Why Religion Is Natural and Science Is Not

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Introduction

After more than a hundred years of books comparing religion and science, an author owes readers some justification for adding one more to the heap. Here is mine. This book compares science and religion in a way that has never been done before. And it has a surprise ending. Actually, there are many surprises in the final chapter.

I will offer a comparison of the *cognitive* foundations of religion and science, as opposed to their metaphysical or epistemological foundations. Some books comparing religion and science touch on cognitive themes, but, at least so far as I know, none makes cognition the focus of its comparisons.

My thesis, in short, is that religion is cognitively natural and that science is not. After clarifying both what I mean by cognitive naturalness and the type of cognitive naturalness that I have in mind, I will make the case for the cognitive unnaturalness of science and the cognitive naturalness of (popular) religion. Then I will draw out some of the far-reaching implications of this argument.

I use the term *cognitive* (and its cognates) in the sense that it is employed in the contemporary cognitive sciences. The focus is on *how human mind/brains represent and process information in perception, thought, and action.*

That sentence disguises in seventeen words hundreds of careers' worth of philosophical problems. What are minds? What are mind/brains? Why have scholars produced such an awkward neologism? How do minds and brains differ (so that we so readily use these two different words in everyday talk)? How are they related or alike (such that scholars have created that awkward term)? What is information?

What is the representation of information? What is the processing of information? What are perception, thought, and action? How should they be distinguished from one another? How are they connected with one another? Generating that collection of questions is only picking *some* of the lowest hanging fruit.

The word *thought* in that italicized sentence deserves some attention. Undoubtedly, *perception* and *action* deserve attention too. Because thought smudges into both perception and action, much of what I say about cognition holds for both of them, too. But, since most of the time thought mediates between perception and behavior, while I do say a few things about action and a few more things than that about perception, I have more that I can say with some confidence about thought. So the focus of the book will be on *thought*.

Cognitive scientists have advanced plenty of proposals about what thought is and what it is like. More to the point, nearly everyone working in the cognitive sciences presumes that thought comes in at least two varieties. I will capture the relevant distinction by contrasting what I describe as "natural" cognition over against the sort of slower, conscious, controlled, effortful, reflective thought that I will call "unnatural" cognition (largely by default). Natural cognition concerns the subterranean parts of our mental lives that constitute our fast, (mostly) unconscious, automatic, effortless, intuitive thought—the contents and origins of which can, not infrequently, prove a struggle for us to articulate.

I should stress that making such a distinction is neither new nor exotic. For example, dual process theories of cognition in psychology track this distinction fairly closely.[1] Plenty of people whose work predates cognitive science and plenty of contemporaries whose work stands outside of cognitive science concur. Deploying the language of the *naturalness* of cognition is not the typical way that scholars mark this distinction, but it is not without precedent.[2]

After introducing the notion of natural cognition, the principal burden of chapter one is to distinguish between two forms of it. The contrast I am drawing in this book about the cognitive foundations of science and religion concerns, respectively, unnatural, laborious, reflective cognition on the one hand and *only one* of the two forms of natural, effortless, intuitive cognition on the other. I will argue that the kinds of instantaneous, automatic intuitions about some matter or other that distinguish natural cognition can arise from either of two sources.

One source, what I call "*practiced*" naturalness, comes from having extensive experience in dealing with some domain. The most obvious illustrations are the sorts of good judgments that experts in any field can make in a snap, whether it is an engineer knowing what building material to use in a structure, a chess master knowing what move to make in order to avoid his or her opponent's trap, or a long-term commuter knowing how the fares work on his or her local transit system. Expertise in some domains is not at all rare. Hundreds of thousands of people in a particular locale may possess expert knowledge about the fare arrangements of their local transit system.

The second source is what I call "*maturationally*" natural cognition, and it is this form of natural cognition on which I will concentrate throughout the remainder of this book. Maturationally natural cognition concerns humans having (similar) immediate, intuitive views that pop into mind in domains where they may have had little or no experience and no instruction. Examples of maturationally natural cognition include speakers knowing how to say something in their native language that they neither have said themselves nor heard anyone else say before, people knowing what someone is feeling or thinking on the basis of observing his or her facial expressions, and even school-age children knowing that the slightest contact with some contaminant might be enough to contaminate them fully.

After distinguishing between these two forms of natural cognition, I go on to explore maturationally natural cognition in greater depth. I examine the fallibility of such domain specific "knowledge," the connections between maturationally natural cognitive systems and various conceptions of mental modules that have been advanced in cognitive science, and the fraught question of the origins of such cognition. I then discuss one particularly important maturationally natural cognitive system, namely, what cognitive scientists call "theory of mind."

Distinguishing maturational from practiced naturalness does quadruple duty in this book. First, it permits a comparison of the cognitive foundations of science and religion without having to settle whether all of the relevant systems are properly considered modular or not on one conception or another of modularity. The modularity of mind is the thesis that human mind/brains are made up of some number of comparatively isolated mental systems (modules) that each deal rapidly, automatically, and, thus, for the most part, unconsciously with some salient problems that all members of our species must solve in the normal course of life. Mental modules are domain specific. The tasks they are taken to address (depending upon the theorist) range from the analysis of inputs to our various sensory systems to such things as using language, recognizing individual faces, dealing with a nearby contaminant, comprehending others' emotional states from their facial expressions or, their tone of voice or their bodily comportment, and so on. I argue that maturationally natural systems certainly do not need to be modular in what has probably been the strictest sense proposed to date, namely, Jerry Fodor's account of mental modules.[3] Since it is a more inclusive category, however, *maturational naturalness* probably encompasses most, if not all, of the systems that have been proposed as candidates for cognitive modules.

Second, it follows that maturational naturalness also enables a comparison of the cognitive foundations of religions and science to proceed without having to settle those fraught questions about modules' origins. This is largely due to the fact that the emphasis in this comparison will be on the cognitive equipment that is typically up and running in human minds by the time children reach school age, rather than on how they are outfitted at birth.

Third, the notion of maturational naturalness provides more suitable grounds for comparing the cognitive foundations of science and religion than does the dual process tradition's distinction between intuitive and reflective cognition. Dual process theories differentiate between two sorts of cognitive systems or, alternatively, two sorts of inferences, between what I am calling "natural" intuitive cognition as opposed to "unnatural" reflective cognition.[4] The crucial point, however, is that further differentiating between the two types of natural cognition—practiced versus maturational—supplies the pivotal analytical tool for comprehending the important differences between the cognitive foundations of science and popular religion. Those differences can only be discerned by focusing on maturational naturalness, as opposed to naturalness more broadly.

Fourth, maturational naturalness also clarifies a technical matter in the literature of the cognitive science of religion. It is violations of the intuitions that our maturationally natural capacities deliver that inspire the notion of counterintuitiveness cognitive theorists employ in their theoretical treatments of religious representations.[5] It is also this notion of counterintuitiveness that I have in mind when I contrast the modestly as opposed to the radically counterintuitive products and processes of popular religion and science, respectively.

Having clarified what I mean by cognitive *naturalness,* I take up the issue at hand: the comparison of science and religion. Chapter three lays out my case for the cognitive unnaturalness of science. I want to confess at the outset that I commit the philosopher's sin of putting two clarifications up front. It may not be the most direct route into a topic, but it can forestall a lot of questions and confusions. The first clarification is that science and technology are not the same things. The second is that a couple of features of science *are* cognitively natural. The plainness of these two clarifications and what may seem like their obvious truth conceal the controversy that surrounds them, especially the first. I do not pretend to resolve these matters. Concerning the first, however, I do give a number of independent, cognitively significant reasons for distinguishing science from technology. Concerning the second, I emphasize that *all* of the cognitive differences between science and religion that I explore in this book are differences of degree. Some researchers have stressed, in effect, how natural some dimensions of scientific cognition seem by showing how infants' behavior manifests them.[6] I do not disagree. It does not follow, however, that *all* dimensions of scientific cognition are natural or that even all *important* dimensions of scientific cognition are natural or that science is remotely as natural from a cognitive standpoint as religion is.

After those clarifications, I take up the features of scientific cognition that do not come at all naturally to human beings. I examine the cognitively unnatural products of science, especially its radically counterintuitive theories, and, then, its cognitively unnatural processes. The latter concern the intellectual disciplines that science requires, the difficulties in acquiring and mastering them, and humans', even scientists', susceptibilities to error. The third chapter ends by introducing a subthesis, whose larger importance will only become clear later, that it is the special *social* arrangements of modern science that compensate (fairly successfully) for the limitations, prejudices, and mistakes to which individual researchers are prone.

I then take up the cognitive naturalness of popular religion (as opposed, for example, to some forms of theological thought). I discuss how much we know about religious matters (that we typically fail to realize that we know), considerations from natural history that point to religion's cognitive naturalness, and a theoretical framework about important cognitive foundations of recurring features of religions. That theoretical framework proposes that religions have evolved to cue a variety of maturationally natural dispositions that develop in human minds on the basis of very different considerations, both from one another and from anything having to do with the roles they might play in religions. I compare religions, from a cognitive point of view, with the wonderful devices that the great Pulitzer Prize–winning cartoonist Rube Goldberg drew. Goldberg's devices used a diverse collection of common items, frequently in ways not connected with any standard functions that they might have, to carry out some mundane task in some spectacularly unnecessary and complicated fashion.

Following the same outline I use to analyze science, I examine, in order, the cognitively natural products of popular religion before turning to its cognitively natural processes. I maintain that popular religions' cognitive products involve only *modestly* counterintuitive representations, *at most,* that are mainly the results of *normal* variations in the operations of garden-variety, domain-specific, maturationally natural, cognitive equipment. I hold that maturationally natural systems may not start out being domain specific, but that is certainly what they look like in their maturity. If that is true, then the cognitive processes that religions recruit will prove every bit as diverse as the various maturationally natural systems they engage—different systems, different processes. Consequently, I review two examples: language and the management of contaminants. I then explore theory of mind and its contributions to the cognitive processes surrounding myth, ritual, and doctrines.

So what if religion is natural and science is not? What are the implications for religion, for science, and for society as a whole? The seven conclusions that I draw from this unprecedented cognitive comparison of science and religion may not match the surprise endings of O. Henry's short stories, but they do aim to shatter some conventional wisdom. Perhaps not all seven will astonish every reader, but I am confident that most readers will find some to be surprising. At the risk of undoing the suspense, here are those seven conclusions, unadorned and unelaborated:

- Traditional comparisons of science and religion are cognitively misbegotten.
- Theological incorrectness is inevitable.
- Science poses no threat to the persistence of religion.
- Relevant disabilities will render religion baffling.
- Science is inherently social.
- Science depends more fundamentally on institutional support than religion does.
- Science's continued existence is fragile.

Nothing in this book is intended to provide an exhaustive theory either of religion or of science or of cognition. On the latter front, for example, I discuss important approaches in cognitive science concerning the embodied (thus, among other things, the emotion-laden) and the (physically and culturally) embedded character of human perception, thought, and action. Because I do not take either approach up systematically or at length, it does not follow that I am either uninterested or unfriendly to these approaches. (Careful reading will disclose more than one place in this book where I do take up findings such approaches inspire.) I have no doubt that current and future discoveries from those quarters will only enrich our understanding of the issues this book addresses. It does follow directly that nothing I say in this book is intended to provide an exhaustive account even of the cognitive dimensions of religion or of science. Over our species' history, the division of labor has mostly worked to our advantage.

Since the comparison is unprecedented, this is only a beginning.

1

Natural Cognition

Knowing It All at Once

People know more than they realize. Anthony Trollope exquisitely illustrates the truth of this claim in the twenty-fourth chapter of *Barchester Towers*, where he shows, in an exchange between two characters, Mr. Quiverful and Mr. Slope, how we can, sometimes, come to understand exceedingly complicated matters in a flash, as when lightning suddenly illuminates everything around us at night. The circumstances of this exchange are complicated. Bear with me, though, since spelling them out will reveal both how much Mr. Quiverful knows on the slimmest of evidence and how astonishing it is that he can know it all so fast.

Mr. Quiverful, the vicar of Puddingdale, is the struggling father of fourteen children.[1] Mr. Slope is the conniving chaplain of a feckless bishop, on whose behalf he offers Quiverful a position that would substantially improve his circumstances. Despite its obvious benefits, Quiverful is only willing to accept the position if it has already been offered to another character, Mr. Harding. When Slope assures him that Harding has declined the position, Quiverful accepts and begins planning his move.

Unfortunately, in the meantime, Slope discovers that if he can maneuver Harding to take the position he can turn the situation to his own advantage. So he pays a second visit to Quiverful—this time to convince him to decline the appointment.

What Slope wants to accomplish is tactically difficult, for it is thoroughly contrary to Mr. Quiverful's interests. Quiverful can barely manage presentable clothes to take his fourteen children to his own church's services. In anticipation of his improved circumstances, Quiverful has already agreed with an auctioneer to sell his farm, requested a curate to replace him at Puddingdale, and ordered new outfits for his wife and three eldest daughters.

Slope's task is also rhetorically difficult. Not only is he acting without the bishop's knowledge, but also he is acting contrary to his wishes and to those of his formidable wife, who has been Slope's patroness. *She* is the one who had suggested Quiverful for the position. Slope must ensure that this conversation *not* result in Quiverful thinking that either the bishop or his wife desires that he surrender the appointment. To attain his various ends, the bishop's chaplain not only is but also must be one of the slipperiest of Slopes.

If anyone is up to these challenges, it is he. Slope has schemed and maneuvered and easily talked his way into plenty of good situations and out of some bad ones. For my purposes, what is significant is Trollope's description of what and how much Mr. Quiverful knows, and of how and how fast he knows it. Trollope says of their second conversation that as Slope began to speak, Mr. Quiverful "saw at a glance that his brilliant hopes were to be dashed to the ground and that his visitor was now there for the purpose of unsaying what on his former visit he had said. There was something in the tone of voice, something in the glance of the eye, which told the tale. Mr. Quiverful knew it all at once."[2]

Slope had hardly begun to speak before Quiverful "saw at a glance" that his appointment was not to be. Quiverful had not consciously searched for evidence to this effect. He had *sensed* his fate from Slope's tone of voice and the look in his eye, long before he might have explicitly inferred it from any statements the bishop's wily chaplain would make. Slope's consummate tactical and rhetorical skills notwithstanding, he had hardly spoken a word before Quiverful had ascertained his aim, appreciated its consequences, recognized his own powerlessness, and, thus, had begun, already, to realize the prudence in comporting himself humbly, even in the face of Slope's mendacity and injustice. Quiverful knew *all at once* that his hopes and plans were crushed.

The intuitive recognition Quiverful displays—certain, detailed, and instantaneous—serves as a useful benchmark when thinking about what I am referring to as the *naturalness* of cognition. The more transparent a thought's (presumed) soundness, the more elaborated the judgment, and the faster it dawns, the more natural is the cognition involved. By contrast, conjectures that we approve only after we have spent some time reflecting on them and carefully weighing the evidence for and against them are comparatively unnatural. Natural cognition is what comes to all of us easily.[3] It takes little, if any, work.

These preliminary comments should already signal why *all* of the assessments of the naturalness or unnaturalness of cognition in this book presume the qualifier "comparatively" (even if they do not always explicitly include it). This brief gloss on the naturalness of Mr. Quiverful's insight appeals to three different dimensions, each of which varies continuously. Our cognition can come (1) with more or less obviousness or transparency, (2) in more or less detail, and (3) more or less quickly. So, not only are these evaluations *not* all or nothing, they also do not turn on some precise metric by which we can measure cognitive naturalness. Claims about the naturalness of various elements of cognition are only estimates, sometimes rough estimates, that arise from weighing numerous considerations simultaneously.

Dealing methodically with such complex problems of multiple constraint satisfaction often involves balancing many more dimensions than we can readily keep in mind. Still, in familiar realms humans usually do not find such problems too hard, especially when they are posed comparatively and especially when the comparisons are stark. So, for example, the success of numerous car manufacturers worldwide testifies to the fact that although considerations of price, size, design, comfort, handling, mileage, reliability, available features, the ease and cost of maintenance, and more can figure in people's decisions about what car to buy, most people manage to make such decisions without too much trouble.[4] While all of my assessments of the naturalness or unnaturalness of cognition are either explicitly or implicitly comparative, not all of those comparisons are stark. For example, both scientific cognition and religious cognition explain and predict. Such overlap, however, is the exception, not the rule. Even where there is overlap, we can often ascertain differences that are systematic and incline toward cognitive naturalness in the case of religion and toward cognitive unnaturalness in the case of science.

So far, then, I have suggested that natural cognition occurs when, straightaway and without reflection, human beings seem to grasp something complex about their environment. They immediately possess intuitions about some matter that are far more elaborate and refined than the readily accessible evidence supports. To say that these intuitions are insufficiently supported by the available evidence isn't the half of it. Often it is not obvious what evidence suggested them. (Trollope's account intimates that the one thing Mr. Quiverful is not completely sure about is what exactly it was about Slope's demeanor that enabled him to infer what he did so readily.) Such *intuition* is the principal manifestation of natural cognition in our mental lives.

Transparent Knowledge

As a first pass, then, beliefs and actions that are intuitive, familiar, and held or done without reflection qualify as cognitively natural. Typically, such beliefs and the actions associated with them are unremarkable and seem part of the normal course of events. Expecting a salesperson on the other end of the line might be a "natural" thing to think when the telephone rings during dinner. Closing the window is the "natural" thing to do when you feel a cold draft. Often, without hearing either what people have to say or the tone of voice in which they speak, mere glimpses of their postures and faces will elicit intuitions about their emotional states.[5] That this is generally true even when people have not met before and even when they are from different cultures only provides further grounds for deeming such perceptual capacities natural.

What I referred to earlier as the "soundness" of cognitively natural beliefs is often only apparent. Although judgments deemed natural in this sense do not require reflection, they do not preclude it either. For example, people might reflect at length on the principles that inform their systems of etiquette. Subsequent inquiry may show that intuitive beliefs about etiquette fail to square with other principles to which we subscribe. Thus, we might detect the tension between preferring that males hold doors for females and affirming the equality of the sexes. Participants in psychological experiments are sometimes startled by their inability to formulate persuasive arguments for moral convictions that they have previously found intuitively and emotionally compelling.[6] In other domains reflection may simply reveal that our intuitive beliefs are false. People's intuitions about basic mechanics, concerning such things as predicting the paths of projectiles, are frequently mistaken.[7]

The opening sections of the next chapter will further scrutinize the apparent soundness of perceptual judgments and intuitive beliefs. For now, though, it is the respect in which their (presumed) soundness is not apparent that will concern us. Often *what* we seem to know and *that* we seem to know it are *so* transparent that we take no notice of either. It is as a result of a cognitive accomplishment, although not a conscious one, that we immediately grab for the glass rolling toward the edge of the table, yet it involves neither summoning what we can articulate about the law of gravity and about the comparative brittleness of glass nor explicitly drawing the requisite inferences. Such intuitive knowledge is transparent in the related sense that it is often not only what we know the world with but what we perceive the world through. The operative assumptions in each case constitute our general background knowledge, which both frames and enables our transactions within our physical and social environments.[8] Frequently, knowledge this transparent becomes, in effect, invisible.

People fail to see just how much they know, because they know it so effortlessly and instantly. (It feels to them like they have known it all along.) They also fail to realize how much they know, because, generally, they are aware of such knowledge only when circumstances violate their expectations. Thankfully, such events are infrequent; otherwise, we would have great difficulty getting by. Glasses do fall to the floor when they roll off of tables. We almost always recognize our family members and old friends. Violations of our expectations probably arise most frequently in linguistic exchanges. Sometimes people's comments simply "do not compute," and we must request clarification. We know the language our conversational partners speak, how it sounds, what constitutes a sensible response to the last thing that we said, and sometimes we even know exactly what they will say next. Largely unconscious expectations structure how we understand the world. Transgressions of those expectations stick out.

Humans also tend to overlook the fact that they know things that they have known for a long time. People seldom think about the fact that they know that rigid objects retain their shapes when they are moved, that the offspring of two creatures of the same type is also a creature of that type, or that one way of asking an English speaker how far it is to the moon is to utter the question, "How far is it to the moon?" That such things are true seems obvious. What is not obvious most of the time, though, is that it is also perfectly appropriate to say that we *know* all of these things—certainly in the nontechnical ways we ordinarily talk about knowledge and certainly if we have been made aware of the fact that we do know these things.

What is also not obvious is just how many of these transparent things we know. One way to glimpse the extent of such knowledge is to begin to compile a list of arrangements that would violate our expectations. The easiest way to do this is to start itemizing our "negative" knowledge. We know that water does not flow uphill, that hammers do not breathe, that we do not eat through our ears, that giraffes have no opinions about the World Trade Organization, that newborns do not write novels, that for me to get three pieces of candy when you get only one is neither an equal division of the candy nor, all else being equal, is it fair—and on and on and on. The possibilities seem endless.

But even this is not all. People also tend to forget that they know the things that they never forget. People know that they have two legs and feet, that their shoes go on their feet, and that they should not step on strangers' feet. People just as readily forget that they know the things that they never forget how to do, even when those actions are quite complicated. For example, they know how to put their shoes on and tie them, they know how to walk across variable terrain, and most children (of a certain age, at least) know that if they step on strangers' feet, they have committed a mistake that calls for some form of redress—whether they can say much about it or not, let alone whether they have mastered the social skill of apology.

Cognition as Embodied and Embedded

Developing such skills and carrying out such actions as putting on our shoes and tying them, walking across variable terrain, and, especially, recognizing our lapses in etiquette and using social skills to remedy them depend on extensive and sophisticated cognitive processing. When actions become automatic, the underlying cognitive operations and, arguably, the actions themselves also qualify as cognitively natural. Patricia Churchland argues that the theory of evolution counsels that more sophisticated forms of animal cognition, including that of humans, have their roots in the systems and processes that enable animals to move through irregular and often dangerous environments.[9]

Theorists from the cognitive sciences have extended Churchland's insight in two related directions. First, they argue that understanding how the mind works requires acknowledging that every type of mentality that we can study, including our own, is embodied in material systems and that our bodily experiences shape our ideas.[10] One kind of evidence that supports the latter is the pervasiveness of metaphors that appeal to the physical, spatial, and bodily when we talk about abstractions. We speak readily (and transparently) about "the *force* of an argument" and "the *weight* of considerations," about "the *spread* of liberty" and a comment's "*containing* some truth," and about how marriage can be "a *balancing* act," "a *tug of war*," or "a *journey*."[11] Neuroscientists and cognitive psychologists cite clinical and experimental evidence suggesting, first, that virtually all of our cognitive operations at the conscious level involve intimate links to emotional states and, second, that unconscious features of cognition are closely connected to our perceptual and motor capacities.[12] In short, they stress that cognition is embodied.

The second extension focuses on the fact that cognition is also embedded. The bodies in which minds reside always operate in one or another context. Humans' physical and social environments often play a pivotal role in their cognitive successes. This can occur without human artifice, as when a hiker selects a naturally occurring feature, perhaps a pair of particularly large boulders, as a landmark. Far more often, though, humans enhance their cognitive powers by exercising their technical intelligence to alter their physical environments (for example, by installing periodic markers along a trail) or by exercising some combination of their technical and social intelligence to organize their social environments (for example, by constructing buildings for particular purposes, such as libraries, factories, and homes).

Structuring physical and social environments are not uniquely human accomplishments. Chimpanzees fabricate tools and cooperate (modestly) in hunts. Human toolmaking and environment-structuring, however, so exceed these capacities in other species that their study necessitates specialized sciences such as anthropology, sociology, economics, and political science.

Cognitive accomplishments are not confined to what transpires in people's heads. Human beings regularly construct artifacts to help them think. Try, for example, multiplying two four-digit numbers without the aid of a pencil and paper or a calculator. Among the vast array of humans' tools it was the development of writing and associated technologies (around five thousand years ago) that drove the most profound changes in humans' cognitive abilities. By imposing coded, symbolic structures on things in the environment, we accord them roles in our cognitive processing and thus transform these items into enduring cognitive accessories. Our writings usually last far longer than our thoughts. Our writings can certainly contain far more detail than we can recall. For some kinds of problems such external cognitive prostheses—from marks on a stick to pencil and paper to the newest supercomputers—are not optional equipment but *integral* components of the requisite cognitive machinery.[13] As Matthew Day has noted, the solutions to some problems may, quite literally, be *unthinkable* without them.[14]

Humans also structure their environments to support their cognitive ends. Such active structuring might be said to constitute an extension of our mentality into the external environment—both physical and social.[15] Environments ordered *by* or *as* tools that we have crafted to help us think provide scaffolding for cognitive exploits that would otherwise be not just unattainable but even unimaginable. Perhaps the best illustrations are the ways humans off-load information into their environments in order to avoid having to remember so much. Prior to the invention of writing, this was usually an irregular and haphazard process. For the past few thousand years, though, once we got smart enough to write out receipts, "to-do" lists, and directions—not to mention our best stories, ideas, and speculations—we have come to rely overwhelmingly on the technology of writing. Organizing the contents of our basement shelves may be a far more mundane way of unburdening our memories, but it is no less effective. To appreciate how cognitively valuable such arrangements can be, consider the problems that changing residences can present, especially for the elderly. Leaving their homes, for which they have well-developed spatial memories that they use to get through a day, for new quarters for which they do not possess such knowledge is disruptive at best and can appear to have induced dementia virtually overnight.

Or take grocery shopping. Keeping a grocery list stores information externally. Positioning a pad and pencil for that list prominently in the kitchen increases the probability that the list is both accurate and current. Situating it close to the door improves the chances that people doing the grocery shopping will remember to take the list along. When the entire system works, the shoppers' mnemonic skills rely on structures outside of their craniums.

We also manipulate our social environment. The grocery list not only absolves everyone from recalling what needs to be purchased, but, posted as it is, it also distributes at least some of the responsibility for keeping the list. Instead of individuals making separate lists that the shoppers must compile, household members construct the list collaboratively.

Humans not only live in a world of artifacts and architecture; they also participate in a variety of social arrangements. They are intimates with families and friends, members of corporations and clubs, and citizens of neighborhoods and nations. These social arrangements enable people to manage a host of cognitive challenges collectively, from households producing grocery lists to insurance companies aiding customers to crews sailing vessels across the seas.[16] Many systems in the modern world are so vast and so complex that their effectiveness depends on distributing the requisite knowledge across armies (sometimes literally) of individuals acting in coordination.

Active coordination, however, is not always necessary. Sometimes, as with well-run markets, the knowledge (for example, of the value of some good or service) emerges over time from local, noncoordinated actions of numerous individuals, none of whom possess that knowledge beforehand. Social divisions of cognitive labor—scribes, craftsmen, physicians, priests, and so on—existed for thousands of years before manufacturers in the Industrial Revolution began to apply similar principles to the production of material artifacts. The birth of agriculture and cities presented human beings with cognitive challenges the solutions to which depend fundamentally upon social organizations that ensure the distribution of problem solving, knowledge, and responsibility. The resulting networks structure people's physical and social environments and build complex dynamic systems that provide solutions to cognitive problems larger than any individual or even a group of individuals can comprehend or manage.[17] Surely, one of the verdicts of the history of the twentieth-century is that for all of their imperfections and susceptibilities to abuse, decentralized markets, if properly regulated, are for most goods and services much better mechanisms for obtaining such things as equilibria between supply and demand (and, thereby, stable prices) than are systems of central planning.[18]

Two Types of Natural Actions

Given how embedded in complex social and physical systems our perceptions, thoughts, and actions are, it is all the more remarkable how natural most of them seem. I argued earlier that neither the continuousness nor the multiplicity of the variables that make for the naturalness of cognition prevent us from distinguishing between thoughts and actions that are more or less natural. Nor do they prevent us from understanding the different kinds of naturalness associated with perception, cognition, and action. Before taking up cognition more directly, it will help to look at divergent kinds of human action in order to appreciate the motive for drawing such distinctions.

Some familiar, unreflective actions we undertake, like chewing or walking, seem perennial. We literally cannot remember when we were unable to do these things, but, in fact, each of us learned them in the first year or so of life. Other actions that seem comparably natural, such as writing or riding a bicycle, are also skills that we had to learn. The actions in this second group feel every bit as ingrained (it is often noted, for example, that people never forget how to ride a bike) and automatic (try writing cursive at normal speed while simultaneously concentrating on the formation of each letter) as chewing or walking. Riding and writing, however, differ from chewing and walking. First, the acquisition of riding and writing skills is not lost in the fog of childhood amnesia. We not only know that we had to learn these skills but most of us remember learning them. The distinction between the two groups of actions in question, however, concerns much more than memory.

Many activities of the second sort involve artifacts—but not all. Dancing, for example, does not. But many do. Writing and riding use writing instruments and bicycles that were created at specific points in human history. Thus, unlike us, sufficiently distant ancestors would have found neither riding nor writing familiar, let alone unreflective or automatic.

Most people learn how to write and how to ride a bicycle during the early school years—sometimes later than that, occasionally much later than that, but usually not much before. Learning such skills almost always involves some consciously structured and targeted assistance and, often, explicit instruction from older people, who have already mastered them.[19] We may offer pointers to beginners such as "be careful not to ride over large stones." Instructors seem convinced that imparting such propositional information helps. They offer it even when the goal is the acquisition of a bodily skill, which—regardless of what anyone *says*—they know from experience is mainly acquired through practice. (Some cultures have structured the process of learning to ride a bicycle in a way that cuts down on the perceived need to offer advice and explicit instruction. They do so by dividing the overall task into separate steps. For example, in much of Europe, learning to balance and steer a bicycle begins before school age with younger children learning to ride two-wheelers that have no pedals. They learn to balance and steer long before they graduate to learning how to pedal.) Still, coaching frequently seems to count, and the relative levels of expertise people manifest with skills like riding and writing vary much more within a population than is the case with more basic skills like chewing and walking. At least initially, the *practice* necessary to acquire these skills includes cognitive processing that is as conscious, deliberate, and focused as cognitive processing can be. Unlike chewing and walking, writing and riding a bicycle are not skills that all normal members of the species, across its entire history, exhibit on the basis of merely being human.

The distinction implicit here will help clarify the subset of natural cognition that I wish to concentrate on in the remainder of this book. Adults competent in all four of the skills in question find them habitual, unreflective, and automatic. In short, they find these actions *natural*. As I suggested earlier, though, that broad use of the term obscures some important differences. Chewing and walking—as opposed to writing and riding—are skills whose acquisition typically:

(1) occurs in early childhood and is not recalled,
(2) is not associated with particular artifacts,
(3) does not require older humans, who already possess these skills, to consciously structure the learning environment or any assistance or instruction they may offer, and
(4) does not turn either on inputs that are particular to a culture or (even) on inputs that are culturally distinctive.

Regarding the third point, teachers of early elementary grades use an assortment of models, drills, and special techniques to aid children in developing the fine motor skills necessary for writing. Whether the tips that we offer children about riding bicycles also merit the term “instruction,” we certainly do not say just anything that comes to mind when we are helping a six-year-old learn how to stay upright without his or her training wheels. In addition, we search out appropriate places to conduct lessons, and we purposely employ different techniques for steadying their bicycles as our students progress. (As students attain better balance, bicycle-riding-instructors usually stop holding the handlebars and clasp parts of the bicycle further aft, where they are mostly out of sight.) By contrast, caretakers do not teach infants how to chew or walk. Typically, they do not consciously model these activities for them either. While adults constantly engage in these actions around infants, they almost never do so with the intention of illustrating how they should be done. Research in developmental psychology indicates that before their first birthdays infants are sensitive to the differences in adults' behaviors on these fronts. On the basis of cues such as eye contact, prosodic patterns, direct address by name, and contingent reactivity, preverbal infants can differentiate and respond to what they take to be "pedagogical" intentions.[20]

Nothing hinges on the specific examples of chewing and walking. Developmental psychologists have highlighted other behaviors that adults manifest around infants that model more sophisticated actions than infants can perform. Nevertheless, adults do not consciously model these behaviors. For example, parents and relatives tend to set up repeated and highly structured "face-to-face exchanges" with infants, in which they make eye contact, mirror the infant's emotions back to them, and, especially later on, vocalize to them in patterns that mimic the turn-taking rhythms of conversations.[21] Reciprocally, by two months of age human infants begin to give faces more detailed attention than previously, when they looked mostly at faces' external contours.[22]

Humans' nearest relatives in the animal kingdom, apes and monkeys, do not do this.[23] Their concern for their young notwithstanding, they do not repeatedly engage in such structured face-to-face encounters with their infants. Among most of these species, prolonged direct eye contact is not a means for establishing the basic skills of social cooperation; it is a means of expressing a threat.[24] Although prolonged eye contact is a peculiarly human form of interaction with infants, again it is not a behavior that adults consciously plan or model. These are activities that adults generally carry out spontaneously and without reflection.

Point four emphasizes not only the universal emergence of skills like chewing and walking among human beings but also, especially, the imperviousness of that emergence to differences in cultural practices. (What seems true here about the emergence of motor skills seems even more obviously true about the development of our perceptual capacities.) Cultures do vary with respect to when caretakers introduce solid foods to infants, what foods they introduce, and how they introduce them, but those differences do not matter. Infants in all cultures quickly discover how to chew. The same goes for walking. Different cultures approve or disapprove of diverse speeds and gaits for various persons in various circumstances, resulting in distinctive styles both within and between cultures even for something as commonplace as walking. These cultural divergences are tellingly portrayed in a scene in the 1999 film *Topsy Turvy* (about the writing and initial production of Gilbert and Sullivan's comic operetta, *The Mikado*). Desiring his actors to exhibit cultural accuracy in their walking, William Schwenk Gilbert (played by Jim Broadbent) recruits three young Japanese women, who are visiting London in connection with a cultural exhibition, to demonstrate how they walk. They illustrate for the actors and the choreographer the walk appropriate in nineteenth-century Japan for "three little maids from school."[25] Gilbert recognizes that how people walk can vary from one culture to the next. His insight notwithstanding, the point here is that none of these differences prevents infants from learning how to walk.[26]

To summarize, then, actions that humans find natural, in the broad sense that I have employed up to now, are of two types. The second of those types issues from skills such as writing and riding bikes that are activities invented at some particular point in human history and that spread from culture to culture. Acquiring these skills usually turns on experienced instructors modeling them and providing detailed, targeted tutelage in specially designed or consciously selected environments that novices will typically recall something about. A host of factors beyond their mere availability within a culture determine whether individuals obtain these skills and become adept at these actions. Those factors include access to the requisite artifacts, teachers, and environments as well as time for all of the practicing that is required. Initially, beginners (who are, typically, at least school age, that is, five to seven years old) must devote considerable concentration to these endeavors, but eventually these skills become familiar, automatic, and unconscious. With extensive practice these thoroughly *cultural* activities eventually begin to feel natural. They become *second nature*. (Often it is not easy for adults to recall what challenges writing and riding once seemed.) However natural they may come to feel, though, their cultural origins should, by now, be evident. Theirs is a *practiced* naturalness.

These practiced, cultural skills contrast with *maturational* skills, such as chewing and walking. Maturational actions are activities that in suitable circumstances human infants in every culture undertake on their own.[27] No one devised these activities, nor does their emergence rest on connections with artifacts. They serve functions and, at least in the case of chewing, include a general form that is as applicable to some other species as they are to humans. Acquiring maturational skills does not hang on instructors modeling these actions or structuring learning environments or devising verbal representations or targeting such representations at novices. No doubt, their mastery demands the exercise of these skills, and babies' initial efforts do involve concentration, but it is clearly not the kind of concentration associated with practicing cultural skills. Certainly, it does not aim at productively integrating knowledge of kinesthetic experiences with the knowledge gleaned from teachers' instructions.

It is the naturalness of actions in this maturational sense that will help clarify the notion of cognitive naturalness that I will concentrate on in this book. The category of maturational naturalness goes beyond the rough and ready criteria of intuition, familiarity, and the absence of reflection that I offered earlier. By now it should be clear that actions can seem natural for different reasons. Unlike the practiced naturalness of cultural skills, maturational skills are so fundamental to human life that their appearance helps to define what counts as "normal." Humans acquire many maturational skills not only in the first year or two of life, before they go to school, but in some cases before they even seem to comprehend much language and certainly before they have begun to produce it. The actions to which maturational skills give birth are justifiably described as natural in a more fundamental sense than are those associated with cultural skills, and it is this maturational naturalness on which I shall focus in this book to compare science and religion. Action and thought (and, of course, perception) that we find transparent, intuitive, and familiar can arise on the basis of either maturation or practice, but because of their spontaneity, their early onset, their ubiquity, and their independence both from explicit instruction and from other forms of culturally distinctive support, maturational naturalness trumps practiced naturalness. But assertions about forms of thought and perceptions are a bit premature, since I have, so far, only discussed in detail the applicability of the distinction between maturational and practiced naturalness with regard to action.

Two (Parallel) Types of Natural Cognition

Gilbert rightly spotlighted culturally appropriate styles of walking for his cast, but the *cultural infiltration* of maturational skills has little, if any, bearing on their simple emergence in normal human beings. The distinction between two types of actions that feel natural does not challenge the claim that all cognition is embodied, but it does suggest that it may sometimes be possible to overplay how much some forms of cognition may be culturally embedded or, more precisely, how much their being culturally embedded pertains either to their simple acquisition or to their overall shapes. Culture unquestionably tunes maturational capacities. It gives them culturally specific features. But culturally specific dimensions play little, if any, role in either the timing of those maturational capacities' emergence, their bare acquisition, or their general architectures.

Language, of course, is the most obvious example of cultural infiltration of a maturational skill. Children who grow up where everyone speaks Turkish themselves speak Turkish, whereas others who grow up where everyone else speaks Norwegian end up speaking Norwegian. Culture, no doubt, infiltrates every form of maturational naturalness at some level or other. (Consider the variety of foods on which infants around the world learn to chew.) Which language a child learns to speak, however, is readily distinguishable from the more general readiness of children in the first few years of life to acquire natural language. This logical point ushers in a causal one. Divergent features of cultures do not seem to have any significant role in determining common patterns of maturational actions that arise in every culture.[28]

The distinction between practiced naturalness and maturational naturalness applies no less readily to intuitions, thoughts, and beliefs.

Cognition too can seem natural simply because it is well-practiced and because it is culturally well-supported or, on the other hand, because it emerges, independently of any culturally distinctive influences, in the course of human development. (See figure 1-1.)

Like practiced, culturally informed actions, some intuitions result (i) from schooling and the study of some culturally articulated domain, (ii) from conscious, laborious, and extensive exercise with routine problems and tasks in that domain, and, eventually, (iii) from experience in independently traversing the domain's associated cognitive pathways. Examples include the intuitions that arise from learning everything from scansion, musical notation, and small motor repair to geometry, pedagogy, and tactics in chess. The breadth and amount of people's intuitions in such areas correlate fairly well with the extent of their preparation and experience. Experts are people who have had solid preparation and extensive experience in some domain, including many of its remotest corners. Experimental psychologists have found that in addition to possessing numerous, developed intuitions, experts also enjoy enhanced powers of perception, speed in making inferences, and memory for pertinent materials.[29]

Some areas of culture are so difficult to understand that few people are able to acquire expertise in those domains. Consequently, many people will not share experts' intuitions in those areas. I will argue later

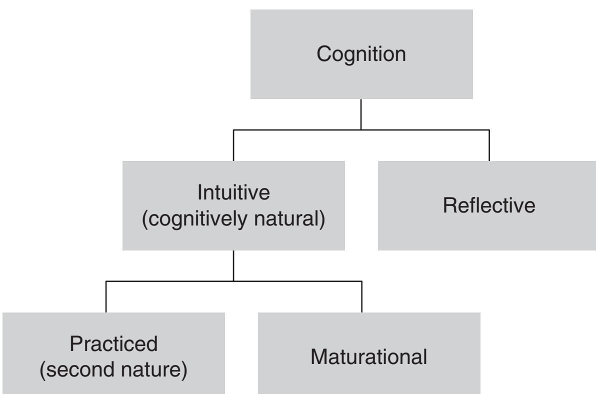

Figure 1-1. Two types of cognitive naturalness in perception, thought, and action

that science is a parade case for such arrangements, but virtually any of the traditional, educationally certified professions would qualify. Litigators have strong intuitions about which kinds of arguments to use with juries and which kinds to use with judges. Librarians immediately know good ways and places to look for various kinds of information in libraries. Engineers automatically recognize which materials will meet particular structural demands.

By contrast, other cultural accomplishments become so critical to human thriving that nearly everyone gains the necessary experience to be able to carry them out unreflectively most of the time. The skill and the knowledge that we all need in order to manage indispensable pieces of technology leap to mind (for example, in most of America, knowing how to drive a car as well as knowing the rules of the road). But cases that do not involve the command of any elaborate technology are plentiful too. For example, most citizens in developed countries have constructed representations of how their nations' postal systems work. They grasp the relationships between the major variables affecting the cost of sending a piece of mail and the efficiency with which it is delivered. Correspondingly, they have at least rough intuitions about how, when, and where to post items to ensure that they will arrive safely and on time.

In comparison with knowledge about cultural domains such as science, engineering, and law, knowledge about complex systems like the postal service is widespread. The familiarity that experts enjoy with the former and that most of us enjoy with the latter supports bodies of knowledge that become so commonplace (in the relevant populations) that they seem natural in many of the same ways that writing and riding a bicycle do. Parallel, then, to practiced, culturally supported *actions*, which become so well rehearsed and habitual as to seem natural, are *perceptual* and *intellectual* competencies that people acquire within various culturally articulated domains. Different people master different precincts with the thoroughness necessary to sustain large collections of instant percepts, apposite intuitions, automatic inferences, and deft actions. Some areas attract wider attention than others. For example, the distribution of knowledge about postal services almost certainly surpasses that associated with classical music. So, many of us would be able to infer automatically that the customary first-class postage (for a letter weighing less than one ounce) would not suffice for mailing a large envelope containing a sixty-page document, but far fewer would immediately conclude from listening to the final movement of Franz Schubert's ninth symphony that he was, among other things, paying homage to Beethoven. Both, though, are examples of culturally supported knowledge that various numbers of humans, depending upon the topic, know so well that they regularly forget that they know it.

For the comparative assessment of the cognitive naturalness of science and religion, however, it is the forms of cognition and perception that are analogous to maturational skills that matter. With cognition and perception as with skilled actions, cultural materials can come to feel natural after repeated practice or intensive study, but the maturational naturalness (of action, cognition, and perception) is the more fundamental form, because maturational knowledge arises in human minds regardless of the peculiarities of cultures. Maturational cognition, like chewing and walking, concerns not only things that humans know well but things that they have known *so long* that they have forgotten that they know them. The considerations I have outlined that differentiate the maturational from the practiced naturalness of actions are the following:

- No one invented them.
- Their emergence never depends upon artifacts (though some cultures have developed artifacts to facilitate their acquisition).
- Humans undertake them spontaneously.
- A few have general forms that we share with other species.
- Their acquisition does not depend upon explicit instruction or specially structured learning environments, and it does not turn either on inputs that are particular to a culture or (even) on inputs that are culturally distinctive.

These also apply without a hitch for discriminating the maturational from the practiced naturalness of knowledge and cognition. That this is so offers indirect support for Churchland's thesis that the architectural and operational principles governing the systems and processes in the brain that manage bodily movement also anchor humans' cognitive achievements. This suggests (i) that most of humans' maturationally natural forms of knowledge will arise comparatively early, (ii) that they will address some of the most basic problems that humans face (like those that are solved by chewing and walking), and (iii) that they will prove to be so ubiquitous that their emergence counts as normal development. In contrast to capacities that possess a practiced naturalness and are second nature to us, perception, cognition, and action that possess maturational naturalness are first nature to us.