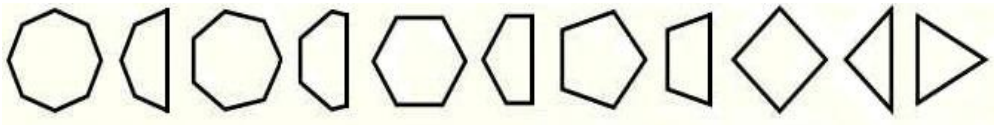
We can address this small efficiency problem by basing our internal language on the process of transforming objects rather than the results of transforming objects. One way that we might do so is by replacing our symbol for regular polygons (R) with a symbol for regular polygons that we do not need to transform (N), and by replacing our symbol for irregular polygons (I) with the symbol for regular polygons that we need to transform (Y). Using this internal language, the eleven-object sequence starting with a hexagon would be:

N8, Y8, N7, Y7, N6, Y6, N5, Y5, N4, Y4, N3

Our polygon transformation methods would be:

For N objects: change the character to Y and return.
For Y objects: change the character to N, subtract 1 from the integer, and return.

By making this simple change, we can now conceive of transformation processes that were previously inconceivable. For example, we can now conceive of a solution to the three-object problem that has a left-handed semicircle as its second object. To do so, we modify the method that displays objects with character Y. Specifically, we replace the function that replaces the rightmost vertex and sides with a line segment that connects the adjacent vertices with a function that replaces all points to the right of the center of the circumscribing circle with a line segment that connects the object points directly above and below this center. To confirm that this process can explain top-row sequence in our three-object problem, we can apply it to an octagon that has a vertex on the rightmost point of its circumscribing circle:



As expected, this process yields the top-row sequence.

When we go to apply either of these transformation processes to the object in the bottom row, we immediately encounter a problem. This apparent circle may be a circle. It may also be either a polygon with a very large number of sides or an *apeirogon*, a polygon with a countably infinite number of sides.[3] We need to expand our internal language, our transformation methods, and our display methods to include not only circles, but also apeirogons.

Let us begin with the internal language. We need to distinguish between apeirogons not to be transformed (n) and those to be transformed (y). Similarly, we need to distinguish between

circles not to be transformed (-) and those to be transformed (+). Because both apeirogons and circles have a fixed number of sides, we do not need to identify their number of sides. However, we do need a method to stop the program from producing infinitely long sequences of objects. Rather than using the integer to keep track of the number of sides, we can use it to keep track of the number of times a display method has displayed each type of object.

Our transformation methods for these four types of objects would be:

For n objects: change the character to y and return.
For y objects: change the character to n and return.
For - objects: change the character to + and return.
For + objects: change the character to - and return.

In the first case, transforming a circle yields a circle. Hence, the first object in the bottom row must be an apeirogon, a transformed apeirogon, or a circle. These three objects yield the following three-object sequences:

apeirogon, transformed apeirogon, apeirogon
transformed apeirogon, apeirogon, transformed apeirogon
circle, circle, circle

If displayed geometrically, these three sequences would appear to be identical.

In the second case, transforming an apeirogon yields a left-handed semi-apeirogon and transforming a circle yields a left-handed semicircle. Hence, the first object in the bottom row must be either an apeirogon or a circle. These two objects yield the following three-object sequences:

apeirogon, left-handed semi-apeirogon, apeirogon
circle, left-handed semicircle, circle

If displayed geometrically, these two sequences would appear to be identical.

In conclusion, we have two equally plausible transformation processes, each producing a different answer not only to our three-object but also our two-object problem. Which of these processes ought we to choose?

The Big Picture

From the timeless view of deciding well put forth in this work, reasoning well calls for us to pursue the timeless end of reasoning well, which in turn calls for us to pursue the timeless end of deciding well. Reasoning well considers not only how well our models ring true with everything we currently know about geometry, mathematics, and logic, but also how well they ring true with everything else we currently know about deciding well.

Imagine that we have just flown into the San Francisco International Airport in California. While driving south on the Bayshore Freeway, we see a billboard displaying the three-object problem

described above and a cryptic website address. When we go to the website, we find that its homepage contains nothing more than a small textbox for our e-mail address, a large textbox with a vertical scroll bar for our answer, and a button for submitting our answer. What do we type into the large textbox?

Before we submit an answer, we ought to consider the context of this problem. Specifically, we ought to consider what the people who designed this test want from us and what we in turn want from them. Whoever they are, it appears that they seek people who excel in reasoning. Assuming that we believe that it would be wise to be found by these people, how do we best let them know that they have found someone who excels in reasoning? One way is to provide as complete of an answer to their problem as we can in a form that they can understand. Another way is to show that we know how to reason well in the current context.

We might begin our answer with a mathematical description of the problem and our solution to it. We begin with a description of the mathematical symbols we plan to use to describe the pattern we see in the top row:

Regular polygon having x number of sides: {x}
Function that transforms first top-row object (x) into second top-row object: $f_1(x)$
Function that rotates object (x) so that one point lies on the rightmost point of its circumscribing circle: $f_2(x)$
Large counting number (René Descartes used one million): n
Number of sides in an *apeirogon* (infinity of counting numbers): ∞

We might then describe the top-row objects and a general pattern for each of the three possible types of objects followed by two families of solutions:

Three top-row objects: $f_2(\{4\})$, $f_1(f_2(\{4\}))$, $f_2(\{3\})$
General pattern for polygons: $f_2(\{n\})$, $f_1(f_2(\{n\}))$, $f_2(\{n-1\})$, $f_1(f_2(\{n-1\}))$, $f_2(\{n-2\})$, $f_1(f_2(\{n-2\}))$ ...
General pattern for apeirogons: $f_2(\{\infty\})$, $f_1(f_2(\{\infty\}))$, $f_2(\{\infty\})$, $f_1(f_2(\{\infty\}))$, ...
General pattern for circles: circle, f_1(circle), circle, f_1(circle) ...

FIRST CASE FOR $f_1(x)$:
For polygons, replace the rightmost vertex and its sides with line segment connecting its adjacent vertices. For circles, remove the rightmost point.

Family of five solutions (all geometric representations appear to be identical):
$f_1(f_2(\{n\}))$, $f_2(\{n-1\})$
$f_1(f_2(\{n\}))$, $f_2(\{n-1\})$, $f_1(f_2(\{n-1\}))$
$f_2(\{\infty\})$, $f_1(f_2(\{\infty\}))$, $f_2(\{\infty\})$
$f_1(f_2(\{\infty\}))$, $f_2(\{\infty\})$, $f_1(f_2(\{\infty\}))$
circle, circle, circle

SECOND CASE FOR $f_1(x)$:
For all objects, replace all points on the object to the right of the center of its circumscribing circle with a line segment that connects the points directly above and below this center.

Family of three solutions (all geometric representations appear to be identical):
$f_2(\{n\})$, $f_1(f_2(\{n\}))$, $f_2(\{n-1\})$
$f_2(\{\infty\})$, $f_1(f_2(\{\infty\}))$, $f_2(\{\infty\})$
circle, left-handed semicircle, circle

We might end by discussing the context of this answer:

I assume that you are looking for people who reason well to help you decide well. If so, your reason for finding people who reason well will be consistent with pursuing the timeless end of deciding well. For it not to be consistent with pursuing this timeless end, your reasoning, however *rational*, however consistent with the reasoning of geometry, mathematics, and logic, would be foolish.

The context of pursuing the timeless end of deciding well puts rationality in a different light. In addressing your three-object problem, I needed to make choices. In making these choices, I assumed what mathematicians currently assume. For example, I assumed that apeirogons exist. When some modern mathematicians assume this, they assume apeirogons are useful tools for helping them "do" mathematics. When others assume this, they assume that apeirogons exist independently of beliefs and circumstances.

From the view of pursuing the timeless end of deciding well, we construct tools for pursuing the timeless end of deciding well. Whether or not these tools are independent of our beliefs and circumstances depends on whether they are indispensable in pursuing this end. By definition, we can never achieve this timeless end. Hence, we can never prove *formally* that any tool for pursuing this end is indispensable. The best we can do is to seek to disprove *empirically* that the tool is indispensable. We do so by acting as if the tool in question is indispensable.

We can apply this reasoning to mathematics as a whole. Mathematics is the study of patterns. We use it as a tool for pursuing the timeless end of deciding well. To prove that mathematics is indispensable in pursuing this the timeless end, we ought to seek to disprove that it is indispensable in pursuing this end. We do so by acting as if it is indispensable. So conceived, mathematics is not only the *study* of patterns, but also the *science* of patterns.

If you seek people who reason well in order to decide well, let us seek to reason well together.

[1] Galilei, Galileo, *The Essential Galileo*, edited and translated by Maurice Finocchiaro (Indianapolis: Hackett Publishing Company, 2008), p. 182.

[2] Most expert object-oriented programmers would recognize this internal language as a bad pattern. Although it provides the desired answer in this case, it limits flexibility. Arguably, it also tends to blind us to other possible solutions.

[3] Most mathematicians consider apeirogons to be *degenerate polygons*, polygons just inside the polygon border that have special features that distinguish them from other polygons. The source of their special features is the strange mathematics of infinities. As strange as it may seem, removing any finite number of sides from an apeirogon yields an apeirogon. Just over the polygon border from the apeirogon is the circle. A circle is a collection of an uncountably infinite number of points a given distance from a given point on a surface. As strange as it may seem, removing any finite or countably infinite number of points from a circle yields a circle.

Changes in Version 2012.12.22

Preface, fourth paragraph

Changed "them" back to "these constraints" in the last sentence.

Chapter 1, *Seeing Through Apparent Miracles*, second paragraph

Changed "one of these Flatlanders encounters an" to "one of these Flatlanders, a square named A. Square, encounters a sphere, an" in the second sentence.

Changed "the Flatlander" to "A. Square" in all (3 occurrences).

Changed "the Spacelander" to "the sphere" in all (2 occurrences).

Chapter 1, Timeless Beauty, last paragraph

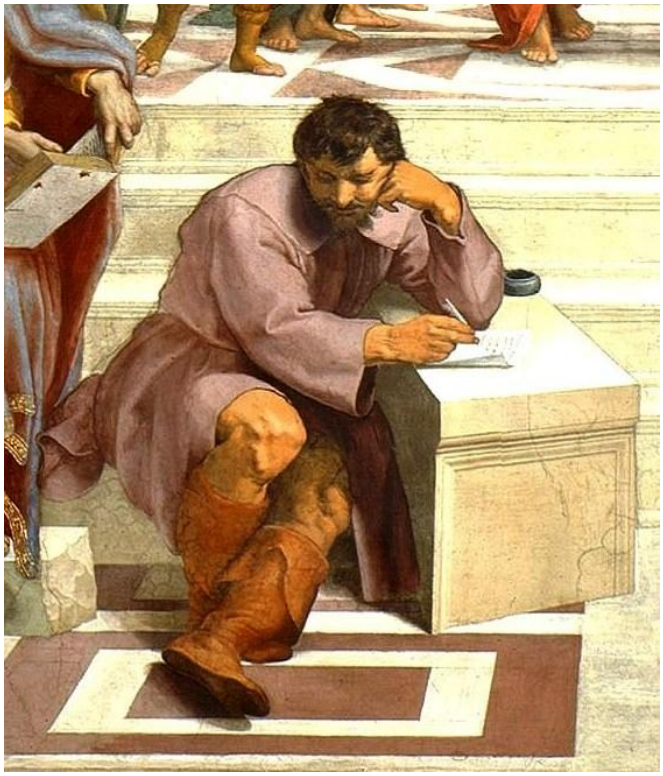
"As a symbol for the Renaissance, compare this image to Leonardo da Vinci's *Vitruvian Man*:

[Vitruvian Man image]

In as much as *Vitruvian Man* became a political banner for temporal reason ("Man is the measure of all things, of things which are, that they are, and of things which are not, that they are not."), we likely would have been better off with the timeless symbol of octagons and squares. To pursue Wisdom well, we must beware of the foolish use of such temporal symbols as *Vitruvian Man* and of such temporal beliefs as the Protagorean sophistry that we associate with it."

was changed to:

"Reinforcing this pattern as a symbol of refining the reason of Plato and Aristotle is the figure of Heraclitus, the pre-Socratic Greek philosopher of flux, of endless change:



"Raphael's cartoon (full-sized paper template) for this fresco does not show this figure. Raphael chipped away part of his completed work in order to add it. Some art historians believe that Raphael added it in response to seeing Michelangelo's recently-completed figure of Jeremiah on the ceiling of the Sistine Chapel, arguably a symbol of the Divinely inspired representing the Divinely inspired.[20] Regardless of the truth of this belief, we can see that the figure of Heraclitus visually connects a symbol for endless rationality (a square within a square within a square) to a symbol for the reason of Plato and Aristotle (a square within an octagon within a square). As Heraclitus contemplates the symbol for endless rationality under his feet, he records his thoughts on the level of his heart. The architectural block on which he both writes and leans not only is out of line with the rest of the architecture in the fresco, but also violates its single-point perspective with a conflicting two-point perspective. This striking juxtaposition reminds us of the problem of representing higher dimensional objects, A. Square's "up-but-not-north" problem. From all of these cues, it is easy to imagine Heraclitus suddenly inspired to replace each of the squares in the pattern beneath his feet with the more complex pattern slightly above his head, thereby creating a three-level version of the five-level image shown above.

"As a symbol for the Renaissance, compare this timeless symbol of refining reason to Leonardo da Vinci's *Vitruvian Man*, which represents the techno-science of first-century BCE Roman engineer Vitruvius:

[Vitruvian Man image]

In as much as *Vitruvian Man* became a political banner for temporal reason, we likely would have been better off with this symbol of refining reason. To pursue Wisdom well, we must beware of the foolish use of such temporal symbols as *Vitruvian Man* and of such temporal beliefs as the Protagorean sophistry that we associate with it ("Man is the measure of all things, of things which are, that they are, and of things which are not, that they are not.")."

"[20] Columbia University's Art Humanities Series video on *The School of Athens* makes this point. It is available online at <http://www.youtube.com/watch?v=uOrG6jfBzEU> (20 December 2012)."

Chapter 7, *An Extraordinary Anomaly*, last paragraph

"Deciding well calls for all of us to decide like fully human beings; hence to judge actions by invariant values and people by the content of their character as revealed by their actions."

was changed to:

"Deciding well calls for all of us to judge actions by invariant values and people by the content of their character as revealed by their actions."

Appendix C, The Big Picture, last paragraph, first block

Changed "the reasoning of geometry, mathematics, and logic" to "rationality" in the last sentence.

Appendix C, The Big Picture, last paragraph, second block

"The context of pursuing the timeless end of deciding well puts rationality in a different light. In addressing your three-object problem, I needed to make choices. In making these choices, I assumed what mathematicians currently assume. For example, I assumed that apeirogons exist. When some modern mathematicians assume this, they assume apeirogons *do not* exist independently of beliefs and circumstances. Apeirogons are inventions rather than discoveries. When others assume this, they assume that apeirogons *do* exist independently of beliefs and circumstances. Apeirogons are discoveries rather than inventions."

was deleted.

Appendix C, new last two blocks

were converted to normal font and paragraph formats and moved to the end of the section.

Changes in Version 2012.12.22

Chapter 1, Timeless Beauty, third paragraph

"Most modern art historians recognize the role of squares and circles in unifying the decoration of the *Stanza della Segnatura*. Few, if any, recognize the equally important role of octagons. The most important octagon is the faux oculus at the center of the ceiling, which is the result of combining two Platonic themes, the unity of virtue and the four elements:"

was changed to:

"Most modern art historians recognize the role of circles, which represent the Divine, and squares, with represent rationality (the reasoning of geometry, mathematics, and logic), in unifying the decoration of the *Stanza della Segnatura*. Equally important is the role of octagons, which represent the timeless pursuit of Wisdom and knowledge of the world.

"The most important octagon is the faux oculus at the center of the ceiling, which is the result of combining two Platonic themes, the unity of virtue and the four elements:"

Chapter 1, Timeless Beauty, new fourth paragraph

Changed "This" to "From the multiple-frame view of this work, this" in the last sentence.

Chapter 1, Timeless Beauty, new fifth paragraph, footnote

"[17] A high resolution image of the *Stanza della Segnatura* ceiling is available online at <http://upload.wikimedia.org/wikipedia/commons/9/90/Raphael_-_Ceiling_of_the_Selling_Room.jpg> (30 November 2012). The four circles containing women represent poetry, philosophy, jurisprudence, and theology. The four hourglass composites of scenes from Greek myth and Roman history represent earth, water, air and fire. Together with the central oculus, these four composites form a Greek cross. The center of this cross represents both *Hagia Sophia* (Holy Wisdom) and *quintessence* (the mysterious fifth element)."

was promoted to the body of the text immediately after the image and changed to:

"The four circles containing women represent poetry, philosophy, jurisprudence, and theology. The four hourglass composites of scenes from Greek myth and Roman history represent earth, water, air and fire. Together with the central oculus, these four composites form a Greek cross. The center of this cross represents both *Hagia Sophia* (Holy Wisdom) and *quintessence* (the mysterious fifth element)."

Chapter 1, Timeless Beauty, new sixth paragraph, footnote

"[18] A high resolution image of *The School of Athens* is available online at <http://upload.wikimedia.org/wikipedia/commons/9/94/Sanzio_01.jpg> (30 November 2012). In the decoration of the *Stanza della Segnatura*, octagons represent the pursuit of Wisdom and circles represent the rational reasoning of geometry, mathematics, and logic. The octagon embedded in the square represents the rationale for pursuing Wisdom. The square embedded

in the octagon represents the need for rational reasoning in pursuing Wisdom. For more about the art of the *Stanza della Segnatura*, see Appendix B."

was deleted.

Chapter 1, Timeless Beauty, new sixth paragraph

Changed "pattern" to "square-within-an-octagon-within-a-square pattern" in the last sentence.

Chapter 1, Timeless Beauty, second to last paragraph, first three sentences

"Raphael's cartoon (full-sized paper template) for this fresco does not show this figure. Raphael chipped away part of his completed work in order to add it. Some art historians believe that Raphael did this in response to seeing Michelangelo's recently-completed figure of Jeremiah on the ceiling of the Sistine Chapel, arguably a symbol of the Divinely inspired representing the Divinely inspired."

were changed to:

"Raphael completed what many people believe to be his greatest work without this figure. Some art historians believe that he added it as a symbol of inspired genius in response to seeing Michelangelo's recently-completed figure of Jeremiah on the ceiling of the Sistine Chapel."

Chapter 1, Timeless Beauty, second to last paragraph

Changed "five-level" to "six-level" in the last sentence.

Appendix A, title

Changed "Producing Well" to "Ever Leaner Production."

Appendix A, Producing Ever More Leanly

Changed title to "The Toyota Approach."

Appendix A, Less is More, last paragraph

"From a modern view of producing well, the ideal end of producing well is a single machine that can produce any material good *efficiently*. From the multiple-frame view, the ideal end of producing well is a process for producing what we need to live *wisely*. The economics of producing well concerns not only of how we make pins (Smith) and who truly owns the pins we make (Marx and the marginalist revolutionaries), but also why we make pins. Producing well calls for us to decide well, which in turn calls for us to produce well. The timeless end of producing well is a boundless factor of deciding well."

was deleted.

Appendix B

Changed "Telling" to "The Art of Deciding" in the title.

Entire Document

Tested external links and updated external link test dates.

Changes in Version 2012.12.26

Chapter 1, Timeless Beauty, fifth paragraph, end

Added the footnote:

"[16] Pragmatic philosophers may find this distinction between temporal and timeless reason useful in addressing problems raised by Nelson Goodman in his book *Fact, Fiction, and Forecast* (Cambridge, MA: Harvard University Press, 1983)."

Chapter 3, *Overcoming Constraints in Deciding Well*, third paragraph

"From the view of modern mathematics, π is *computable*, which is to say that we can program a Turing machine, an abstract computing machine that does nothing more than follow programmed rules, to compute π to any number of decimal places. In contrast, from the multiple-frame view, π is computable in theory, but not in practice. In theory, the claim that π is computable arises from reducing the actual problem of computing π to an abstract problem of computing π that ignores constraints. In practice, we need to consider constraints on computing π. Ignoring these constraints tends to blind us to the practical problems involved in choosing the best means of computing π."

was reduced to a footnote.

Chapter 6, Worldly Benefits of Detachment, first paragraph, third sentence

"We find this benefit in the *Bhagavad-Gita*:

"Always perform with detachment
any action you must do;
performing action with detachment,
one achieves the highest good."[7]"

"[7] *The Bhagavad-Gita*, trans. Barbara Stoler Miller (New York: Columbia University Press, 1986), third teaching, paragraph 19."

was deleted.

Chapter 6, A Common Timeless End, last two paragraphs

"However useful creating a frame for linking well may be in helping us better understand living well, it does not tell us whether we ought to link well in order to live well or to live well in order to link well. As a practical matter, we only need to choose between living well and linking well when we lack the resources to pursue both. Pursuing the timeless end of deciding well provides us with the resources to pursue both. Deciding well makes it ever less probable that we will need to choose between living well and linking well.

"From a logical view, the belief that we ought to link well in order to live well conflicts with the belief that we ought to live well in order to link well. From the multiple-frame view, we best settle this conflict by having these beliefs compete in the marketplace of ideas for helping us decide well."

were changed to:

"However useful creating a frame for linking well may be in helping us better understand living well, it does not tell us whether we ought to link well in order to live well or to live well in order to link well. From a logical view, the belief that we ought to link well in order to live well conflicts with the belief that we ought to live well in order to link well. From the multiple-frame view, we only need to choose between living well and linking well when we lack the resources to pursue both. Pursuing the timeless end of deciding well provides us with the resources to pursue both. We best settle this conflict by having these beliefs compete in the marketplace of ideas for helping us decide well."

Note that changes in the last week of 2012 are included in 2013. My intention was to finish the book in 2012. Any changes in 2013 were to be minor corrections recorded in to the 12/31/12 section. The substantial size of the changes called for moving the 12/31/12 section to the first quarter of 2013 change page.
