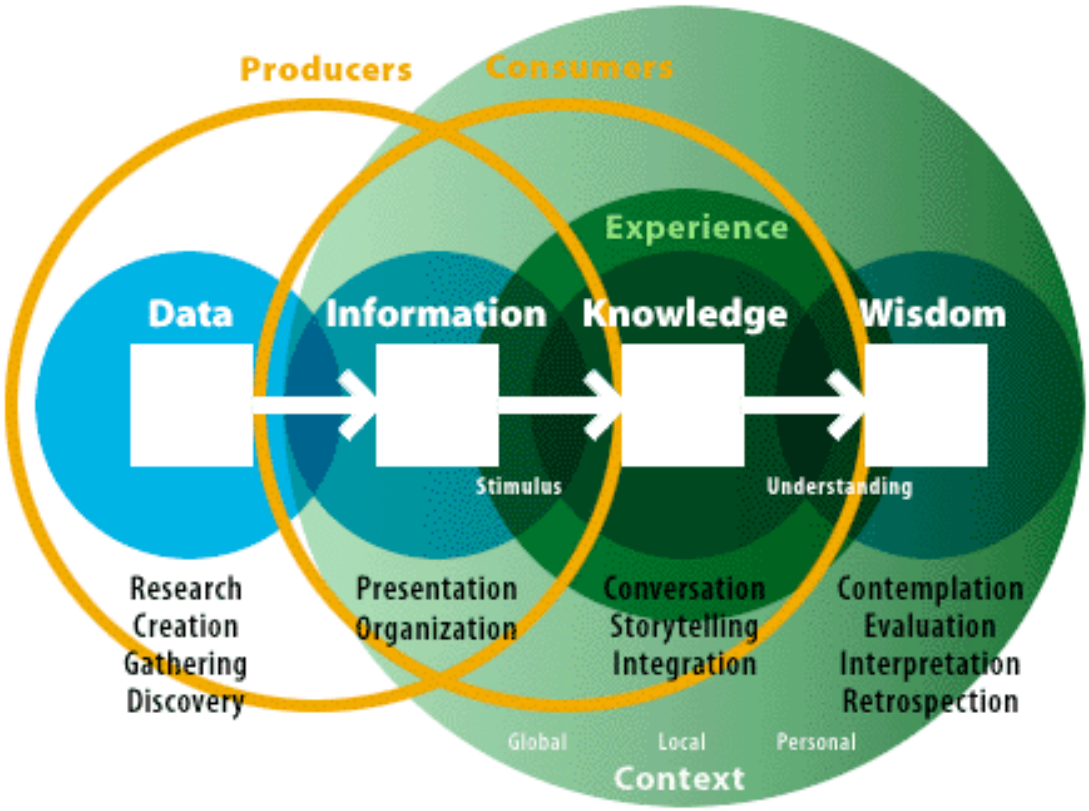
R – Constraining Reasoning with Reality

Dear: This is the start of this book's Part 4. Most of Part 1 dealt with feelings (of awareness, enjoyment, freedom, fears, gladness, happiness, hopes) associated with goals. Most of Parts 2 and 3 dealt with ideas. In Part 2, I began to show you what I mean by "Belief in god (any god) is bad science…" In Part 3, I tried to show you what I mean by "the policy part" of my more-complete summary statement: "Belief in god is bad science and even worse policy." In the rest of this book, I'll be urging you to replace "belief in god" with "confidence in the scientific method" (Part 4) and with "trust in yourself" (Part 5), and I'll be encouraging you to adopt the goal of helping knowledge expand.

And if you'd permit still another reference to the analogy that I've used before, then I'd say that in this Part 4 (from **R** through **X**), I'll be pretending that I'm walking on my "southern trail by the river" (which I trust you remember is along the access trail for the irrigation ditch), back from the dam, to where I park my old truck at the beginning of the trail. On this trail back, I plan to pick up the pace – like an old horse heading back to the barn. Then for a change, in the final part of this book, Part 5 (**Y** and **Z**), I'll be pretending to take you for a drive in the truck, to explore some of the back roads and trails in the nearby hills and mountains. [And yah, okay, once again you can drive – and to divert myself from my goal to survive, then again when needs arise, I'll try to stay calm by covering my eyes!]

Just as when you were driving my truck, one of my main messages to you in the rest of this book will be: constrain yourself! I'll start by trying to show you what I mean by urging you to constrain reasoning with reality (in this **R**) and to constrain speculations with the scientific method (in **S**). I'll then try to show you how to test for "truth" (in **T**), and deal with uncertainties, develop useful working hypotheses, and gain understanding (in **U**). After that, I'll try to explain what I mean by encouraging you to constrain instincts with reason, activities with values, values with objectives, and objectives with scientific principles. Stated differently, I'll be encouraging you to adopt the sound alternative to all religions called "scientific humanism", which means replacing "belief" in various fictitious gods with trust in your ability to apply the scientific method to make your own decisions.

Looked at differently, chapters in this Part 4 can be seen to reflect (at least in outline) how the scientific method can be used to try to progress from some data set through to gaining some wisdom: applying reasoning (**R**) to try to make sense of some data set, developing scientific hypotheses or scientific models (**S**) that succinctly summarizes some data set and provide testable predictions, testing the predictions to try to get closer to the "truth" (**T**), in time develop some understanding (**U**) of some process, ascertaining the value (**V**) of that understanding, and as appropriate, using that understanding with wisdom (**W**), e.g., to help humamity make progress toward more peace and prosperity (**X**). And I should admit: my reason for going through that was to alert you to a critical idea that I'll be wanting you to keep in mind as I progress through these chapters, namely, that there's a progression in understanding as one goes from information (e.g., tabulated data) to knowledge (making sense of some information) and then to wisdom (knowledge that can be usefully applied). The following graphic might help you understand what I mean.[1]



[1] Copied from http://www.nathan.com/thoughts/unified/index.html. The figure is contained in an article by Nathan Shedroff entitled "Information Interaction Design: A Unified Field Theory of Design."

By the way, at the outset I should admit that the chapters in Part 5 (**Y** & **Z**) are in some sense "outliers" – but I hope you recall the wisdom: in analyzing data, don't ignore the outliers! In the **Y**-chapters, I want to try to help **y**ou apply understanding, value, and wisdom to guide **y**our own life. And the **Z**-chapters – well, they're definitely "outliers": I'll try to explain what I promised in earlier chapters (starting in **A**!), namely, how the universe appears to have created itself from a total void (i.e., the original "**z**ero" that existed "in the beginning"). Thereby, I want to try to show you that the very old idea that "something can't be created from nothing" isn't correct – unless one realizes that, in fact, the "something" that's here, i.e., the Universe, is in fact nothing, and that, as Einstein said, the "nothing" from which this universe was created is actually "something" (although it's a "something" for which we don't have any data, information, or knowledge, and therefore, we definitely don't understand).

Anyway, that bit of clarity (☺) aside until **Z**, to begin this "hike home" along the river road, I'll start with the concept of constraining reasoning with reality. When I'm walking, I remind myself of this concept (as well as other concepts) with "R":

Rest & Relaxation – and "Re-creation":
physically, emotionally, intellectually, in an expanding universe of experiences.

Reasoning, Rationalizing, and Reductionism:
restrict reliance on high-wire stunts in reasoning with reality (rely on a safety net of data); doubt any reasoning claimed to provide reasons for reality (the reasoning may be mere rationalizing); constrain the analysis of reductionism with the synthesis of construction.

To explain what I mean by the first of part of the above is easy. Thus, to the standard advice to "get some R&R" (i.e., "Rest and Relaxation" or "Rest and Recuperation"), I've added something that some author recommended (whose name I've forgotten): "Re-creation", with the forced break in the word recreation (and the result pronounced as "RE-creation") used to emphasize that the meaning of the word 'recreation' is *to RE-create.*

I similarly encourage you, Dear, to routinely set aside time for yourself to get some R&R – and RE-creation! In part, I do this daily with my walk; maybe you want to do similar. If, instead, you choose to jog, please be

careful to protect your ankles and knees, e.g., by running with good shoes on a soft track. Remember that, if on average you run three miles per day, then every 25 years you'll run completely around the world; therefore, you need to protect yourself for the long haul! Personally, I prefer to walk, perhaps in part because, for me it's easier to think when I'm walking than when I'm running.

When I walk, I seek (with "R" and with the walk itself) "RE-creation" for all four of my "Board of Governors"; that is, I seek to stimulate myself physically (Board Governor Body), emotionally, intellectually, and by expanding my "universe of values" through expanding my universe of experiences. As just a single, otherwise-trivial example of expanding my experience, Dear, today at dawn the sun had moved sufficiently far north that it first appeared through an eastern mountain valley, and to the west, across the river, the first light lit only the long bluff behind the town. It was beautiful, like stage lights illuminating a velvet curtain just before the performance begins. It made me wonder if anyone, including those who first walked these hills 5,000 years ago (and left the petroglyphs) had ever been so lucky as to have seen the sight. And then I mused: maybe some of what I've seen has not been seen before, so in spite of doubts, I'll push on further with this "personal glyph" (with 'glyph' Greek for 'carving'), hoping that at least a few kids might pause to try to understand its message.

Yet, although I'm convinced that it's most important to seek rest and relaxation and re-recreation daily, I encourage you, also, to set aside other (and longer) time periods for R&R – and R. On weekends, for example, try not to do the "same old, same old" (especially, don't waste even more of your precious time staring at the "boob tube"!): on successive weekends, attend a play, go for a hike, help clean up a playground, learn some self defense, attend a symphony, go horse-back riding, sit in on a lecture on philosophy, take some children to the zoo, go golfing, and so on. When you have the time and money, plan a week in Paris, another in the Rocky Mountains, and more than a week in China. And if you ever find yourself with more time than you know what to do with, Dear, then maybe you could visit some old people (not just your grandparents!) who want just to see your sparkling eyes and hear your soothing voice.

To explain what I mean by the rest of what I review with "R" (dealing with the dangers of relying on reasoning, the need to be wary of rationalizations, and with recommended limitations on reductionism) is more difficult and

will take quite a while. I plan to delay showing you limitations of reductionism until **S**, dealing with Science, and **U**, dealing (in part) with Understanding Uncertainties (in particular, see the part in **U** dealing with "order out of chaos"). Here let me just mention that reductionism (i.e., trying to understand some thing or process by taking it apart, piece by piece, and then trying to understand all its components) has dominated science during the past 400 years (or more) and add that the serious limitation of reductionism is that it can easily fail to reveal the essence of the thing or process, namely, miniscule interactions among the system's components.

For example, enormous amounts of mental energy (and taxpayer money!) have been invested by high-energy physicists to identify "fundamental particles", by molecular biologists to "map the human genome", and by ecologists to identify and understand all components of individual ecosystems. In each case, however, what may dominate (and, in many cases, seems to dominate) are small (even miniscule) interactions among the system's components – and without knowledge of these interactions, knowledge of the entire system (e.g., of macroscopic bodies, human bodies, and ecosystems) has been elusive. Thus, in many cases, reductionism amounts to the familiar "failure to see the forest by focusing on all the trees" – or worse: focusing on individual hairs near the stomata of the leaves of the branches of each tree! I expect such reductionism is especially foolish when trying to understand how the human brain works.

But setting aside further comments on reductionism until later chapters, in this chapter I want to tackle the rather complex task of showing you the dangers of relying on reasoning, the pitfalls of rationalization, and my strong recommendation that you subject all results in reasoning to rigorous experimental tests. To start, let me summarize by encouraging you, Dear, to reject Aristotle's stated goal of "living a life of reason". Many have adopted this goal (including me, before I saw the danger); eventually I saw that relying on reason, alone, without testing reasoned results *via* the scientific method, is like walking on a greased tightrope between the tops of two tall buildings, with no safety net below to save you from an almost certain fall. What I'll be encouraging you to do is always protect yourself from high-wire stunts in reasoning with a safety net of data. I've incorporated that idea in the title of this chapter: "Constraining Reason with Reality".

By the way, Dear, if someday you would like to delve deeper into philosophy, then you might want to notice that the idea of constraining

reason with reality already conflicts with the famous (or notorious) idea promoted by the German philosopher Hegel (1770–1831): "All that is real is rational; and all that is rational is real." Hegel developed this idea starting from the ancient Greek philosopher Heraclitus' idea that "all is flux"; he then developed what's now called "Hegel's dialectic", described in the dictionary that comes with this computer as follows [which seems to be a quotation from an unidentified philosophy text and to which I've added the notes in "square brackets"]:

> The ancient Greeks used the term 'dialectic' to refer to various methods of reasoning and discussion in order to discover the truth [e.g., the dialogues of Socrates or "the Socratic method"]… Kant applied the term to the criticism of the contradictions that arise from supposing knowledge of objects beyond the limits of experience, e.g., the soul. [No "criticism" is necessary – other than to recommend eliminating the contradictions, by eliminating opinions based on zero data!] Hegel applied the term [dialectic] to the process of thought by which apparent contradictions (which he termed thesis and antithesis) are seen to be part of a higher truth (synthesis).

Hegel's idea of the dialectic strongly influenced the young German philosophers Karl Marx (1818–83) and Friedrich Engels (1820–95), who collaborated to produce the philosophy of "dialectic materialism", better known as Communism, which like so many "planned" social systems was a colossal failure, demonstrating the hubris of philosophers (and the greed of politicians) who would force their ideas of "the rational" onto other humans.

In any event, my response to Hegel's "what's real is rational; what's rational is real" is the same as something I once heard a certain grandchild say: "Show me the data!" On the one hand, maybe "the real is rational"; i.e., maybe someday humans will understand reality – although as I'll be showing you, some aspects of reality (e.g., in quantum mechanics, chaos theory, and the concepts of "consciousness" and "total nothingness") are currently beyond understanding. But on the other hand, I doubt "the rational is real": just because some ideas are rational (and doncha know, religious philosophers love to argue that their concepts of God, souls, heaven, hell, etc. are "rational"), doesn't mean that they are real!

As I've written before, Dear, if you want to know if something is "real" (e.g., if it exists), then don't think about it; try kicking it (or similar). Then, if your foot hurts, proceed with the "useful working hypothesis" that it exists. Thus, although I can agree with Shakespeare that "There are more things in heaven and earth, Horatio, than are dreamt in your philosophy",

when's the last time, Dear, you had a friendly chat with one of those beautiful, invisible, flying pink elephants?!

Anyway, in this and subsequent chapters, I want to illustrate some of the dangers of failing to constrain reasoning with reality. A huge number of examples could be given of horrible consequences when otherwise-brilliant people (such as Aristotle, Descartes, Spinoza, Hume, Hegel, Marx, and many others) made the mistake of relying on reason rather than on data. I'll also show you serious consequences when less intelligent people (such as your father and I) made the same mistakes of relying on reasoning rather than data. For example, it was your father's failure to test his ideas against data that led to your being indoctrinated in Mormonism.

To begin, I want to define some words carefully – because as I'll be showing you, taking care with words is an essential step to avoid a large class of reasoning errors. In particular, in my copy of Webster's dictionary, the origin of the word 'reason' is given as the Latin verb *reri* meaning "to think", in turn suggested to be derived from the Indo-European root *re* meaning "to fit or join". The definition given for the noun 'reason' is:

> **1**. an explanation or justification of an act, idea, etc. **2**. a cause or motive **3**. the ability to think, form judgments, draw conclusions, etc. **4**. sound thought or judgment; good sense **5**. normal mental powers; a sound mind; sanity **6**. *Logic* any of the premisses of an argument…

In addition, the verb 'reason' is defined as

> **1**. to think logically about; think out systematically; analyze **2**. to argue, conclude, or infer… **3**. to support, justify, etc. with reasons **4**. to persuade…

My dictionary adds that a synonym for the noun 'reason' is *cause* and for the verb 'reason' is *think*.

Okay, I can imagine a certain grandchild's reaction to those definitions and my caution to take care not to rely on reasoning: eyes rolled back and head rocking in disbelief, flabbergasted that anyone could be so foolish as to advise caution against thinking logically! Therefore, Dear, let me immediately respond that of course I want you to think as logically as you can. I don't want to discourage you from reasoning but to warn you about the dangers of relying on reasoned results that haven't been tested against reality.

Let me put it this way. First, I doubt that you would get much argument if you claimed that some of the greatest feats of reasoning ever recorded were by Aristotle (who is appropriately identified as "the father of logic") and by Descartes (who, along with Spinoza, is appropriately identified as one of the originators of "the Age of Reason"). If IQ tests had been available during their lifetimes, I expect that they would have scored in excess of 200. Both of them (as well as Spinoza) went through elaborate reasoning to "prove", for example, that God exists (as well as other silliness), and then lived their lives consistent with their conclusions.

But as I showed you in an earlier chapter, Dear, both of them made gigantic mistakes in their reasoning. [Spinoza didn't make a similar error, but he reached the rather-useless conclusion that God is everything, i.e., nature – and it's rather silly to replace the perfectly good word 'nature' with the emotionally charged word 'God'.] Consequently, Dear, if mental giants such as they (as well as Plato, Augustine, Thomas, Kant, and many other brilliant people) could make such enormous errors in reasoning, then mental midgets such as we should take great heed – by having the "common sense" to test predictions of our reasoning against data, which is something that all these "mental giants" failed to do (basically because they all lived when science was in its infancy and the scientific method wasn't so obvious).

Let me try to state my position more directly. Dear, of course I encourage you to always reason as best you can. But, Dear, I urge you also to reject both Aristotle's advice "to live a life of reason" and Spinoza's assessment "I call him free who is led solely by reason." If you do attempt to live a life of reason, almost certainly you'll make even greater mistakes in your life than did Aristotle, Descartes, Spinoza, and many others. Instead of relying on reason, rely on data; instead of relying on reason, rely on the scientific method; instead of relying on reason, use your head as best you can – which includes not only checking all reasoned results to determine if they're in agreement with reality but also (and extremely importantly) using the scientific method to test the predictions of your reasoning.

Now, Dear, I'm concerned, here, that you'll conclude that I'm making the proverbial "mountain out of a molehill." Therefore, I'm "sorely tempted" to give you some examples to show you that I'm not. There are many (hundreds, thousands, millions?) of examples that could be used to illustrate the dangers of relying on reason alone, but because some of the important

examples that I want to show you are rather complicated, I want to delay showing them to you until later in this chapter and in later chapters. Consequently, in addition to reminding you of the many "logical fallacies" that I reviewed in an earlier chapter (**If**, dealing with "Finding Immortal Fallacies"), permit me to list just three items under a broad title such as "General Classes of Reasoning Errors" and then provide you with an extremely brief description of examples for each:

1. *The Error of all Reasoning by Analogy* (e.g., Aristotle's "justification" of slavery).

2. *The Error of all "Proofs" of Existence* (e.g., all "proofs" of the existence of any god).

3. *The Error of all "Proofs" by Pleasure* (e.g., all "proofs" that any specific religion is "true", because "in your heart, it feels right").

So, Dear, it's not a "mole hill"; it's a mountain! But please be patient; it'll take me a while to get just to the foothills.

One of the "foothills" deals with 'rationalization'. That is, if reasoning is to conform to reality, it's critical to force all reasoning to yield testable predictions (and then to subject its predictions to a continuous battery of experimental tests), because perhaps no human brain is immune from the infirmity or debility or feebleness (or self protection?) known as 'rationalization'.

According to Webster, the psychological meaning of 'rationalizing' is

> to devise superficially rational, or plausible, explanations or excuses for (one's acts, beliefs, desires, etc.), usually without being aware that these are not the real motives.

I'll give you some famous examples later. For now, let me remind you just of various "reasons" that a certain grandchild has proposed for who knows what silliness or trouble she got into, only later to admit (when the proposed reasons were put to a test): "Well, they weren't really the real reasons"! "Riiiiiight", said the grandfather.

Now, Dear, I expect that you understand at least some of what I mean by cautioning you against relying on reasoning, but you may still be wondering

why I seem to be (in your familiar words) "making such a big deal about it". As a summary, let me say that "the big deal" is not just that millions of people have been murdered because of reliance on reasoning rather than on the scientific method (though they have), nor that tens of millions of people have been killed in wars because of reliance on reasoning rather than on the scientific method (though they have), nor that hundreds of millions of people have experienced various types of enslavement because of reliance on reasoning rather than on the scientific method (though they have), nor even that billions of people are now living in delusions, poverty, and misery because of reliance on reasoning rather than on the scientific method (though they are). Instead, Dear, the "big deal" is that I want to do what I can to help children (especially a certain few that I happen to know), so they won't make the same mistake of relying on reason rather than using their brains as best they can (by applying the scientific method in their daily lives).

The huge problem with relying on reasoning, is that it's so astoundingly simple to make mistakes: for every "right way" to reason, there may be a million ways to make mistakes! Of these mistakes, usually the most significant (and usually the most difficult to correct) are derived from errors in original assumptions (or premisses), typically derived from errors of "leaping to conclusions" (and then inadequately testing these conclusions against reality). On the other hand, the mistakes that are usually the easiest to find and correct are those within the logic, itself (i.e., errors in "the mechanics of reasoning", such as the many "logical fallacies" that I surveyed in Chapter **If**). Below and in subsequent chapters, I'll show you examples of these different types of errors and suggest ways to avoid them, but before beginning that (rather-massive) endeavor, let me remind you what is meant by 'logic' and outline some general features of what humans do when we reason.

At the outset, consider the question (which I hope you'll ask yourself before undertaking any endeavor): What's the objective? In the case of all logic (or all reasoning), the objective is to *infer* something, that is, to mentally proceed from some ideas considered known to reach some new idea. This meaning for 'infer' can be inferred (!) from its Latin roots, which are the preposition *in* (meaning "in, into, within, or toward") and the verb *ferre* (meaning "to carry"). Of course, to make sense of this definition, one *infers* that a person is "to carry" ideas from the known toward the unknown – but then, it's rather difficult to carry ideas in the opposite direction, i.e., starting

from an idea one knows nothing about! At least, that seems to be the logic of it. (☹)

And while I'm at it, let me repeat the definition of the word 'logic' (already quoted in an earlier chapter). According to my copy of Webster's dictionary, the word 'logic' is derived from the Greek word *logos* (meaning "a word, reckoning, thought"), in turn from the Greek verb *legein* (meaning "to speak, calculate, collect"), and in turn from the Indo-European root *leg* (meaning "to gather"). Thus, from its roots we can infer that logic is a way to gather our thoughts. More specifically, at least according to my dictionary, 'logic' means:

> **1**. the science of correct reasoning; science which describes relationships among propositions in terms of implication, contradiction, contrariety, conversion, etc… **2**. a book dealing with this science **3**. correct reasoning; valid induction or deduction [the lack of *logic* in his scheme] **4**. way of reasoning, whether correct or incorrect [to use faulty *logic*] **5**. the system of principles underlying any art or science **6**. necessary connection or outcome as through the working of cause and effect [the *logic* of events] **7**. the systematized interconnection of digital switching functions, circuits, or devices, as in electronic digital computers.

Within this definition (in #**3**) there's reference to logical induction and deduction, and before showing you some of the many ways to make mistakes in reasoning, let me try to make sure you understand the difference between 'induction' and 'deduction' (and also mention some aspects, relevant to logic, of the related words 'abduction', 'adduction', 'reduction', and 'seduction').

In logic, the difference between 'induction' and 'deduction' is similar to the differences between 'increase' vs. 'decrease', 'inflation' vs. 'deflation', or 'intoxication' vs. 'detoxication'. If you think about it, you'll see that this difference is, itself, different from the difference between 'incline' (meaning a slope) and 'decline' (going down a slope), or between 'inception' (to start) and 'deception', or between 'incisive' and 'decisive'. If you will check your dictionary for the meaning of the prefix 'in', you will see that it has many meanings (some from Latin, some from Greek), and as I'll be trying to show you, it's very easy to make mistakes in logic by not taking adequate care to understand the relevant meaning of words – or even of prefixes!

Thus, in the words 'induction' and 'deduction' (as well as in the words 'abduction', 'adduction', 'reduction', and 'seduction'), 'duct' is from the

Latin word *ducere* meaning "to lead" (as with the air 'ducts' in your house), 'in' is a prefix meaning "in, into, within, on, or toward", and 'de' is a prefix meaning "away, from, off, down, or undo". In logic, 'induction' means reasoning from particular facts or individual cases leading to a general principle, whereas 'deduction' means leading from one or more general principles (or premisses or assumptions) to a conclusion applicable for a special case. In analogy, the ducts in your house that lead from the central blower (for the furnace or air conditioner) to specific rooms could be called "deducts", while the return-air ducts (that lead from individual rooms back to the central blower) could be called "inducts"!

If the difference between induction and deduction makes some sense to you, Dear – but not a lot – then good (!), because as with the air ducts in your house, there's essentially no difference between the "inducts" and the "deducts" (they're both made from similar aluminum!) – at least there's no noticeable difference, until the air starts flowing. Similarly, to understand the difference between induction and deduction, you need to know the direction of the flow (of ideas).

In the case of logic, as I already mentioned, the goal is inference, i.e., the "direction of the flow" is from (mere!) "information" to "knowledge" or from "old knowledge" to "new knowledge". This inference is conducted either by induction or deduction, depending on where you start: if you start from ideas known from specific cases (individual rooms in your house) and try to infer general principles (get to the central blower), then that type of inference is (arbitrarily!) called *induction*. In contrast, if you start from general principles (the central blower) and try to infer applications for special cases (individual rooms), that's (arbitrarily!) called *deduction*.

And while I'm here, let me comment on the meanings for the other "duct words" mentioned above, i.e., abduction, adduction, reduction, and seduction. Thus, 'ab' is a prefix meaning "off or away" (so 'abduct' means "lead away") and 'ad' is another prefix meaning 'to' (so 'adduce' means "lead to"). Consequently, although I'll not use the words 'abduct' and 'adduce' in what follows, you may find (especially in books on logic) that some authors describe how hypotheses can be abducted from data (by induction) and how premisses adduce a conclusion (by deduction).

More significantly for what I want to show you, 're' is prefix meaning 'back' (so 'reduce' means "lead back"), and 'se' is a prefix meaning "apart,

alone, or astray" (so 'seduce' means "lead astray"). Consequently, when I return in later chapters (as I've already advertised) to the dangers of *reductionism*, the danger is to "lead back" the study of complicated systems to a study of their components without adequately accounting for interactions among the components. Similarly, when I return later in this and later chapters to the dangers of *seduction*, I'll be describing how attempts to stimulate emotions can seduce (or lead astray) an argument from being logical.

But of more relevance to the main point of this chapter (to urge you to be wary of the dangers in reasoning and to demand that reasoning be ratified with data), I want to alert you, first, to take care to distinguish between *induction* and *deduction*, because the way that you "crawl through the ducts" (either in your own reasoning or in following someone else's reasoning) is really quite important. Again, *induction* means proceeding from specifics in an attempt to reach a more general conclusion (or principle or reason or cause); therefore, inferring general (or "fundamental") scientific principles proceeds by induction. In contrast, *deduction* means reasoning from the general to the specific; therefore, deduction is the basis of all applications of science, i.e., in applying scientific principles to solve practical problems, such as in engineering and medicine. "In general" (that is, by induction; i.e., by generalizing from many specific examples, some of which I'll show you in this chapter), deduction is simpler and (more significantly) more dangerous than induction, for reasons that I'll now try to explain.

Deduction is normally simpler than induction, because once the "general principles" (or premisses or assumptions) from which deduction starts are accepted as correct, then "all" one need do is take care to avoid making mistakes in "the mechanics of deduction" (the meaning of which I'll soon address). Thus, applications of science (e.g., in engineering) are generally easier than developing new knowledge, because the practitioners know (or at least we hope they know!) both general principles that are to be applied and details of the mechanics of deduction (i.e., how to apply the general principles to the specific problem to be solved). Consider some examples:

- Before deducing how to build a bridge, a civil engineer should know general principles about stress and strain and about strengths of materials, and how to apply these principles to the specific bridge to be constructed;

- Before deducing what medicine to prescribe, a physician should know general principles about biochemistry and anatomy of the human body and how to apply the principles for the benefit of a particular patient; and

- Before deducing weather forecasts, a meteorologist should know both general principles about how the atmosphere's temperature, moisture, and wind fields evolve and how to apply these principles to make forecasts from current conditions.

In many such applications of general principles (and in most such applications in science) the "mechanics of deduction" is to use mathematics, a little of which I now want to review – for reasons that I hope will become obvious.

Now, Dear, to illustrate "the mechanics of deduction", I don't want to go into a lot of mathematics. Yet, please be patient with me, while I go into a little math that you already know, because if you'll consider some of the details of "routine mathematical deduction", then I expect that you'll see that, already, you're amazingly competent in "the mechanics of deduction" (not just in math). In addition, starting from reviewing what you already know about deduction in math, I expect you'll quickly see that you already know many ideas about deductive logic that will be important in this and subsequent chapters.

There are a number of reasons to try to illustrate deductive reasoning using examples in math. These reasons include: 1) in math, the hidden (or implicit) assumptions or premisses are usually relatively simple to uncover, 2) in math, various "rules of valid deduction" (such as those of association, distribution, and commutivity) are relatively simple, and 3) in applications of deductive logic using the "language of mathematics" (as opposed to using other languages, such as English), definitions are usually clear. For contrast to that last point, let me recall that, when a certain four-year-old grandchild asked me "Grampa, how come you don't believe in God?", I responded "I'll tell you when you're older". To that, you responded "I'm already older!" Now, Dear, although I agree that your logic was compelling, yet if you'll think about it for a bit, I expect that you'll agree with me that you "won the argument" merely by shifting the meaning of the word "older" to a definition that bolstered your argument!

And while I'm reminiscing, let me relay another illustration of the brilliant deductive logic of a certain four-year-old, which she displayed on the same day. "How could you be four?", I asked, "when last year you told me you were three?" Totally unfazed, you shot back: "That was last year!" So I asked: "Oh, do you mean that three plus one equals four?", as I held up three finger on one hand and one finger on the other. "Uh huh" was the knowledgeable four-year-old's response. "But I thought two plus two equals four", I responded, holding up two fingers on one hand and two on the other. And so, of course, you started counting my fingers, touching them one at a time: "One, two, three, four." So I prodded you some more: "But, how could it be that three plus one equals four, and yet, two plus two also equals four?" To which the erudite little four-year-old explained: "Cause this one (grabbing one of my two fingers) belongs over there (pointing to my other hand)!" It's hard to argue with a four-year-old who's already committed to the scientific method!

There is, however, more to my story than just my reminiscing. What I want you to realize, Dear, is how competent you already were (when your were four!) not only in the scientific method (subjecting hypotheses to experimental tests) but also in "the mechanics of deduction". And now that you're "even older", if I asked you to identify two numbers whose sum is 100, you'd quickly answer: "Lots of them: 99 and 1, 98 and 2, and so on." And if I asked you to identify two numbers whose sum is 100 and that are equal to each other, you'd quickly respond: "50." Or if I asked you: "If the sum of two numbers is 100 and their difference is 50, then what are the two numbers?", you'd fairly quickly deduce: "One is 75; the other is 25."

More generally, Dear, if I asked you to identify two numbers, say x and y, that satisfied $x + y = A$ and $x – y = B$, where A and B are two known numbers (such as, in the previous paragraph, when $A = 75$ and $B = 25$), then I'm sure that with paper and pencil you'd quickly proceed as follows:

(1) $x + y = A$
(2) $x – y = B$
adding Equations 1 and 2
(3) $2x = A + B$, or
(4) $x = (A+B)/2$
and then substituting the result (4) into (1) and simplifying
(5) $(A+B)/2 + y = A$, or
(6) $y = A - (A/2 + B/2) =$
$A - A/2 - B/2 = A/2 - B/2 = (A - B)/2.$

You might even then mention: "For example, if A = 100 and B = 50, then x = (A + B)/2 = 150/2 = 75 and y = (A – B)/2 = 50/2 = 25, as I already said."

Now, Dear, let me use this example in "the mechanics of deduction" (in this case, using the language of mathematics) to infer (by induction!) some general principles (not limited to cases in mathematics). That is and again: although from some general statement or statements [such as (x + y) = A and (x – y) = B, where A and B are two known numbers)] it's possible to deduce specific illustrations [such as if A = 100 and B = 50, then x = (A + B)/2 = 150/2 = 75 and y = (A – B)/2 = 50/2 = 25], what I want to try to do now is infer (by induction) from this particular example some general principles (about deduction). For example, from the example shown, what do you think of the inference (by induction, and which I'll put in italics, because I want to refer to it again) that, although deduction may yield knowledge of information that you previously didn't realize, *deduction doesn't yield new information?*[2]

Immediately you may doubt the above inference, claiming that you didn't know that x = (A + B)/2 and y = (A – B)/2 until after you had completed your deduction. But, Dear, I didn't say that you couldn't gain new "knowledge" from deduction. Obviously you did gain such knowledge. But once you accepted the premisses that x + y = A and x – y = B, then those premisses contained all the "information" (i.e., as you just finished demonstrating, x and y could have no other values other than those deduced).

"Phooey!" exclaimed a certain grandchild in her characteristic succinctness, adding, "What about all deductions made by all detectives? Do you mean that all perpetrators of all crimes are known before investigations begin?"

That's a good point, Dear – but again I'd caution you to be careful to distinguish between 'information' and 'knowledge' (of the information). A famous example that seems to bolster your criticism is the following:

> To the detective, the new priest said: "The first person who confessed to me confessed that he committed murder – but my vows require that I not divulge his

[2] Dear: Again, please be careful to distinguish between 'information' and 'knowledge', e.g., as in Shedroff's figure, shown near the start of this chapter. Let me put it this way: there's an absolutely humongous amount of 'information' on the internet, but I bet that nobody has 'knowledge' of all of it!

name." Later to the detective, the baron mentioned: "I was the first person who confessed to our new priest". Whereupon the detective arrested the baron for murder.

Now, it may appear not only that the sheriff displayed superb Aristotelian logic to make his arrest (relying on the implicit premiss that if A = B and B = C, then A = C) but also that his deduction led to new information (that is, the information that the baron had committed the murder). But if you look at the example again, Dear, you'll see not only that already the murderer was known (to the priest and to the murder!) but also that all the sheriff did (and all that any detective ever does) is complete a definition. That is, Dear, this "brilliant piece of detective work" can be reduced to:

Claim #1:	The first person who confessed to the priest was the murderer.
Claim #2:	The first person who confessed to the priest was the baron.
Conclusion:	By compacting the two claims into one, eliminating the now-superfluous phrase "the first person who confessed to the priest", then the single statement is: the baron was the murderer.

That is, Dear, rather than show that deductions can lead to new information, this example shows (and all examples of all detective work show) that some definitions take time to be completed. Stated differently, at most, deductions provide new knowledge about old information.

"So what?", asks a certain impatient grandchild, "Who cares if deductions don't generate new information? What counts is new knowledge!"

And of course I agree, Dear, but let me take your argument one step further. For example, suppose a certain grandchild asked her grandfather why he didn't believe in God. Next, suppose that she was now "older" and even more argumentative – although the latter is rather hard to imagine! Further, suppose she started rattling off umpteen different "proofs" of the existence of God, from Aristotle's "first-cause argument" through Thomas's five proofs and Descartes' "perfectionist proof", as well as other "proofs", even adding some of her own, such as "God is love; love exists; therefore God exists" or "God made the universe; the universe exists; therefore, God exists." Then, how would her grandfather respond?

Simple. I'd respond: "Child, get real. You can never obtain new information by deduction – and the existence of any god would be new information. That is, deductions just rehash premisses. In every deductive 'proof' of the existence of God ever invented – or yet to be invented by

someone foolish enough to waste his or her time on such an enterprise – the information that God exists is assumed as a premiss!"

Again you might argue (that wouldn't surprise me – or bother me!): "Fine, maybe deduction can't generate new information, maybe to get new information more data are needed, but grandfather [and I know I'm in trouble when I'm called 'grandfather'!] you miss the point: the goal of proofs of the existence of God is not to gain new 'information' about God but to demonstrate that available information gives us 'knowledge' of God."

Okay, Dear, once again you make a good point – but I trust it wouldn't upset you if I responded that the goal can't be achieved. To see why, I'll push my inference even further. Thus, from the mathematical example that led to your conclusion $x = (A + B)/2$ and $y = (A – B)/2$, I infer by induction that: *Deduction doesn't yield new information (although deduction may yield knowledge of information that you previously didn't realize); that is, all information is contained in the premisses (commonly including some hidden or "implicit" premisses).* That is, at most, all that any deduction can ever do is just restate, rearrange, repeat, re-express, reword, rehash, reshape, redefine… information already assumed in the premisses.

And before I'm assaulted with more of your criticism, let me add that certainly I'd agree that such "rehashing" of premisses (also known as deduction!) can be useful. For example, it was much easier to see the values for x and y when you expressed them in the form, $x = (A + B)/2$ and $y = (A – B)/2$, than when I gave the same information to you in the form $x + y = A$ and $x – y = B$. Nonetheless, any resulting knowledge, clarity, convenience, and other usefulness that deductions can yield shouldn't obscure the central issue: deductions produce no new information, just a rehashing of premisses – including all "hidden" or "implicit" premisses.

And in case you don't quickly see all the hidden premisses in the above math example, then first let me congratulate you on how well you've learned your algebra: it's now almost "second nature" to you, so you no longer need to stop to think about how you do it! But now, look at some of the implicit premisses in your calculations, which I repeat here for more convenient reference:

(1) $x + y = A$
(2) $x – y = B$

adding Equations 1 and 2
(3) $2x = A + B$, or
(4) $x = (A+B)/2$
and then substituting the result (4) into (1) and simplifying
(5) $(A+B)/2 + y = A$, or
(6) $y = A - (A/2 + B/2) =$
$A - A/2 - B/2 = A/2 - B/2 = (A - B)/2$.

First, to obtain Equation 3, you added together Equations 1 and 2 and used the implicit premiss: "Equals added to equals yields equals" (which permitted you to add x – y to the left-hand side of Equation 1 while adding B to the right-hand side). In addition, to obtain Equation 3, you used the implicit premiss that x + x = 2x (which in turn follows from the premisses that "things exist and are distinct" and from the definition of the number "2"), and then to obtain Equation 4, you used a generalization of the idea that "equals added to equals yields equals", namely, "you can do what ever you want to one side of an equation, so long as you do the same to the other side". Finally, to perform the simplification in Equation 6, you used both the implicit premisses known as "the associative law for addition" [which in general can be written as A + (B + C) = (A + B) + C] and "the distributive law for multiplication over addition" [which in general can be written as D x (E + F) = DE + DF, with, in the present case, D = – 1 and then D = 1/2]. In total (and I don't claim that I listed them all!), that's a lot of hidden premisses!

Similar occurs in all deductions, Dear, although usually it's more difficult both to identify all the implicit premisses and to see that the conclusion is contained in the premisses. For example, once Einstein had adopted the premisses of his "theory of special relativity", that 1) the laws of physics are the same for all observers regardless of their steady velocity (a premiss known as Galilean invariance, named after Galileo, because he first proposed it – to explain why humans didn't notice that the Earth was moving) and that 2) the speed of light would be the same for all such observers (a result found experimentally by Michelson and Morley, for which they received the Nobel prize), then those two premisses (plus the same hidden premisses of algebra used in the math example above) contained the result $E = mc^2$, meaning that mass is a form of "solidified energy" and that mass could be changed into energy, such as in an atomic (or more accurately, "nuclear") bomb – a result that certainly no one expected was contained in the premisses.

But notice, Dear, that the information was there in the premisses; yet, Einstein was the first to gain "knowledge" of the "information" that mass could be converted into energy (e.g., in a nuclear bomb). Similarly in the case of the "God bomb"! That is, Dear, if anyone attempts to gain 'knowledge' about the existence of any god from available 'information' (such as the information that the universe exists, that the physical constants of the universe are "finely tuned" to permit life, that life exists, that there's order and beauty in the world, etc.), then all such "proofs" of the "existence of God" are deceitful: the existence of God MUST BE contained in some premiss – and it's usually contained in one of the "hidden" premisses, surreptitiously.

To verify that claim, you need to re-examine each "proof" (of God's existence) carefully. I won't use the space, here, to go through each of the "proofs" that I reviewed in an earlier chapter (**Ie**), but I invite you to do so. In each case, if you're careful, you'll catch yourself saying something similar to "Whoa – wait a minute – here you're assuming the existence of God!" For example, in Aristotle's "proof", when he assumes that a god was needed (as a "first cause") to get things in motion, you might say: "Whoa, wait a minute, here you're assuming the existence of some god. Haven't you ever witnessed a soap bubble bursting? All that's needed for motion to occur is an explosion and conservation of momentum!" In the case of Thomas' "first cause proof" (that the universe must have been created by something and that something is God), again you might say: "Whoa, wait a minute, you're assuming the existence of God. In contrast to your assumption, lots of things are caused by themselves, for example, all radioactive decay. Similarly, the universe could have created itself by some symmetry breaking fluctuation in a total void." And so on, through all such "proofs", which in reality are just "rehashings" of premisses.

Which then suggests (by induction) something more about all deductions, namely, if you seek to prove something is "true" by deduction, then two demonstrations are needed: a) that the logic of your deduction is valid (which is usually a relatively easy task, e.g., that you didn't make any algebraic errors), and b) that all your premisses are "true" (which, as I'll be showing you in multiple chapters to follow, can be extremely difficult). In fact, in many cases, the best way to test the soundness of the premisses is first to (validly) deduce as many conclusions as possible from the premisses and then submit these conclusions to experimental tests.

For example, from your deduction for x and y [namely, x = (A + B)/2 and y = (A – B)/2], then you can relatively easily "run many experimental tests" to check if the result is "true" (e.g., for A = 100 and B = 50, you obtained x = 75 and y = 25, which is right, and so on). In most other cases, though, it's not nearly so easy (as in the test of your mathematical result) to test if the results you deduced are correct (and therefore, that all your premisses are "true"). For example, in the case of deductions in the special theory of relativity, as a result of incorporating the Michelson-Morley experimental result (that observers moving at different speeds would always measure the same speed for light) and in contrast to Newton's assumption that the passage of time would proceed at the same for all observers, Einstein deduced that observers moving at different speeds would conclude that time durations would be different, e.g., if you took off on a rocket, Dear, leaving me behind on Earth, then I would conclude that you aged more slowly than I did – and you would conclude that I aged more slowly than you! That seemed to be (and is!) a bizarre deduction – but experimental physicists confirmed it: the measured lifetimes of various short-lived elementary particles were found to vary with their speeds, as Einstein predicted. As an even more dramatic and more difficult test of the validity of Einstein's deduction, his theory predicted that mass and energy were related *via* $E = mc^2$, suggesting that mass could be transformed into energy – which was dramatically confirmed after the difficult (and expensive) task of developing and exploding the first nuclear bomb.

Further, another inference (by induction) about all deductions may now seem "obvious", namely, *if valid (i.e., error-free) deductive reasoning leads to an unsound conclusion, then because deductions don't generate new information, one or more of the premisses must be wrong*. I first introduced this concept early in the book (at least by chapter **C**); I strongly urge you to think it through, and if you agree that it "seems to be true", then be prepared to apply this concept whenever you become confused: if valid reasoning leads to an unsound conclusion, then one of your premisses must be wrong. In addition, consider another "general principle" dealing with deductions – an induction that, in due course, I'll try to justify: *if valid deductive reasoning leads to an unsound conclusion (such as a paradox) and yet if it's unclear which premiss is wrong (or which premisses are wrong), then clarity can usually be achieved by (i) more precisely defining all terms, (ii) restating the deduction to expose hidden premises, and (iii) explicitly distinguishing premisses from data and definitions*.

But as yet, I don't want to try to explain details in the second inference, above, for a number of reasons. One reason is that some of the details are rather involved. A second reason is that I think that the best way to explain the details is with examples, and that makes the explanation even longer. A third reason is that, in many cases, such details aren't very important, because rather than investigate details to try to see if a deduction is wrong (including any paradox) the best way is to return to the mantra: "Show me the data!" And a fourth reason why I say that such details aren't usually important, Dear, is the main point that I wanted to get to, namely: almost always, the most significant danger of deductions is not from errors in "the mechanics of logic" (which are relatively easy to correct, especially if one demands "Show me the data!"), but from starting from unsound premisses, i.e., starting from erroneous inductions.

Actually, you can use the above ideas to test if your premisses are correct. For example, in the case of Einstein's special relativity, no one seriously doubted either Galilean invariance or the rules of algebra, but doubts remained about the validity of the Michelson-Morley result that the speed of light would be the same for all observers, regardless of their speed. And if you'll think about it for a bit, I bet that you'll still find their result "hard to believe": if I threw a baseball to you at 50 mph while you were driving away from me at 40 mph, then I trust you agree that my baseball would come at you with a speed of only 10 mph; if so, then how come if I aimed a flash-light (or similar) at you while you were roaring away from Earth at almost the speed of light, you would conclude that my light was coming at you at the speed of light?! Well, "hard to believe" or not, the nuclear-bomb blast basically demonstrated that all of Einstein's premisses were correct, in particular, that the Michelson-Morley experimental results were valid – unless, of course, you win the Nobel prize for demonstrating that the whole bunch of them were misled!

Consequently, Dear, putting the above pieces together, I would ask you to consider the following inference (by induction) about all deductions:

> *Deduction doesn't yield new information (although deduction may yield knowledge of information that you previously didn't realize); that is, all information is contained in the premisses (commonly including some hidden or "implicit" premisses). Therefore, if you seek to prove something is "true" by deduction, then two demonstrations are needed: (i) that the logic of your deduction is valid (which is usually a relatively*

easy task, e.g., that you didn't make any algebraic errors), and (ii) that your premisses are "true" (which can be extremely difficult). Further, if valid (i.e., error-free) deductive reasoning leads to an unsound conclusion, then because deductions don't generate new information, one or more of the premisses must be wrong. In addition, if valid deductive reasoning leads to an unsound conclusion (such as a paradox) and yet if it's unclear which premiss is wrong (or which premisses are wrong), then clarity can usually be achieved by (i) more precisely defining all terms, (ii) restating the deduction to expose hidden premises, and (iii) explicitly distinguishing premisses from data and definitions.

Now, Dear, if (as I hope) the above "summary" seems reasonable to you, but you would now like to know if it's "true", then I'm sorry that I'd need to respond to you: "I think so, but I dunno!"

And if your response to that is something similar to "Thanks a lot, grampa!", I'd respond: "Don't blame me, kid; blame reality!" And if you don't know what I'm talkin' about, then guess what: you'll need to be very patient with me, 'cause I won't finish my explanation of what I mean until I get through **S** (dealing with Science), **T** (dealing with Truth) and **U** (dealing with Understanding).

The root problem is that, in reality and in general, reaching valid, general conclusions *via* induction is much more difficult than reaching valid, particular conclusions *via* deduction. With the above, italicized "summary", I've suggested (by inductive inference) some general conclusions about all deductive reasoning, mostly arguing (by analogy) from a single, simple example in math (i.e., deductions from $x + y = A$ and $x – y = B$).
If nothing else, ya gotta be impressed that I'm "pretty gutsy" to stick my neck out so far, based on so little! Besides, soon I'll be criticizing (severely) all "inductive arguments by analogy"! But if, instead of "guts" you'd like "proof", I'm sorry to respond that not only can't I provide you with "proof" that my generalizations are "true" but also I'll stick my neck out even further to say: "Kid, there ain't nobody who can provide you with such "proof"!" As far as I know, it can't be done. But if it's some consolation (and it should be!), I'll add that as far as I know, nobody has yet demonstrated that the above summary is wrong.

And if that "explanation" doesn't "do anything" for you, Dear, then let me try to explain. I'll start with the summary statement that in reality (in what

are called "open systems") inductive inferences are much more difficult and must be held much more tentatively than inductive inferences in "closed systems", such as mathematics. To see what I mean, recall what you learned about "inductive proofs" in math. For example, suppose on an examination you were given the question: "Prove by mathematical induction that $(x + 1)^2 = x^2 + 2x + 1$ for x equal to any integer." Certainly you could "verify" that result by substituting in many different values for x (e.g., it works for x = 1, x = 2, and so on) and you could "prove" that result simply by multiplying (x + 1) by (x + 1), but displaying typical meanness (☹), your teacher wanted you to prove it "by mathematical induction".

So, you racked your brain and finally remembered the rule: to prove something by induction, prove that it's true for x = 1, assume it's true for x = n, and then demonstrate that it's true for x = n+1. Then, since n is an arbitrary integer, you've demonstrated that it's always true, QED. Remembering that, your answer would be similar to the following.

1. For x = 1, $(x + 1)^2 = (1 + 1)^2 = 2^2 = 4$ and
   for x = 1, $(x^2 + 2x + 1) = (1^2 + 2 \bullet 1 + 1) = (1 + 2 + 1) = 4$,
   so it works for x = 1.

2. Assume it's true for x = n, i.e., that
   $(n + 1)^2 = (n^2 + 2n + 1)$.

3. Then for x = (n + 1),
   $(x + 1)^2 = (n + 1 + 1)^2 = (n + 2)^2 = (n^2 + 4n + 4)$, while
   $(x^2 + 2x + 1) = [(n + 1)^2 + 2(n + 1) + 1]$. But since by assumption
   $(n + 1)^2 = (n^2 + 2n + 1)$, then the previous line becomes
   $(x^2 + 2x + 1) = [n^2 + 2n + 1 + 2(n + 1) + 1] = [n^2 + 4n + 4]$.

Consequently, since the given expression is true for x = 1 and has now been shown to be true for x equal to any integer, n + 1, if it's true for x = n, then it's true for all n. QED.

So now, now that the little skunk correctly answered at least one question on her math exam, she wants a similar "proof" that all my inductive inferences dealing with deductions (and put in italics, above) are "true". Ha! Kid: not only can't I do it but also, I bet that no one will ever be able to do it!

Dear: Inductive proofs work in math, because in math, all the elements (of the set of numbers) are precisely defined and obey specified rules (e.g., the associative and distributive laws). But in reality, such definitions and laws don't normally apply. For example, if you eat more than 2,000 calories per

day, will you always gain weight? You may, but what if you exercise more, or what if you're digestive system isn't working properly, or what if… That is, in reality the best we can do is make our inductive inferences as best we can – and then test them. If they're wrong, we dump them; if they're not found to be wrong, the best we can do is hope that they're right – but we should always be worried that sometime in the future, someone might demonstrate that they're wrong! That's science – and the above is a crude statement of "Popper's principle", which I'll return to, again and again.

But in case you're getting not only confused but also rather discouraged, let me try to "regroup". You may be confused because I don't seem to provide firm demonstrations of anything, and you may be discouraged because deductions seem rather pathetic (they don't generate any new information) and because inductions seem so unreliable, since in reality (as opposed to in closed systems, such as pure math) there's no way to prove that they're "true". And though I think that such a bleak picture is painted appropriately, maybe I can add a little color and light.

Before trying to "paint a prettier picture", however, once again I want to remind you about the important difference between 'information' and 'knowledge'. Look again at Shedroff's figure (given near the start of this chapter): from it, I trust you agree that there's much more information "out there", in the world (e.g., on the internet), than any one person has knowledge of. Therefore, the overall goal of any inference (either by deduction or induction) is not to generate new information but to gain more knowledge.

Given that the goal of all reasoning is inference, leading one's mind from (mere) "information" to "knowledge" or leading one's mind from "old knowledge" to "new knowledge", then as I've already tried to demonstrate, deductions are (in a sense) rather pathetic. Certainly they can't produce new information; to get new information, you'll need to collect more data! In another sense, however, deductions are extremely useful: not only can they provide us with knowledge about available information they can generate "new knowledge" about "old knowledge".

Nonetheless, if you want to get "sticky about it", any deduction only demonstrates how the explicit and implicit premisses apply in the special circumstances under consideration. Thus, deductions can be useful for building bridges, curing illnesses, making weather forecasts, making bombs,

and even responding to silly questions from old grandfathers, but again, deductions don't (can't!) yield new information – "just" knowledge.

Inductive inferences have similar restrictions – and in addition, almost always (except in closed systems such as pure math), they're less reliable than deductions (assuming the deductions contain no "mechanical errors" or "logical fallacies"). Inductions can't generate new information (again, to get new information, you'll need to collect more data!), but they potentially can provide knowledge about existing information and new knowledge about old knowledge. Any induction, however, must be tested against new data to get more information about whether the induction might be right or wrong.

Therefore, Dear, to be wise, you must be very careful whichever way you "crawl through the ducts" (either by induction or deduction). Or maybe a better analogy, than crawling through ducts, is to suggest that all inferences are like stunts in walking on a greased tightrope, with the rope stretched between two tall buildings. Walking across on the tightrope in one direction, in deductions, there are a huge number of ways to slip on the greased rope – and fall! When walking across the rope in the other direction, in inductions, maybe the rope isn't so greasy, but when you get to the end, when you finally want to make your generalization, you'll find that the rope isn't tied to a building but to pole, facing downward (☹), and you're required to take a run and make a huge jump to try to get to a place where you can stand – or fall to the ground below. And let me add that whenever you try any such high-wire stunts in either deduction or induction, then be forewarned: they can be dangerous! Therefore, make sure that you have a safety net of data beneath you: test all inferences (inductions and deductions) against reliable data.

I think I'd better try to illustrate what I mean. To start with an example of inductive inference, suppose that every [whatever] person you ever met was a [… (fill in the blank)]. You then might conclude (i.e., infer by induction) that <u>all</u> such people were [… (fill in the blank with the same characteristic)]. I trust you agree that such an inference could easily be dumb – but not necessarily dangerous. In fact, sometimes such inductions are used as the basis of (rather sick) jokes, e.g., about all blondes, all Polish or Irish people, all Mormons, and so on.

[And let me insert my hope, Dear, that you'll do what seems appropriate to try to stop such "jokes" (which stimulate racism, intolerance, and similar).

Thus, as circumstances suggest, at least don't laugh at such "jokes", perhaps inquire about how the "joke teller" inferred his induction, perhaps point out that your mother is blonde, your best friend is Polish, one of your great-grandmothers is Irish, that two of your grandparents are Mormon, and similar – or perhaps just disengage yourself from such a stupid person.]

But setting that mini-lecture aside, suppose that, "armed" with your "general principle" (reached by induction) about "all" such people, you then encountered a particular [whatever] person for the first time. If you then deduced (i.e., inferred from your "general principle" dealing with <u>all</u> such people) that your new acquaintance was another one of those people who [… (fill in the blank)], not only would that deduction probably be dumb, it could be dangerous (both for you and your new acquaintance).

As an example, suppose all Jewish people that you had ever met had considered themselves to be "God's chosen people". You disliked this attitude and inferred (by induction) that all Jewish people were "racists". That inference, Dear, would be dumb, for it would be a highly inappropriate description of people such as Freud, Einstein, Marlow, Feynman, and no doubt millions of other Jewish people, many of whom have been leaders in what I will be describing as the "humanist revolution". Thus, Dear, inductions (or generalizations) can be dumb.

In other cases, though, deductions from dumb generalizations – such as the deductions from Hitler's dumb induction about all Jewish people – can be absolutely horrible. In such horrors, what typically happens is that someone with some leadership abilities (such as Moses, "Saint" Paul, Muhammad, Joseph Smith, Hitler, Stalin, Mao…) advances some stupid induction, and then a huge flock of simple-minded followers accept the stupid generalization as a premiss for their subsequent deductions. Thus, ideas of racism and religious intolerance, promoted by the clerics who wrote the Old Testament, the New Testament, the Quran, the Book of Mormon, and all other "holy books", are ignorant inductions (or generalizations). The evils of racism and religious intolerance then follow from dangerous deductions by sheep-like followers.

As just one of who-knows-how-many horrible examples, consider the following stupid deduction by "the first, great Christian philosopher" Augustine (354–430 CE). He's also known as "Saint" Augustine and he (along with "Saint" Paul) is generally "credited" (or others say "blamed")

for creating Christianity (and therefore Mormonism). Here is Augustine's argument "justifying" slavery:[3]

> God… did not intend that His rational creature [Augustine assumed that he and his fellow clerics were 'rational']… should have dominion over anything but the irrational creation [Augustine assumed that a coyote that can identify a rabbit as food is irrational!] – not man over man, but man over the beasts… And this is why we do not find the word 'slave' in any part of Scripture until righteous Noah branded the sin of his son with this name [recall that this alleged 'sin' was to see his father, the drunken lout Noah, naked]. It is a name, therefore, introduced by sin and not by nature… The prime cause, then, of slavery is sin, which brings man under the dominion of his fellow – that which does not happen save by the judgment of God, with whom is no unrighteousness, and who knows how to award fit punishment to every variety of offence…

I trust, Dear, that such statements sicken you – and more so, when you think about how many people's lives were horribly ruined by such stupidity.

Please, Dear, think for a moment about the horrors of Augustine's stupidity. "The prime cause… of slavery is sin"? Kidnapped, enslaved, brutalized, dehumanized people are "sinful"?! It's "the judgment of God" that a person be a slave?!! Slave traders do God's work?!!! Slave traders are simply agents of God "who knows how to award fit punishment to every variety of offence"?!!!! For contrast, consider what Euripides wrote in 425 BCE (almost 1,000 years before Augustine): "Slavery... that thing of evil, by its nature evil, forcing submission from a man what no man can yield to." And then, Dear, please think again about the recipe: stupidity plus power yields evil or, as Goethe summarized, "Nothing is so evil as ignorance in action."

If you look at Augustine's "argument", I hope you see the error in his reasoning. He made no mistakes in the mechanics of deduction (such as shifting meaning of words, misinterpreting conjunctions or conditionals, mangling syntax, or any of the many other potential errors, which I outlined in Chapter **If**). That is, the mechanics of his deduction are faultless. Nonetheless, he made a monstrous error: he started from the (unstated) premiss that the Bible is "true".

That the Bible is untrue (as are all "holy book") is simple but tedious to demonstrate. I have already shown you some of this in the "excursion" **Qx**

[3] Copied from *A History of Western Philosophy* by W.T. Jones, Harcourt, Brace, and Company, New York, 1952, p. 375.

and will show you more in the "excursion" **Yx**, which deals with the colossal scientific failure known as religion. In the case of the Bible, a simple summary of its unsoundness is to say that it's inconsistent with known scientific principles (in astronomy, biology, ecology, geology, physics…) and that its predictions (e.g., about the future of the Jews, about the fate of neighboring cities and states, and about when the world would end) have been demonstrated to be false. Therefore, Dear, one can demolish Augustine's "justification" for slavery by saying that it's a valid deduction leading to an unsound conclusion, because it starts from the faulty premiss that the Bible is "true".

Then, Dear, think of other horrors that follow from accepting other statements in various "holy books" as "true":

- If the *Old Testament* is "true", then it follows that there's a "thing" that controls this universe that approves, promotes, and even demands the slaughtering of children because of what their parents think, the killing of unbelievers and homosexuals, and so on, on and on,

- If the *New Testament* is "true", then the guilty can be absolved of their crimes by punishing the innocent,

- If the *Quran* is "true", then all who think otherwise should be terrorized, mutilated, and murdered, and

- If the *Book of Mormon* is "true", then all innocent, helpless, and beautiful "colored" children are guilty of a crime of which one of their ancestors was accused, countless generations ago – except, of course, for those children who are "colored" a sickly whitish-pinkish-brownish "flesh" (!!!) color, similar to the skin color of the racist who wrote the *Book of Mormon* (almost certainly Sidney Rigdon) and the skin color of money-digger Joseph Smith who peddled and profited from the scam.

In fact, there's another huge class of premisses that are false not because they have been demonstrated to be inconsistent with reality but because they're meaningless. For example, consider the premiss (accepted as "true" by all comic-book connoisseurs!): *Superman is powerless against kryptonite.* I trust you agree, Dear, that there's not much point in arguing whether this premiss is true of false; instead, what's relevant is that, in

reality, this premiss has no meaning: 'Superman' and 'kryptonite' are just some silly ideas concocted for some comic books.

And if you don't see the relevance of that example, Dear, then let me state here that, similarly, there's no point in arguing about the "truth" or "falsity" of premisses such as "God exists", "souls exist", "miracles occur", "Jesus is the son of God", "the angel Gabriel conveyed Allah's message to the 'profit' Mohammed", "the angel Moroni conveyed God's message to the 'profit' Joseph Smith", and so on. As I'll demonstrate later (in **T**, dealing with "Truth") such premisses conveyed in various "holy books" are just as meaningless as "Superman is powerless against kryptonite."

Meanwhile, though, the consequences of adopting false or meaningless premisses can be (and have been) absolutely horrible. Thus, from the false (meaningless) premiss that there's a "superior race" of humans (it's meaningless because there's only one "race" of humans!) not only did the Ancient Israelites reportedly slaughter whole populations but also the Nazis slaughtered six million Jews; from the false (meaningless) premisses that anything "supernatural" exists (what exists, is, by definition, natural!) and that the clerics can communicate with this "supernatural", billions of humans have yielded and continue to yield control over their lives to con-artist clerics; and to list just one more of countless examples, from the false (meaningless) premiss that there's "life after death" (do words no longer have meaning?) not only did the Ancient Christians willingly go to be eaten by lions, but today, Islamic terrorists strap explosives around their waists and blow themselves up in their "Jihads" to kill the "infidels".

Alarm bells? Worse? Insanity? Screams of bloody murder? Then, Dear, please see the importance of checking premisses. For one of the fundamental principles of logic (i.e., of fundamental science) of which I'm confident is this: if your error-free reasoning leads to a false conclusion, then one of your premisses must be wrong.

But then an obvious question is: "Who in his or her right mind would want to adopt an unsound premiss?" And an equally obvious answer is that few people "want to", but then, for just one set of sources of unsound premisses (those contained in all organized religions):

1) When they were children, people were indoctrinated with false or meaningless premisses by their parents and by other members of their

societies, who in turn were indoctrinated with the same stupidities when they were children, thereby propagating unsound premisses (e.g., about "the will of God") for thousand of years,

2) Unfortunately there have been and there continue to be some unscrupulous (or insane) people who are certain that the end justifies the means and are quite prepared to dupe followers with what they know are unsound premisses (i.e., lies), and

3) How do followers know if their leader's premisses are unsound, especially if the leader's premisses are consistent with premisses (and prejudices) already held by the people?

Thereby, during at least all of recorded history (viz., the past 5,000 years) and probably for at least the past 10,000 years – and continuing today – leaders have used religion to "manipulate the masses". Indoctrination of children with unsound premisses is therefore a major problem. Such indoctrination is relatively easy to accomplish, not only because there always has been survival value in children trusting "big people" but also because many times it's difficult to teach children how to purge their minds of unsound premisses.

For example, Dear, throughout history the vast majority of people have accepted the premiss that each person possesses "an immortal soul". The historical record shows that only a few "brave souls" (such as Thomas Jefferson, Robert Ingersoll, Sigmund Freud, Bertrand Russell, and Albert Einstein) have had sufficient intelligence and courage to abandon the comforting delusion of the stupid induction about the immortality of souls. Similarly, the vast majority of people have accepted the premiss that various gods exist (as other than just ideas), and again, at least according to the historical record (which has been badly mangled by the clerics of the world), only a few intelligent and courageous people have said "show me the data!" Then, when the two unproven premisses of the existence of immortal souls and gods were added to the people's primitive training in tribalism (which led the majority of people to the incorrect but "instinctive" premiss that "our tribe is better than your tribe"), then the people were "ripe for the picking" by priests and politicians.

That the vast majority of people could be easily manipulated by false premisses was clear to early leaders (such as Egyptian Pharaohs,

Mesopotamian leaders such as Sargon the Great and Hammurabi, as well as various other liars and schizophrenics such as Moses, Plato, "Saint" Paul, Muhammad, Sidney Rigdon, Joseph Smith, and many others). The technique of using false premisses to manipulate "the masses" was generally well known and applied by the time of the Ancient Greeks and Romans, as is illustrated in the following quotations [to which I've added the underlining]:

> "Our forefathers in the most remote ages have handed down to their posterity a tradition, in the form of a myth, that these bodies [the planets] are gods, and that the divine encloses the whole of nature. The rest of the tradition has been added later in mythical form with a view to the persuasion of the multitude and to its legal and utilitarian expediency…" [Aristotle (384–322 BCE)]

> "Since the masses of the people are inconsistent, full of unruly desires, passionate, and reckless of consequences, they must be filled with fears to keep them in order. The ancients did well, therefore, to invent gods and the belief in punishment after death." [Polybius (c.204 – c.122 BCE)]

> "The great mass of women and common people cannot be induced by mere force of reason to devote themselves to piety, virtue, and honesty. Superstition must therefore be employed, and even this is insufficient without the aid of the marvelous and the horrible." [Written ca. 20 CE by Strabo of Amasia, a geographer and contemporary of the Roman Emperor Augustus, who lived from 63 BCE to 14 CE]

> "Religion is regarded by the common people as true, by the wise as false, and by rulers as useful." [Possibly from Seneca the Younger (c.4 BCE – 65 CE)

And if you should think, Dear, that such manipulation of the people was done only in ancient times, then please let me know if you ever hear the President of this country end a major speech without the phrase "God Bless America" – for if I'm still alive, I'll want to vote to re-elect that president!

But more to the point of the dangers of deductions from unsound premisses, the question is: How does one know if one's premisses are sound? For example, how does one know if God talked to Moses (rather than Moses concocting the story, so he could organize the Israelites under a new priesthood), if Jesus was the son of God (rather than just a myth made up by a new bunch of power mongers), if Allah (*via* the angel Gabriel) talked to Muhammad (rather than Muhammad fabricating his "visions" in an attempt to organize Arab tribes – or maybe he was hallucinating), if the angel Moroni talked to Joseph Smith (rather than Rigdon convincing Smith to help him start up a new religion), if the Jews are God's chosen people, if the Aryans are a superior race, if men are superior to women, if white people are

superior to colored people, if black is beautiful, if Americans are ugly, if all Muslims are terrorists…?

Given such questions, Dear, I hope you see the extreme danger in deductions: your logic can be flawless, but if you start with a stupid premiss, then your conclusions can be absolutely horrible. Not just "garbage in, garbage out" (known by the acronym GIGO), but throughout history there has been a horrible string of: "faulty premiss in, atrocity out". As Voltaire warned: "If we believe in absurdities, we will commit atrocities."

Thus, Dear, if you're inclined toward accepting the premiss that you have an immortal soul, that God exists (as more than just an idea), that Jesus was the son of God, or any of the other premisses that I listed above, or any other premiss that you might consider, then as just the first step, before you get carried away in a chain of deductive logic, I strongly urge you to dig into all relevant and reliable data and to do the best you can to determine if the premiss is sound.

And let me repeat my offer that I made many chapters ago: I'll give you a million dollars (or, at least, all the money that I have) if you can find even the tiniest shred of data that supports any of the premisses: people have immortal souls, God exists as more than just a silly idea, or that God communicated with Moses, Jesus, Muhammad, Joseph Smith, or any other con-artist "profit". In fact, while I'm at it, let me make the same offer if you'll provide me with the tiniest crumb of data that support the premisses that the Jews are God's chosen people, that the Aryans are a superior race, that men are superior to women (in my view, women are superior to men, e.g., at making babies!), that white people are superior to colored people, and that all Muslims are terrorists. (I don't make the same offer re. "black is beautiful" or "Americans are ugly", Dear, because I know that some data can be found that support those statements – as well their reciprocals).

So, Dear, assuming that you make no mistakes in the mechanics of deduction, then the critically important feature of deductive logic is to start from sound principles (or premisses). Meanwhile, though, the task of identifying sound principles is considered to be a part not of deductive logic but the central feature of inductive logic – or of science. And if all the terminology is stripped down to its essentials, then the essence of identifying sound premisses is to use the scientific method.

Now, Dear, I hope that you're becoming infuriated with me! I hope your "logic" or "reasoning" is something similar to the following:

> "Well, then, Grampa, get on with it! If the critical feature of all deductive logic is the premisses from which one starts – if the *sine qua non* [I didn't know that you knew that meant 'without which none'!] of sound reasoning is sound premisses, and if the mechanics of deductive logic are relatively simple, then get to the important stuff: show how to obtain sound premisses!"

Patience, child. Have you forgotten that one of the prime functions of grand parents is to develop patience in their grandchildren?!

Dear, the thrust of the rest of this book (in fact, the thrust of this entire book) is to try to help you identify sound premisses: in **S**, I'll dig deeper into the scientific method (which is the only known way to identify sound premisses); in **T**, I'll address testing for the "truth" of such premisses; in **U**, I'll explore what is meant by understanding the inevitable uncertainty of all such premisses and how to develop useful working hypotheses. So, Dear, please be patient: soon, I'll get to "the important stuff", but meanwhile, why don't you get to some other "important stuff", namely, some exercise?!