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The Naturalness of Religion and the Unnaturalness of Science

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Aristotle's observation that all human beings by nature desire to know aptly captures the spirit of "intellectualist" research in psychology and anthropology. Intellectualists in these fields agree that humans have fundamental explanatory interests (which reflect their rationality) and that the idioms in which their explanations are couched can differ considerably across places and times (both historical and developmental). Intellectualists in developmental psychology (e.g., Gopnik and Meltzoff 1997) maintain that young children's conceptual structures, like those of scientists, are theories and that their conceptual development—like the development of science—is a process of theory formation and change. They speculate that our explanatory preoccupations result, at least in part, from a natural drive to develop theories. Intellectualists in the anthropology of religion (e.g., Horton 1970, 1993) hold that, although it may do many other things as well, religion is primarily concerned with providing explanatory theories. They maintain that religion and science have the same explanatory goals: only the idioms of their explanations differ.

The connections between the concern for explanation, the pursuit of science, the persistence of religion, and the cognitive processes underlying each clearly merit further examination. By considering both their cultural manifestations and their cognitive foundations, I hope to clarify not only how science and religion are related but some of the ways their explanatory projects differ.

I shall argue that, despite their centuries' old antagonisms, no development in science will ever seriously threaten the persistence of religion or the forms of explanation religion employs or the emergence of new religions. (I strongly suspect that science will never seriously threaten the persistence of particular religions either, but I only aim to defend the

weaker, collective claim here.) In section 3.3, I shall show that religion and its characteristic forms of explanation are a "natural" outgrowth of the character and content of human association and cognition. First, though, I must say a few words about the senses of "natural" I have in mind and note some respects in which religion may seem "*un*natural". The principal aim of section 3.2 will be to show that at least on some fronts science does not come at all naturally to humans.

3.1 Preliminaries

Although science studies the natural world and religion seems concerned with supernatural worlds, I shall argue that, cognitively speaking, it is religion that is natural and science that is largely unnatural. Describing some aspect of human mental life or conduct as "natural" can support a vast number of possible meanings. I shall focus on two.

We say that a belief or action is "natural" when it is familiar, obvious, self-evident, intuitive, or held or done without reflection—when it seems part of the normal course of events. Closing the window is the "natural" thing to do when sitting in a cold draft; expecting a salesperson on the other end of the line is the "natural" thing to think when your telephone rings during dinner. Of course, what counts as the normal course of events depends, in part, on our social and cultural circumstances.

Judgments and actions deemed "natural" in this first sense typically do not require reflection. That they are obvious or self-evident does not, of course, preclude reflection in such domains. For example, people might reflect at length on the principles and preparation that inform their system of etiquette, although provided their elders have successfully imparted to them the social graces, that reflection is unlikely to have much impact on their on-line judgments and behaviors.

The point of calling many features of religion "natural" and many features of science "unnatural" in this first sense is not merely to note that much about religion is so readily available that it does not even prompt reflection, whereas much about science does. The point is also that even when reflection about religious matters occurs, nonreflective habits of mind typically overwhelm its effects in on-line cognitive processing (see, for example, discussion of Barrett and Keil 1996 in section 3.3).

Thoughts or acts can also said to be "natural" in a more restrictive sense, if they have features that rest on what Pascal Boyer (1994) has called

"noncultural" foundations. This second sense is more restrictive: things counted as "natural" on the basis of their comparative independence from specific cultural input form a subset of those deemed natural in the first sense, that is, ones that seem familiar, obvious, or self-evident. These aspects of human activity and mental life not only do not require extensive cultural support, often it is not obvious that they require much of any cultural support.

Two considerations bear on "natural" in this second sense. The first, less easily measured consideration concerns the relative superfluousness of particular cultural arrangements for the generation and persistence of the behavioral patterns and cognitive accomplishments in question. The second, more important consideration for the purposes of this chapter is cognitive.

Some cognitive capacities seem to turn neither on any particular cultural input nor, as in the case of face recognition, on any peculiarly cultural input at all. Children's proclivity to acquire language and nearly all human beings' appreciation of some of the basic physics of solid objects, their assumptions about the mutual exclusivity of taxonomic classes in biology, and their abilities to detect and read agents' minds are just some of the proposed candidates for human cognitive capacities that arise independently of any particular cultural input.

These capacities seem in place comparatively early in human development, and their functioning usually seems both automatic and fast. Their operations occasion no conscious searches for evidence, and even if they did, the associated inferences seem woefully underdetermined by whatever evidence might be available. Why, for example, should shifting his weight to his other side and momentarily raising an eyebrow make us so confident that our interlocutor is skeptical of our claim?

Whether such considerations (together with the noncultural status of the underlying cognitive processes and representations) require that these capacities also be innate has been a point of considerable debate over the past thirty years (see, for example, Spelke 1994). The more interesting question, though, is what being "innate" might amount to (see, for example, Karmiloff-Smith 1992). As Jeffrey Elman and his colleagues (e.g., 1996, 369) have noted, some of the representations and processes in question are, quite possibly, the nearly inevitable outcomes of comparatively minor variations on familiar principles guiding learning in neural networks.

In calling religion "natural" and science "unnatural" in this second sense, I am suggesting two things. First, the elaborate cultural institutions surrounding each play a far more integral role in the generation and persistence of science than they do in the case of religion. (Indeed, for some religious systems, for example, among prehistoric hunter-gatherers, such far-reaching cultural institutions have never existed.) Second, most of the cognitive activity underlying religion concerns cognitive processes that rely far less on particular cultural input, particular forms of cultural input, or even peculiarly cultural input than is the case with science.

Such claims about religion are contrary to appearances. Focusing on the idioms in which religion frames its explanations can foster a sense that religion is unnatural. Religious presumptions about superhuman agents who have extraordinary properties and do extraordinary things contribute to the intuition that religion is less natural than science. After all, allegedly miraculous events conflict with almost everyone's common sense. Even the most experienced and sensitive scholars of religion periodically confront alien religious beliefs that strike them as either bizarre or hilarious. The apparent uselessness of rituals also contributes to this impression. Rituals often seem like empty forms at best, but more often, like utterly pointless activities.

Nothing, though, promotes the notion that religion is unnatural more than the practice throughout the field of religious studies of insisting (1) that religion and religious experience, in particular, are unique; and therefore (2) that religion requires special methods of study. Various scholars of religion (see, for example, Farley 1988, 68–69; Cannon 1996, 43; and Paden 1992, 10) maintain that religion's distinctive status sets a singular, principled constraint on the effectiveness of scientific proposals to explain it. They deny that customary forms of explanation in the natural and social sciences will yield *telling* accounts of religious phenomena—holding, in effect, that the modes of study deemed most worthwhile in the investigation of the natural world are especially limited or inadequate when it comes to religious phenomena. Indeed, these putative limitations on scientific methods result from the assumption that religion is unnatural or that it deals with the nonnatural.[1]

My goal in section 3.3. is to shake this impression of religion's "unnaturalness". I shall discuss the respects in which religion (including its principal forms of explanation) can be fairly described as "natural" (in both of the relevant senses). Contrary to the sentiments that inform so much

research in the field of religious studies, many features of "religious cognition" are not at all extraordinary, and thus the methods and findings of the cognitive sciences can illuminate them. Consequently, contrary to widespread assumptions in both religious studies and anthropology, gaining insight into related aspects of religious systems may not depend on scrupulous attention to all of the details of cultural contexts. My case turns largely on surveying analyses of religious idioms (concerning both thought and action) and their underlying ontologies that have emanated over the past decade from cognitive accounts of religious phenomena. Those accounts reveal just how "natural" the forms of religion and of religious explanation are—at least in comparison to the explanations science advances.

First, let us turn to respects in which science may be described as "*un*natural" in the two senses at hand. Let me emphasize that I do not intend to portray the comparative naturalness of religion and science as a stark or obvious contrast, but only to suggest that it is religion and not science that has the greater natural appeal.

3.2 The Unnatural Nature of Science

In making my case for the comparative unnaturalness of science relative to religion, I do not aim to undermine arguments of developmental psychologists (Carey 1985; Gopnik 1996; Gopnik and Meltzoff 1997) to the effect that the cognitive maneuvers of children and scientists are similar in many respects. These developmentalists argue (1) that scientists' and children's conceptual structures are theories; (2) that, for children as well as scientists, these theories provide explanations of events in the world; (3) that, like scientists, children are sensitive to the role evidence can play in improving their conceptual structures; and (4) that conceptual development in children is, like scientific change, a process of formulating, evaluating, amending, and sometimes even replacing theories.[2]

In claiming that religion is more natural than science, it does not follow that nothing about science comes naturally. Undoubtedly, some cognitive activities scientists engage in—their formation of hypotheses, their attention to evidence, and their elaboration, modification, and replacement of theories—predate the emergence of distinctively scientific traditions and institutions and probably do constitute fundamental operations in cognitive development.

Intellectualists in the anthropology of religion share with intellectualists in developmental psychology (and Aristotle) the conviction that human beings have basic psychological inclinations to make sense of the world around them. They maintain that the resulting presumptions and concerns about obtaining explanations are natural inclinations of the human cognitive system in the senses at hand. But note that if an intellectualist account of religion is on the right track, then religion is *no less* natural in this respect than science is. Religion, no less than science, expresses this natural inclination in humans to the extent that it deploys conceptual structures ("theories"—in the developmental psychologists' comparatively broad sense of that term) for the purposes of explanation.

If the drive for explanatory theories is a psychologically natural, that is, a noncultural, inclination displayed equally, though differently, in science, conceptual development, and religion, then what is it about science that justifies dubbing it "unnatural" (or quintessentially "cultural") and setting it apart from religion and conceptual development? What distinguishes science is, first, the relative sophistication and systematicity it brings both to the generation of empirical evidence and to the assessment of that evidence's import for explanatory theories and, second, the pivotal roles that social and cultural arrangements—as opposed to our ordinary cognitive predilections—play in those processes (see Gopnik and Meltzoff 1997, 20, 38; Gopnik 1996, 508; and Brewer and Samarapungavan 1991, 222).

This is not to question children's recognition of the importance of collecting evidence. Nor shall I question the religious on this front either, though, that may be unduly charitable, as remarks on memory in section 3.3 will suggest. Rather, the points I wish to make turn on highlighting both the centrality and the difficulty of systematically pursuing, producing, and appraising empirical evidence in science (Brewer and Samarapungavan 1991, esp. 221). The requisite skills neither automatically come to human beings nor automatically become habits of the human mind. This is one of the reasons why science must be *taught* and why so many have such difficulty both learning it and learning how to do it.

It is also a reason why speaking of "the scientist as child" is so apt (Gopnik and Meltzoff 1997, 13–47). Children are not so much like sophisticated little scientists as scientists, their considerable training and expertise notwithstanding, are like children, not only insofar as they exhibit similar explanatory interests and strategies, but also insofar as they exhibit the same cognitive biases and limitations that other human beings do.

Whether as children or educated scientists, human beings seek explanations, generate theories, and consider evidence, but they also operate with vague hypotheses, perform fallacious inferences, have memory lapses, and display confirmation bias (see the final paragraphs of this section).

Scientists can get around some of their cognitive limitations by exploiting a vast array of tools (such as literacy and mathematical description) and cultural arrangements (such as journals, professional associations, and the division of labor). Children, by contrast, mostly work in comparative isolation unaided by these tools, unable to take advantage of such arrangements, and unacquainted with the enormous bodies of knowledge to which scientists have access (Brewer and Samarapungavan 1991).

The institution of science does an even better job than either individual scientists or local research teams of getting around cognitive limitations because it is the collective product of an international community of inquirers for whom prestige, fame, and wealth turn, in no small part, on their seizing opportunities to criticize and correct each other's work. Such communal features of the scientific enterprise establish and sustain norms that govern scientific practice. They also ensure that the *collective* outcome of the efforts and interactions of mistake-prone individuals and small research groups with one another in the long run is more reliable than any of their individual efforts are in the short run. (Contrary to the intellectualists in anthropology, the divergent idioms in which science and religion frame their explanatory theories are not the only things that distinguish them.)

Gopnik and Meltzoff (1997, 13) concede that insofar as such social considerations "are an important part of theory formation and change in science, whatever the children are doing is *not* science." The creation of explanatory theories and the insistence that they stand up to empirical evidence are necessary but not sufficient conditions for science. In addition to these cognitive proclivities, the invention, persistence, and progress of science depend crucially on developing traditions for extending and criticizing theories with increasing systematicity and insight. Pursuing that process is what Thomas Kuhn (1970) called doing "normal science." Developing such traditions is at least indirectly responsible for the huge range of activities scientists undertake in the course of their work. The pivotal role of these additional cultural arrangements guarantees that science will not inevitably erupt *only* from cognitive dispositions to formulate theories

and to care about empirical evidence. (I shall argue in section 3.3 that religion, by contrast, requires far less cultural support.)

Some of the best evidence of science's unnaturalness, that is, evidence of its substantial dependence on cultural arrangements that entail uncommon and comparatively difficult forms of cognition, is its *rarity*. For some, recognizing that rarity may turn on not confusing science with technology. Science and technology are not the same thing—not because science is independent of technology but because technology can be and once was wholly independent of science. Some historical perspective—indeed, some prehistorical perspective—may clarify this point.

First, the connection between basic scientific research and its technological spin-offs is a comparatively recent phenomenon. Before the nineteenth century, the history of technology is mostly unrelated to the development of science (Wolpert 1992). The invention and improvement of agricultural implements and techniques, weaponry, forms of transportation, and even basic household tools until the last few centuries have turned mostly on the practical ingenuity and creativity of workers and craftsmen who regularly faced the relevant problems. Antonio Stradivari made great violins long before anyone could explain the connections between their construction and their exquisite sound. If literacy is a necessary condition for doing and possessing science, then all of the tools that appeared before literacy are obvious illustrations of the potential independence of technological pursuits.

Unlike technology (and religion, for that matter), science originated *within* human history. Our prehistoric ancestors designed and developed a variety of tools, but they did so without the aid of science. In addition, technology, unlike science, is not the exclusive achievement of humans. We now know that other species have produced tools—other species within the genus *Homo*, chimpanzees and, perhaps, some of the Australopithecines (Mithen 1996, 95–98).

Even in the age of modern science, we still possess a rough and ready but sound intuition that inventors of new technologies like Bell or Edison neither had quite the same interests nor pursued quite the same activities as research scientists such as Maxwell or Morgan. The crucial point is that the practical orientation of technology and the abstract theoretical interest in understanding nature that characterizes science are not the same aims, even if they are regularly interconnected now.

Rejecting the relatively firm distinction between science and technology for which I am arguing leaves the problem of explaining important, discontinuous episodes in the history of human thought. According to many historians and philosophers of science, science has existed at least twice in human history—once among the ancient Greeks and a second time beginning in early modern Europe.[3] In both instances, science instituted ongoing exchanges concerning competing theories about the world that turned, at least in part, on the systematic pursuit, accumulation, and assessment of empirical evidence.

Among the huge range of activities scientists undertake, two deserve particular attention when considering the unnaturalness of science:

1. Scientists develop explanatory theories that challenge received views about empirical matters; and
2. Their critical assessment of those theories highly values evidence born of empirical tests.

Most of the puzzle solving of normal science follows on these activities, especially the second. The important point, for now, is that neither the *contents* of scientific theories that dispute received views nor the *forms* of thought required for such critical assessment come to human beings very readily.

The contents of most new, popularly unassimilated scientific theories agree with common sense no more (and often a good deal less) than do the most fantastic religious beliefs. Science and religion concur that the empirical world is not always the way it appears, and both supply proposals about the realities behind the appearances. Moreover, we sometimes have no better accounts of the underlying forces and factors science champions than we do for the entities religious systems proffer. The accomplishments of Newton and Darwin are examples. Both men advanced theories that depended on presumptions (about gravity and inheritance respectively) for which they had no satisfactory accounts nor, in Newton's case, even any hypotheses.

Science challenges our intuitions and common sense repeatedly. With the triumph of new theories, scientists and sometimes even the public must readjust their thinking (Thagard 1993). When first advanced, the suggestions that the earth moves, that microscopic organisms can kill human beings, and that solid objects are mostly empty space were no less

contrary to intuition and common sense than the most counterintuitive consequences of quantum mechanics have proved for us in the twentieth century. Although science and religion both change, a central aim of science is to arrive at more penetrating explanatory theories that correct and—sometimes quickly, sometimes slowly—supplant currently prevailing views (McCauley 1986).

Admittedly, in well-developed sciences (e.g., chemistry) the vast majority of practitioners today are not out to uproot fundamental theory. Even in the highly specialized research of most contemporary science, however, this central aim has not changed. It is just that the more penetrating explanations and the improved theories typically concern much narrower domains. The recent upheaval in the theory of ulcers is a fitting illustration (Thagard 1998, 1999).

When compared to the history of religion, the cumulative effect of scientific change seems unnatural on another count. In contrast to religious accounts of nature, the history of science has been marked by increasing restriction of the range of phenomena for which agent causality constitutes an appropriate explanation (Churchland 1989). In one domain after another, science has replaced purportedly exhaustive explanations of natural processes and events in terms of agents' decisions and actions with narrower, more detailed, partial accounts of phenomena in terms of (mostly probabilistic) mechanisms. Nineteenth- and twentieth-century science has purged such agent-oriented explanations from biology, and it is the conviction of most cognitive scientists that the next few centuries will go some way toward doing the same for psychology. (Anticipating a bit—those accomplishments have hardly even dented humans' unreflective, "*natural*" inclinations to adopt the intentional stance indiscriminately in unguarded moments. This includes scientists' tendencies to lapse into intentional and teleological talk when discussing the operations of complex systems. (Dennett 1987))

More generally, scientific descriptions differ considerably from common descriptions of everyday phenomena. Contrast ordinary talk of the weather with the technical vocabulary of meteorology or our customary talk of moods with the biochemical accounts of the underlying neurophysiological mechanisms. Science pursues explanations of increasing theoretical depth. A theory's increasing depth involves not just the distance of its specialized concepts from common concepts but also a larger set of events that fall within its explanatory purview—

yielding a wider range of empirically testable consequences. It searches for accounts of reality that are more comprehensive and discerning and for which the production of evidence requires progressively more rarefied circumstances. The efforts and costs associated with apparatus for producing these exotic environments (e.g., a supercollider) or with getting to them (e.g., launching the Hubble telescope into orbit) are sometimes monumental.

Explanatory theories in science possess increasingly greater theoretical depth because, unlike religion, science is finally concerned with understanding nature for its own sake and not merely for its effects on us. Lewis Wolpert argues that the historical scarcity of inquiries committed to the intrinsic value of understanding nature is evidence not only of the comparative unnaturalness of such inquiries but of the limits of humans' natural curiosity. "The idea that man is innately curious is partial myth: man's curiosity extends only to what affects his conduct" (Wolpert 1992, 54). In their pursuits scientists are not impervious to our practical concerns with nature, but such concerns are not necessary for doing science. Many scientists devote their entire careers to highly esoteric, impractical studies of nature's narrowest corners. Their interests in appraising comparatively detailed, low-level proposals ensure that those theories remain empirically responsible (see Barbour 1980, 242).

In addition to the persistent unnaturalness of scientific proposals, institutionalized science also involves forms of thought and types of practice that human beings find extremely difficult to master. The acquisition of scientific knowledge is a painstaking and laborious process. To become a professional scientist requires at least a decade of focused education and training, and even then, the scientist typically gains command of only one subfield within a single scientific discipline. Not only is scientific knowledge not something that human beings acquire naturally; its mastery does not even guarantee that someone will know how to *do* science. After four centuries of astonishing accomplishment, science remains an overwhelmingly *unfamiliar* activity, even to most of the learned public and even in those cultures where its influence is substantial.

The more felicitous comparison here is not with religion on the hoof but with theology. The pursuit of theology involves many of the same forms of thought (e.g., deductive and abductive inference) in which science engages. Unlike science, though, such sophisticated forms of thought are not necessary for either the occurrence or persistence of

religion. Religion can and does thrive *without* theology (Wiebe 1991). In his classic discussion of their religion, Fredrik Barth (1975) insists that the Baktaman of New Guinea are completely unconcerned with theology and that they do not even carry out unsystematic theological reflection.

In science higher-level cultural forces, in contrast to lower-level psychological ones, play a far more significant role in shaping the relevant (explanatory) materials (e.g., the contents of theories as opposed to the contents of myths). The importance of the activities and experiences of a highly trained elite compared with those of an untutored public differs vastly for ensuring the persistence of the two systems in question.

Unlike science, neither the emergence nor the persistence of religion depends on elaborate cultural institutions or the expertise of an esoterically trained elite (either ecclesiastical or theological). Theology as systematic study by either individuals or institutions, although often influential where it does arise, is not at all necessary for the emergence or persistence of religious systems, which occur naturally as reliable by-products of garden-variety features of human cognition and association.

By contrast, science, throughout its history, would not have existed without progressively more sophisticated explanatory theorizing and evidential reasoning and the resulting activities that constitute cutting-edge endeavors. The emergence and persistence of science as a cultural form depend on the coordination—through avenues of professional communication and association—of gifted individuals' invention of new cognitive tools as well as their ongoing refinement of familiar ones, shaping the resulting practices and products along very specific trajectories. These are not activities that come naturally or easily to human beings. Whatever currency scientific knowledge gains within a culture, that knowledge is always the result of determined effort and prolonged reflection of the most esoteric sorts by an intellectual elite.

Scientists, themselves, have produced evidence about the difficulties of doing science. Experimental psychologists (Tweney, Doherty, and Mynatt 1981) have revealed that college-level science students often fail to exhibit the forms of judgment and inference suitable for rational assessment of scientific theories. Even experienced researchers are sometimes prone to erroneous forms of reasoning (Kahneman, Slovic, and Tversky 1982), although they are less likely to make some types of errors when they are operating in areas where they possess expertise.

These sorts of findings have at least two implications. First, overcoming the cognitive biases and errors to which human beings seem all too naturally prone requires extensive study and experience, yet even these provide no guarantee against such shortcomings. Second, it is the comparatively narrow *community* of research scientists that is primarily responsible for maintaining science's critical traditions. Scientific standards, just like scientific knowledge, depend mostly on the evolution of the expert scientific community's collective judgment in the long run. Individual scientists are far too susceptible to such problems as errors in reasoning, flawed heuristics, and confirmation bias.

The difficulties associated with reasoning properly, judging reliably, and comprehending esoteric scientific concepts go some way toward explaining why science progresses so slowly most of the time. These difficulties are also excellent indications of just how *un*natural doing science is from a cognitive standpoint.

3.3 Religion: Doing What Comes Naturally

In making a case for the relative unnaturalness of science, I looked briefly at both the practices and modes of thought characteristic of science as well as the contents of the resulting scientific products. A survey of the same considerations for religion will disclose just how natural religion is in these respects. Various large-scale indications suggest that aspects of religious cognition rely far less on cultural foundations than is typically presumed. Religion's beginnings are less singular, its changes are (far) less fundamental, and its scope is more broad than is the case with science. I will discuss each in turn.

First, the birth of religion is less exceptional. Religion dates from our prehistoric past. Both the archeological and the anthropological evidence shows that human religious activities do not depend on keeping chronicles or on inventing writing or even on establishing fixed settlements. If burial of the dead constitutes sufficient evidence of religious activity, then Neanderthal burial practices confirm that religion was not even always confined to a single species (see, however, Mithen 1996).

Second, many religious ideas and forms have recurred throughout history across a wide array of physical and cultural settings. All religious systems (including Buddhism as it is popularly practiced) look to agents and their actions as the critical variables for making sense of both the

social and natural worlds. This is true regardless of whatever more elaborate representations (e.g., the Holy Trinity) a religious elite may impose. Religion—as it is commonly practiced—reliably operates within a framework of commitments to culturally postulated superhuman (CPS) agents, their causal powers as agents, and the ability of our standard theory of mind to make sense of their actions and states of mind.

Although a few scientific ideas (atomism, heliocentricism, continental drift) required extended consideration in more than one era before they eventually prospered, at least so far in the history of science, this seems the exception and not the rule. Science is *uniquely innovative.* Its pursuit has regularly generated new theories and conceptual tools (the calculus, gravity, natural selection, field theory, inferential statistics, quantum theory, antimatter, chaos theory, implicit memory, distributed representation) that have sometimes required reinterpretations of science's most fundamental metaphysical assumptions. In addition, science has not undergone the conservative revolutions that some religious groups have where the explicit aim is not only to overthrow the prevailing states of affairs but to resuscitate earlier forms of religiosity or religious practice *in all of their details* (even when those goals are transparently implausible).

And third, although not every human being is religious, unlike science, religion occurs in *every* human culture. Even when a particular religion becomes extinct, religion itself does not disappear but inevitably reemerges. New religions regularly spring up in human populations (Earhart 1980). If a new religion does not surface quickly enough within a given society, then an existing religious system inevitably invades from without. As Dan Sperber (1996) argues, religious ideas are contagious. Religions propound ideas to which humans seem particularly susceptible.

Thus neither the birth nor the persistence of religion critically depends on any special cultural conditions. (If the experience of the twentieth century is representative, religions persist, as often as not, even in the face of direct suppression.) At least in comparison to interest in scientific ideas, the appeal of religious ideas is in no small part a function of our cognitive predilections.

Analyses of religious phenomena of the sort that I (and others) have advocated elsewhere also point to this conclusion. In contrast to science, religion relies far more fundamentally on our standard cognitive equipment. Much about the contents of religious claims and the modes of

religious thought are "natural" in both of the senses I discussed. Compared to science, religion regularly involves assumptions that are more common, materials that are more familiar, and judgments that are more intuitive.

Humans come by the modes of thought religion utilizes far more readily than they come by many of those that science employs. With the exception of a few extraordinary individuals (Faraday comes to mind), becoming a scientific participant virtually always requires extensive formal education. Although considerable education is sometimes a prerequisite for religious activity, this is true only about *some* forms of participation in *some* religious systems.

Science has never arisen in nonliterate cultures. As I argued in section 3.2, its practice and appreciation demand developed intellectual skills, of which the most fundamental are literacy and mathematical fluency. Possessing such forms of intellectual expertise—together with systems of external scientific symbols (Bechtel 1996)—is a key to discerning, retaining, and engaging scientific materials. Standard scientific works—like theological and ecclesiastical works but quite unlike most other religious works—are usually carefully reasoned, tightly constrained by detailed conventions, and couched in relatively dry, antiseptic prose.

The vehicles for imparting religious knowledge and the cognitive capacities on which they depend are far more basic. Typically, religion (in contrast to both science and theology) relies primarily on theater and narrative. (This is not to imply either that rituals are simply plays or that myths are simply stories, but only that the cognitive processes involved in each are essentially the same.) Myth and ritual are essential ingredients in every religion. A fundamental point about myths and rituals is that they are supposed to have been handed down from one generation to the next *without change*. (The invention of writing and reading has mostly encouraged that assumption.)

Religion's explanatory "theories" are usually embedded in or inferred from myths, which take the form of stories. These special religious stories account for arrangements in the natural and social worlds by appealing to the actions, intentions, and mental states of CPS agents, who possess extraordinary properties and who operate both within and beyond the world of everyday experience.

Rituals are actions. CPS agents have allegedly either modeled or prescribed rituals, which participants in the religious system are supposed to repeat. That is also the usual rationale for why participants always do rituals

the same way, at least ideally. It is the gods, after all, who have stipulated their forms. Although properly performed rituals either change (or maintain) states of affairs in specifiable ways, only the CPS agents know for sure whether any performance has met all of the requisite criteria. Carrying out these ritual actions provides humans with a means for establishing some order in, and imposing some control over, their natural and social worlds.

Preservation is paramount with such materials; in the absence of literacy particularly, this is no mean feat. Not all religious texts are myths but nearly all of the most memorable ones are. (Even scientists remember stories more readily than they remember theoretical or analytical treatises.) Research in cognitive psychology (Rubin 1995) has demonstrated how narratives like those in myths manipulate a host of variables that appeal to the natural propensities of human memory, including imagery, rhyme, metaphor, and other "literary" devices, as well as basic narrative structures. Narratives are about agents feeling, thinking, and doing things in ways that are causally connected with one another. Events occur in a particular sequence. Actions take place in specific places at specific times, and they have specific consequences that occasion other actions and states of mind in the agents involved. It is difficult for people to remember most human affairs in any other way. In rituals, where the scripted actions do not always hang together in such a familiar way, religions throughout the world enlist other mnemonic aids. Repeated rituals, such as sacrifices, rely primarily on sheer frequency effects to enhance their memorability. Non-repeated rituals, which a normal participant does only once, such as rites of passage, often exploit many of the same variables that underlie "flashbulb memories." (McCauley 1999; Winograd and Neisser 1992).

Each of these considerations imposes constraints on the contents and forms of both rituals and myths; taken together, these constraints can substantially limit the range of viable variation. This is particularly important in nonliterate societies, where religion had its beginnings and where its transmission does not rely on the possession of texts. In these settings especially, religious truths are primarily to be retained and transmitted, rather than reflected on and challenged. The crucial point is that neither comprehension nor retention of religious materials requires development or possession of any of the sort of specialized intellectual skills on which both the acquisition and the progress of science depend.

Religion rests on far more basic cognitive abilities, the most important of which is the ability to distinguish agents and their actions from other things and events in the world. Agents are entities in our environments who merit very different treatment from everything else. Their detection is critical to humans' physical and social survival, and research in developmental psychology (see, for example, Golinkoff 1983, 1986) affirms that children possess this ability in their first year of life.

Events that involve agent causality require representations crucially different from those for events that do not. The cognitive representation of ritual actions depends on a basic action representation system that is "in place" quite early in human development. Indeed, Tom Lawson and I (Lawson and McCauley 1990) have argued that the representational principles and the resulting action structures for religious rituals differ not one whit from those for ordinary actions. Beyond introducing into action representations CPS agents from a religious conceptual scheme, nothing about the cognitive representation of religious rituals differs from the representation of any other action.

By their facility at representing agents and their actions, human beings are thus particularly well prepared to generate, comprehend, recollect, and transmit religious stories, beliefs, and rituals. Where scientific explanations provide progressively more detailed and systematic analyses of complex processes and mechanisms, religion summons CPS agents and their actions for explanatory purposes. At least four types of evidence suggest that the latter approach comes more naturally to the human mind.

First, human beings—children in particular—seem to be inveterate anthropomorphizers. Our cognitive mechanisms for detecting the eyes, faces, and forms of macroscopic organisms that have them, and of human beings in particular, as well as the related mechanisms for attributing agency, mentality, and personality to things in the world, are *profoundly liberal* in their operations, generating false positives at every turn (Guthrie 1993). We not only see faces in the clouds; we routinely talk about our cars' and computers' recalcitrant moods. Advertisers have anthropomorphized everything from cleaning products to vegetables to airplanes. Indeed, superimposing human characteristics on products is probably second only to sex in the advertiser's bag of tricks for grabbing human attention. Attributing agency and psychological properties to various parts

of the physical universe—sometimes on the basis of the skimpiest evidence—seems nearly a cognitive compulsion in human beings (see Mithen 1996, 55, 164–167).

In an intriguing set of experiments, Justin Barrett and Frank Keil (1996) have shown that subjects reliably treat deities anthropomorphically in their on-line cognitive processing, regardless of their nonanthropomorphic, "theologically correct" pronouncements about God during more reflective moments. They do so whether they are Catholics, Protestants, Jews, or atheists in the United States or, as subsequent research shows, Hindus, Sikhs, or Jains in India. These findings indicate that a good deal of people's knowledge about how the gods operate does not turn on any specifically cultural content, or at least not on any uniquely religious knowledge.

Second, humans seem to find explanations in terms of agents and their actions more naturally appealing. Social psychologists have discovered telling biases in human judgment on these counts (for discussions, see Gilbert and Malone 1995; Anderson, Krull, and Weiner 1996). Human beings are overwhelmingly predisposed to give accounts of their own and others' behaviors in terms of socially shared theories about agents and their states of mind. Even when experimenters openly manipulate the independent variables that account for the variance in subjects' responses, those subjects typically remain not only unaware of these variables' influence but convinced of the critical role of agents' actions and mental states in determining the outcomes.

Third, religious ontologies and narratives go hand in hand. I have already mentioned mnemonic advantages narratives enjoy, compared to other forms of knowledge organization. The prominence religious systems accord CPS agents and their actions is of a piece with the central role that narratives play in religious thought and practice. Narratives, after all, go nowhere without agents. Agents' actions and states of mind are the underlying engines that drive narratives. Proliferating agents inevitably requires proliferating narratives because every agent has a story. Introducing individual agents raises kinds of questions that only stories can answer. In explaining sequences of individual events, explanations even in the natural sciences may sometimes seem to resemble narratives. But such appearances are misleading. Explaining a mass extinction on the basis of an upheaval in the weather caused by a huge meteor's impact with the earth makes reference neither to actions nor to an agent's states of mind.

Descriptions of chains of efficient or material causes do not constitute a narrative.

Finally, as Boyer (1994) has emphasized, by appropriating such fundamental notions as "agent" (and the conception of causality that accompanies it) for the purposes of characterizing the invisible forces of the universe, religious systems provide participants with a huge amount of information "for free". This last point deserves some elaboration.

Boyer (1999, 2000) argues that religious categories are parasitic on a host of "natural" ontological categories, which even young children readily deploy (see also Keil 1979, 1989). Concomitant with each category are nondemonstrative inferences that provide an army of default assumptions concerning that category's instances. Knowing, for example that a toaster is an *artifact* immediately entitles us to assume that it has a determinate size, shape, and weight, that human beings have had some influence on its current state, but also that it does not respirate, contemplate, or copulate. Similarly, knowing that gods are *agents* licenses inferences about their values, preferences, mental states, and actions.

What distinguishes religious from natural ontologies, according to Boyer, is the violation or transfer of some of the intuitive properties associated with entailed superordinate categories. For example, if something is an agent, then (normally) it is also a physical object and possesses all of the associated physical properties. CPS agents may differ from normal agents in that they *violate* the constraints this superordinate category, "physical object," imposes. Thus, they may pass through solid objects or be everywhere at once. CPS agents may violate constraints that other superordinate categories, such as being an organism, impose. So, CPS agents may be eternal, parentless, or capable of recovering from death. On the other hand, the *transfer* of psychological properties appropriate to agents can render artifacts, such as statues or ebony trees, capable of hearing, comprehending, and remembering humans' pleas.

Compared with scientific categories, those in religion lack theoretical depth. Contrary to first impressions, religious accounts of things differ little from everyday accounts. Religious systems import all of our familiar, commonsense psychology about agents' intentions, beliefs, desires, and actions for the explanation of phenomena throughout the natural and social worlds. Whether applied to other drivers on the road or to the rulers of the cosmos, this system performs quite nicely most of the time for understanding and anticipating agents' actions and states of mind. The

rationale underlying an explanation of someone's illness as the result of an ancestor's interventions based on that ancestor's displeasure with the victim's conduct is as readily comprehensible to a child as it is to the most experienced religious official.

In the absence of cultural forms that foster the collective growth of humans' critical and imaginative capacities, human beings rely on their natural cognitive dispositions, which often appear to be domain specific and comparatively inflexible in their application. CPS agents, stories about them, and rituals for controlling and appeasing them are the inevitable outcomes of a cognitive system that simultaneously seeks explanations, possesses an overactive agent detector, and, perhaps most important *lacks scientific traditions*. As Daniel Dennett (1998, 122) has remarked, "Until science came along, one had to settle for personifying the unpredictable—adopting the intentional stance toward it—and trying various desperate measures of control and appeasement."

To review: religion occurs in every culture and predates history. On most fronts, religious materials embody assumptions and take forms that are either commonplace, intuitive, or a normal part of cognitive development. The modes of thought and the patterns of explanation that religious systems exploit are usually familiar and uncomplicated. Moreover, religious systems depend fundamentally on an array of cognitive resources that arise early in human development. All of these considerations suggest that religion is cognitively more familiar than science and that religion taps cognitive traits that are more widespread and readily available than those science requires. So, too, does the fact that participants acquire religion more easily than science.

Acquiring the knowledge necessary to participate in a religious system is much more like acquiring a natural language than it is like mastering the knowledge and skills necessary to do serious science. Acquiring religious knowledge often requires little, if any, explicit instruction. Humans are *born into* religious and linguistic communities. Like natural language, religion exploits cognitive dispositions, which seem to arise early in human development.[4] Because so many pivotal religious conceptions have so little theoretical depth, possessing everyday concepts prepares people for the acquisition of religion in a way that it does not prepare them for the acquisition of science.

Since some otherwise normal human beings are not religious, though, the suggestion that the acquisition of religion depends on some

domain-specific cognitive mechanism devoted just to it is not at all plausible (despite the underlying uniformities of religious cognition I have emphasized). Still, the evidence I have been surveying is consonant with the proposal that cognitive mechanisms that arose to address very different problems—such as distinguishing basic ontological categories and differentiating actions from other sorts of events—are fundamentally engaged in the generation and acquisition of religion. (I am unconcerned here about how responsible innate factors are for the development and eventual shape of these mechanisms.)

If the acquisition of basic religious competence turns so critically on the possession and operation of such naturally occurring cognitive inclinations, then participation in a religious system should be largely independent of differences in intelligence, and so it seems to be. Indeed, the acquisition of and participation in a religious system seem to turn no more (and, perhaps, even less) on so-called general intelligence than do the acquisition and use of natural language.

Advocates of cognitive modularity, who hold that specific, dedicated neural mechanisms underlie such capacities, argue that one sort of evidence for the existence of mental modules is precisely the fact that these singular mechanisms occasionally get disconnected in a small fraction of the population. Some persons, who might have most other cognitive capacities essentially intact, may, for example, prove severely impaired (either congenitally or as the result of injury) with respect to such things as the recognition of faces, the production of grammatical speech, or the detection of agents. Prosopagnosics are incapable of recognizing faces. Broca's aphasics are incapable of producing grammatical speech. Simon Baron-Cohen (1995; Tomasello, Kruger, and Ratner 1993) argues that autism is precisely the inability to detect agents and to read their minds. The abilities of autistic people to recognize agents and to distinguish actions from other events seem substantially impaired, while their abilities on most other fronts often fall within the normal range.

Oliver Sacks (1995) describes an autistic woman who has learned to manage well enough to earn a Ph.D., teach at the college level, and run her own business. Still, he reports that she does not comprehend many features of even standard social exchange. Baron-Cohen (1995) argues that rather than benefiting from the virtually automatic operation of what he calls our "theory of mind module," such people manage by enlisting their general intelligence for carrying out standard inductions about their social

experience. They are destined to possess no more knowledge about human conduct than what the methods of behaviorism can afford. My bet is that, as a result of their disability, religion is something that even autistic persons functioning at such a high level do not readily comprehend or acquire. In this connection, it is worth noting that Sacks (1995, 259) reports that his subject was "bewildered" by myths and drama.

Many primatologists maintain that the abilities to detect agents and read their minds are not the exclusive possessions of modern humans (see, for example, Byrne and Whiten 1988). The archeological evidence about other members of our genus suggests the same. If that is true and if my analysis of the character and origins of our religious proclivities is correct, then religion involves the expression of some of our most basic cognitive inclinations.

If religion is as natural and science is as unnatural as I have argued, science poses no significant challenge to religion. Indeed, if my analysis is correct, it is the preservation of *science* that should concern us—its current prominence notwithstanding. In the global marketplace of ideas, that is, in the transmission of culture, some views have natural disadvantages. Science, with its esoteric interests, its counterintuitive claims, and its specialized forms of thinking, certainly seems to qualify. Those historians and philosophers of science who point to two critical episodes in the history of Western thought hold that science was once lost and had to be reinvented. One consequence of my view is that nothing about human nature would ever prevent its loss again.

Notes

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1. Such claims are regularly asserted but rarely (if ever) argued. How they could be advanced without assuming that religion deals with matters *beyond* the natural realm is difficult to see. But it is just that assumption that has led critics such as Tom Lawson and me (Lawson and McCauley 1990, 1993) to argue that religious studies itself often includes covert religious (or "theological") presumptions.

2. I have argued (McCauley 1987) that adults' conceptual structures are best understood as theoretical, and I have no hesitations about so characterizing children's–I am

far more optimistic now about the ability of connectionist and neural network models to account for our conceptual resources (see Churchland 1989; Barsalou 1999). I am also sympathetic with the view that semantic and conceptual development is usefully construed in terms of changes in theories, though I hasten to note that theoretical progress does not always involve revolutionary changes. Theory development in science and, I suspect, in scientists and children as well is often evolutionary rather than revolutionary (see McCauley 1986).

3. Compare the position of Karl Popper (1992, 136–165), who sees these two cases as discontinuous, and thus sees two separate points of origination for science, with that of Lewis Wolpert (1992, 35), who holds that they constitute a single, continuous tradition.

4. This point seems uncontroversial. The disagreements arise about how elaborated the initial dispositions are (see Elman et al. 1996, 41).

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