Cognitive Science, Religion, *and* Theology

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S&TR SERIES

Cognitive Science, Religion, *and* Theology

FROM HUMAN MINDS TO DIVINE MINDS

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Preface

At social events when I need to make small talk or meet new people, the question I dread is, "So, what's your field?" My dread isn't because I don't value what I do or don't like to talk about my work—like most academics, I have a probably unjustifiably high opinion of my field. My fear is that my answer will only lead to more confusion:

"I do cognitive science."

"What is that?" comes the inevitable next question.

"The science of the mind and how we think." Such a curt answer for such a vast and important field only invites confusion and more questions. My aim for this book is to give a more complete answer to the question, "What is cognitive science?" But my task is also to highlight the potential for this scientific area to have exciting and challenging things to say about religion and theology.

The engagement between "science" and "religion" is often presented as a dialogue between two individuals. Science and Theology talk to each other. Science tells Theology what its latest and greatest accomplishments are and then Theology scurries to figure out how to accommodate those findings. Theology points out the dependence of Science on certain prescientific assumptions and commitments that are often supplied by Theology, and insists that without Theology to inform discussions concerning values (what we ought and should think or do), the findings of Science are just as likely to be harmful as beneficial. In this dialogue, Science tells Theology what it knows, and Theology tells Science what it knows.

As interesting and important as this dialogue can be, it isn't the only dimension in which a science-religion engagement can happen. Some sciences (particularly the psychological and social sciences) can apply the tools of science to the study of religion. This second dimension of the science-and-religion dialogue also has two types of activity. Perhaps the most common scientific study of religion is the investigation of the consequences of religious commitments, thoughts, practices, and organizations. The political scientist might wonder how being religious or not changes voting practices. The demographer might wonder whether religious identification changes fertility rates. The psychologist might explore whether some religious practices encourage or discourage mental health. These types of studies treat some dimension of religion as a cause, predictor variable, or *explanas* of some effect, outcome variable, or *explanadum*. But we might want to try to explain various dimensions of religion as well. Why do people tend to be religious? Why do religious practices take the forms they do? Why are some beliefs more common than others? These too are topics for scientific exploration at the hands of the human sciences.

Cognitive science can be a fruitful dialogue partner with religion on both dimensions and in all four ways. (1) Findings from cognitive science can potentially support or challenge theological claims. (2) Theological positions can inform how and why one does cognitive science, and what we should do with what we find. (3) The outcomes of religion can be studied through cognitive science. (4) Cognitive science can uncover causes for features of religion, including why people tend to have certain theological commitments. Few sciences have this potential breadth of engagement with religion and theology. My chief aim for this book is to convince readers of the tremendous positive possibilities for such engagement—that findings from cognitive science merit our attention whether we are scholars, religious leaders, or generally educated citizens. I hope to also encourage some readers to get involved with teaching or researching in this area that is blossoming with potential.

In recent years conflict between "science" and "religion" has generated considerable heat, but far less light. My secondary aim for this book, then, is to demonstrate that in this particularly exciting area of science, we can move beyond a simple conflict thesis and see that cognitive science is not simply a friend or foe for religious or nonreligious people. It is a useful tool for learning. Sometimes we learn things that make us change or abandon our beliefs and behaviors, and at other times we learn new things that build upon or further our existing beliefs and behaviors. Cognitive science should and will do likewise. Those committed to discovering truth, and confident that their worldview is true, should see a rigorous and robust cognitive science as a valuable companion.

The view I present of cognitive science is much more an invitation to explore than a summary of completed journeys. After introducing cognitive science as a field of study (chapter 1), I sketch a general working model of the mind and how we form beliefs of any kind (chapters 2 and 3). In the next section (chapters 4 through 6), I begin filling in this model by considering how humans naturally make sense of the basic furniture of the world, how we make sense of other humans, and how such ordinary thought makes us prone to religious thought. The final section of the book (chapters 7 through 9) turns more directly to applications of cognitive science for religion and theology, including questions concerning religious experience, practice, revelation, and education.

To try to make this book broadly accessible, I shared early drafts of the manuscript with an interdisciplinary group of Oxford University scholars at different career levels. We met periodically to discuss the text and harvest feedback. I have done my best to incorporate their comments and criticisms into the final version, but in doing so was forced to make some difficult decisions about word choices and just how much time to spend on particular topics. A topic that bored the linguist excited the astrophysicist. A term that meant one thing to the economist meant something entirely different to the philosopher.

I share this background as a warning, particularly to philosophers and theologians. Though I raise some philosophical and theological issues—and offer some suggestions pertaining to the relationship among cognitive science, religion, and theology—this is not a book of philosophy for philosophers or of theology for theologians, and I will thank both camps for their patience (and mercy). Usually when I take up such issues here, my motivation is only to discourage those (usually scientists) who regard the implications of cognitive science for religious and theological beliefs as simple and straightforward. I am not trying to solve any philosophical or theological problems here but only indicate the sorts of problems to which findings from cognitive science might fruitfully contribute. I leave proper treatments to the proper experts.

Cognitive Science, Religion, *and* Theology

CHAPTER 1

What Is Cognitive Science?

The point is almost so obvious that it hardly needs stating: humans are distinctive because of their ability to think, reason, imagine, and learn—their cognitive abilities. When Hamlet trumpets the greatness of humans, it is the human mind that takes center stage:

> What a piece of work is a man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action, how like an angel! in apprehension, how like a god! the beauty of the world, the paragon of animals; and yet to me, what is this quintessence of dust? (*Hamlet*, act 2, scene 2)

The words *reason, faculty, action,* and *apprehension* point to humans' ability to think and direct their actions apart from mere instincts. Shakespeare recognizes as well a tension between the marvels of the human mind and the less lofty biological ("paragon of animals") and physical ("quintessence of dust") nature. The great thinkers throughout the ages and the world's religious traditions have sought to embrace this tension in their treatments of human nature. In the Genesis creation story, humanity is presented as derived from the dust of the earth and yet above all animals, and ultimately separated from God by succumbing to the temptation of knowledge:

> And the serpent said to the woman, "You will not surely die. For God knows that in the day you eat of it your eyes will be opened, and you will be like God, knowing good and evil." So when the woman saw the tree was good for food, that it was pleasant to the eyes, and a tree desirable to make one wise, she took of its fruit and ate. (Gen. 3:4–6, NKJV)

It is the gifts of the mind that separate humans from the other animals, and on the basis of mental prowess humans vie to "be like God." In Buddhism too we see ambivalence about thought: it distracts and enslaves us to worldly concerns, and yet it is through disciplining our thought (such as meditative practice, *vipassanā*) that genuine wisdom or insight (*paññā*) can be achieved. Understanding how humans think, then, may be critical in understanding distinctive features of human nature, how we may relate to the transcendent, and the key to human thriving.

In a direct hand-to-hand combat with a wolf, leopard, bear, Tasmanian devil, or ape, an average human would fare poorly. Without natural weapons such as claws or powerful teeth and jaws, and lacking impressive quickness and power, humans are not terribly formidable foes. Human babies, in particular, are relatively helpless. A two-year-old human is known as a "toddler" because of its clumsiness, but the same aged chimpanzee can swing from tree to tree, and the two-year-old wildcat or canine is already an adult, able to catch an antelope on the run and tear it to bits. Lacking impressive physical attributes, human survival and thriving are critically dependent upon the power of our minds.

The obvious importance and distinctiveness of human thought do not mean its scientific study—cognitive science—is so obvious. In fact, very well educated people do not even realize that cognitive science exists. In this chapter I give a brief explanation of what cognitive science is and what it is cognitive scientists do, laying the groundwork for an exploration of cognitive science as it relates to religious expression and theological issues. After all, how the human mind handles religious information may provide insights into the nature of revelation, how people understand scripture, and how they "read" the natural world for messages from the divine.[1] Understanding the prerequisite kind of mind for being religious could also amplify accounts of the origins of religion for humanity and in individual lives. For religious ideas and practices to spread and persist, they must ride on cognitive equipment. It may be, then, that just how cognition supports religious thought and action might have practical implications for religious communities—for instance, how to successfully teach children, what impact changing a ritual might have on participants, and identifying which points of doctrine might be most subject to distortion. On the other hand, perhaps religious thought and practices are not just informed and shaped by human cognition, but can also change our thought-producing equipment in important ways: religious practice might impact human cognition beyond merely filling in content. Before turning to these big questions, an introduction to cognitive science is required.

Surveying the Terrain of Cognitive Science

Cognitive science is the interdisciplinary area of scholarship that considers what the human mind is and how it functions; how people think. Thinking includes everything from perceiving what is in the world around us to reflectively and abstractly reasoning about hypothetical worlds that are not around us. I am not including all human behavior as the object of cognitive science. A psychologist or a physiologist may study sneezing, yawning, or sleeping, but that isn't cognitive science. Cognitive science concerns imagining, recalling, watching, wondering, pondering, and deciding. Without denying or affirming animal thought (another fascinating matter), my focus here is on human thought. That said, in some cases the study of nonhuman animals provides special insights into the character of the human mind.

Recently my family and I had a Sunday supper with friends and afterward played a wonderful game that required each of us in turn to try to provide clues for everyone else to guess what was depicted on a card. The card could present a famous person, an occupation, a location, an object, an event, or any number of different things. A roll of a die determined the restricted range of clues that the player could provide. They could be a drawing, a wordless performance (think charades with sound effects), words all beginning with the same letter, or a comparison with two other things (for instance, one successful clue was "smaller than a swimming pool, bigger than a mattress" for the answer "waterbed"). This group effort was a race against time. Not only was the game a lot of fun, it was fascinating watching various types of human thought at work. The clue givers had to figure out what critical information would trigger the right association in the minds of at least one member of the audience within the constraints of the rule-types. The guessers had to try to infer a concept from the very strange and indirect clues—almost mind reading. One seemingly amazing instance was when my wife gave a two-second hula dance and then mimed opening a can with a pull-tab. The whole act lasted less than three seconds and in a heartbeat my daughter (correctly) answered, "Spam!" How? Cognitive scientists are interested in every step of interactions like these. How does a person (my daughter) perceive another person's body (my wife's)? Understand the movement of that person as an example of a known dance (hula)? Regard that dance as indicating a particular culture or place (Hawaii)? Recognize a cupped hand, first, as a hand and, next, as indicating holding something that isn't actually there? Recognize a movement as representing opening a familiar container type (a tin with a pull-tab) that isn't actually present? Put the concepts HAWAII and TIN-WITH-PULL-TAB together to trigger a memory that Hawaiians are inordinately fond of Spam and get the correct answer "Spam"? How did my daughter do all of this in a fraction of a second? And how did my wife suspect that someone would be able to rapidly piece all of this together and choose this performance strategy? And why did we all feel surprise and amusement at this exchange?

Cognitive Science Is Not Neuroscience

These questions are the sorts that animate cognitive scientists, questions about how human minds work, how we think. Notice, however, that few of us would be satisfied if we answered these questions by simple appeals to brains or biological structures. Consider: Question, "How did my daughter get from hula and can-opening motions to Spam?" Answer, "Her brain did it." Not terribly satisfying, right? Even if we narrow the scope a little, "This part of the brain and that part of the brain did it," we're still left with the wrong kind of answer. Though the brain sciences can and do make important contributions to cognitive science, cognitive science is not first and foremost about where things "happen" in the brain. It isn't really about brains at all. It is about minds.

If someone asks you how the United States federal government works, you wouldn't answer by saying that it is located in Washington, or even specifying that the White House is at 1600 Pennsylvania Avenue and the Capitol is about one-and-a-half miles ESE of there and the Supreme Court building is a bit over a quarter mile to the east of there. How the U.S. government works isn't (usually) answered by appeal to the physical structures involved. To use the familiar comparison with our office computers: cognitive science isn't about the "hardware" of human minds—silicon chips, circuit boards, and the like. Cognitive science is about the "software" of human minds: How does this word processor work? Why do I get an error message when I try to open this file? What can I do to import information from my spreadsheet to my presentation file? If my IT officer answered any of these sorts of questions by explaining how semiconductors work in my computer's microcircuits, I'd show him the door. It isn't that computer hardware isn't interesting; it just isn't the right level of explanation for the sorts of questions being asked. Similarly, I think brain science is fascinating, but that doesn't mean it is the right level of explanation for the questions that cognitive scientists are (usually) trying to answer.

You may have noticed that I keep putting "usually" in parentheses here and there. The reason is that in some small proportion of cases, the physical structures of the brain do play a role in illuminating why we think the way we do. The area of cognitive neuroscience considers these cases, and I will say more about it below. I am belaboring the brain-mind distinction here because so many people—academics and nonacademics alike—confuse cognitive science with brain sciences. Snazzy pictures of brain scans make for good television and print media, but that can lead to the *mis*perception that brain science is the direction that *all* science of the mind and behavior is headed.

Brain sciences, neuroscience, and related areas pertaining to the anatomy and physiology of our nervous system contribute greatly to our understanding of human behavior and provide tools for medical solutions when things go wrong. My very first publication was a coauthored paper arguing that the failure of a subcellular structure in certain neurons could account for bipolar disorder and features of its treatment with lithium.[2] A feature of neuron function arguably has an impact on the wide range of manic and depressive behaviors that characterize bipolar disorder. Understanding the biology of the brain and the rest of the nervous system matters, sometimes in surprising ways. But not all of neuroscience is cognitive science. The kind of neuroscience I dabbled in at the beginning of my academic career was not cognitive science. The identification of a subcellular neural structure failure might have helped explain episodes of mania, but it didn't explain anything about language use, analogical reasoning, or learning during manic episodes. Other areas of neuroscience are even further afield, concerned with the nuts-and-bolts of how neurons communicate with each other or how brain structures develop without meaningful reference to thoughts and feelings at all.

Topics of Study

The cognitive science umbrella covers a wide range of topics—as broad as the innumerable domains of human thought. In just one issue of *Trends in Cognitive Sciences* (December 2004), a leading professional journal in the area, you can find essays on:

- How value and probability are represented by brain structures such that they can be used to make decisions
- Immediate, "working" memory in sign language versus spoken language
- Children's developing understanding of other's mental states
- Understanding the unspoken implications of conversation
- Why certain muscular actions become rhythmical when they are learned
- What it would mean for a robot to have emotions

In just this sample of topics we can see a range from very general thought activities such as decision-making to very specific problems such as keeping sign language in memory as one uses it.

Grouping the various topics that cognitive scientists consider can be done in many different ways. Commonly, however, problems are grouped by the general cognitive process or activity that seems most critical. These processes include:

- Perception—how do we use our senses to identify patterns and objects in the environment? How do we recognize the furniture of the world? How much is perception influenced by situation, personal history, and cultural context?
- Attention—how do we focus on some ideas or incoming information as opposed to others? What are the limits on human attention? How much can it be divided among tasks? Can attention be expanded through practice?
- Memory—how is memory structured? Do we have different

types of memory? How can we put ideas, images, events, or action-sequences into memory? How do we retrieve information from memory? Why do we forget? Are there techniques that can be used to improve memory?

- Conceptualization—where do our concepts come from? How do we categorize ideas? How do collections of ideas or experiences of events become knowledge structures? How do we form stereotypes and think with them?
- Communication—how do we communicate with others? How do we use language, gestures, facial expressions, and other actions to convey ideas or feelings? How do we understand the messages others try to send? How do we acquire language, including grammar and vocabulary? What role does language play in thought?
- Reasoning—reasoning overlaps with decision-making and conceptualization, but places an emphasis on conscious, careful reflection on ideas, on what we know and don't know, and on how to solve problems. How do we come up with answers to questions? When are we able to reason using the rules of logic or probability?
- Learning—we reason *from* something we know *to* something else (inference). We make decisions regarding ideas we have acquired somehow. Before cognitive science was born, the scientific study of learning principally concerned how animals (including human animals) acquire behaviors that are not simply instinctual. The cognitive science of learning emphasizes how new information, ideas, concepts, and words are acquired.
- Decision-making—how do we form judgments? What thought strategies do we use automatically to decide whether something is or isn't the case? How do we decide to do one thing as opposed to another? How do we string many decisions together to make complex plans?

- Imagination—just as we can form *percepts* (impressions from perceptual systems) through all of our senses, perhaps we can form all of these kinds of images "in our heads," from images of what a cat's fur feels like to what baking bread smells like to what a sunrise looks like. How accurate are these mental representations? How do we use them in thought? How does this sort of image-based imagination compare to language-based imagination? How are we able to think about things that are not necessarily so?

These processes are not discretely partitioned from each other but interact in most real-world thought and action. Cognitive scientists also consider how these various processes interact. For instance, how does attention impact memory? Does language modify perception and concept formation? Can forming visual images improve memory or problem-solving? How do concepts impact communication or imagination?

Another category of cognition deserves mention here even though it does not really constitute a different process parallel to the categories above. Our feelings or *emotions* can be considered in any of these general processes. For this reason, I consider emotions a dimension of cognition rather than a separate process or activity. A cognitive scientist might be interested in why certain types of thought might get infused with certain emotional qualities and how different physiological states can acquire meaningful content that lead to the rich diversity of feelings people report experiencing. Do particulars of language change our feelings? How does intensity of emotion impact memory, attention, or perception? What role does emotion play in reasoning or decision-making?

Similarly, across all of these categories we might consider how consciously accessible dynamics differ from nonconscious dynamics. Is there more going on in our thoughts than we can introspectively become aware of? If so, how do these nonconscious cognitive processes impact conscious ones?

Problems That Animate Cognitive Science

At universities today, you will rarely find something called the Department of Cognitive Science. Many of the scholars who engage in cognitive science do not even identify themselves as "cognitive scientists." They are tucked away in various university departments. Cognitive science is not an academic discipline as much as an interdisciplinary field that falls at the intersection of several other disciplines: psychology, computer science, linguistics, neuroscience, philosophy, and anthropology (including archaeology). Each of these disciplines has subareas or specialties that contribute to cognitive science (see Table 1).

We must tread softly when we use the term *scientist* as we delve into the broad field of cognitive science. Some investigators might be natural scientists (neuroscientists and some psychologists), others are applied scientists (many computer scientists and some psychologists), social scientists (many psychologists, linguists, and anthropologists), or not scientists at all (philosophers and some linguists and anthropologists). Not all cognitive scientists are *scientists* in the sense that their research constitutes the collection of empirical data through scientific methods, and quantitative analysis of those data to test models and hypotheses.

What earns them all the title *cognitive scientists*—even the philosophers—is that they bring scientific evidence to bear on claims and predictions about how humans think and the character of the human mind, and attempt to discover naturalistic explanations for the phenomena the data reveal.[3] What they have in common, in other words, is a common set of problems. Everyone in cognitive science is looking at a few major threads of concern. Many of these threads are theoretical "pure" science issues, but others are applied problems. We can divide these into theoretical problems and applied problems.

Table 1. Constituent Disciplines of Cognitive Science

Cognitive science is an interdisciplinary field that falls at the intersection of several other disciplines. Each of these disciplines has subareas or specialties that contribute to cognitive science.

Psychology

Psychology, the study of thought and behavior, overlaps considerably with cognitive science. Those areas of psychology closest to cognitive science are cognitive psychology (the psychological study of thought), cognitive development (how cognitive systems develop and change across the lifespan), social cognition, and psycholinguistics (the psychology of language), an area shared with linguistics.

Computer Science

An important branch of computer science tries to develop artificial intelligent systems with computers and robots in order to model or mimic human intelligence. These Artificial Intelligence (or AI) projects can serve to generate solutions to computational problems that serve as analogs for how human minds might solve comparable problems. Conversely, discoveries in the broader cognitive sciences can give computer scientists fresh ideas for solving Artificial Intelligence problems. Computer science has also created computer-based artificial "neural networks" that help model different ways in which cognitive systems might be structured and work. They can suggest how a human mind "could" work. Computer scientists are constantly creating new research instruments and methods applicable across the various sciences, including cognitive science.

Linguistics

Some aspects of linguistics—the study of the diversity, history, and use of language—make valuable contributions to cognitive science. It asks, for instance, could we use any symbolic communication system equally well (binary code? semaphore flags?), or do we have natural predilections that make some languages easier? How is language acquired during early childhood, and how does this compare to second language learning later in life? What is the relationship between thought and language? Do the particulars of a language (say, German or Hindi) impact the way the speaker thinks, feels, and learns? Does human cognition shape the way languages evolve over time? Because language is so intimately tied to many areas of reflective higher-order thought, cognitive science is inseparable from linguistics.

Continued

Neuroscience

Neuroscience, at its core, is about how neurons function individually or in concert, but increasingly it contributes evidence relevant to deciding how human thought works, an area called *cognitive neuroscience*. For instance, some cognitive scientists are concerned with how people use mental images, the kinds of images you experience if I ask you to imagine the face of your mother, or picture in your mind walking from your house to the nearest grocery store. Do we really think with images, or is this just an illusion? Among the different types of evidence we might use to answer this question, neuroscientific evidence can be especially telling. If we really do use visual images, we might expect the same circuits of the brain to be active when we conjure up a visual image and inspect it "in our heads" as when we inspect a visual image in the external world. Likewise, we might expect that if someone has a particular disability when it comes to making sense of scenes or objects, that person might have a comparable disability imagining scenes or objects. On both counts, affirmative evidence that we really think with images has been found through the application of neuroscience.*

Philosophy

The study of the mind had once been the sole domain of philosophy. It has long addressed topics of introspection and reflection, reasoned discussions about how we know and how we should know, and debates about consciousness and the relationship between the mind and body. This continues to be a contribution to cognitive science, especially regarding the study of consciousness, the relationship between minds and brains, and evaluating competing models of how the human mind works. Philosophy helps us see how different levels of explanation and different types of evidence from the various constituent disciplines can be successfully integrated.

Anthropology and Archaeology

Although most of anthropology and archaeology concerns human behavior and organization, cultural expression, human evolution, human remains and artifacts, it assists cognitive science with the investigation of how culture interacts with human cognition. For instance, can the recurring expression of human activities such as sports, music, and religion be anchored in the human mental processes? This is an important question for religion and the cognitive science of religion (CSR), which draws extensively on anthropology. The same importance can be applied to the study of ancient tools as evidence of how human cognition worked in the past.

*For a review of evidence, see Stephen M. Kosslyn, Giorgio Ganis, and William L. Thompson, "Neural Foundations of Imagery," *National Review of Neuroscience* 2, no. 9 (2001): 635–42.

Theoretical Problems

Numerous theoretical questions energize cognitive scientists, but one or more of three broad questions seem to lurk in the background of nearly every discussion in cognitive science: what is innate and what isn't, how to best characterize the mind, and how minds and bodies are related.

What is "innate"?

We seem to hear a lot these days about different behaviors, personality dispositions, or ways of thinking being *innate* or *hardwired into the brain* or *in your genes*. Behind all of these figures of speech is the idea that some aspects of our minds might be a fixed part of our biology. Just as humans have brains, hearts, and livers, we also have (barring developmental disorder) the ability to see, the desire for touch, and the drive to eat. Perhaps much more subtle and interesting features of human thought are also "innate." On the other hand, surely some aspects of our thought are not fixed. Whether someone is a Red Sox fan or a Yankees fan or does not care about baseball is not innate (regardless of what a colleague of mine insists).[4] Clearly the *particular* language we speak, foods we prefer, music we enjoy, and a host of other preferences and aspects of who we are are not endowed to us by our genes but are acquired through our social environment. Perhaps, however, some aspects of even these seemingly arbitrary aspects of our thinking are not so independent of our biology after all. These questions—sometimes expressed as the nature-nurture debate—have been animating cognitive science since its birth. In the next chapter and again later in this book I return to these issues.

How do we best characterize the mind?

It is helpful to think about the mind as a computer, similar to the silicon-based machines that we use for doing accounting, word processing, surfing the Internet, and a host of other tasks. Minds, like personal computers, have some basic hardware (our bodies, including brains and nervous system) that limits what we can and can't do and how well we do things. Additionally, human minds have "programming" that has come from elsewhere that shapes how we operate. For computers, human programmers have provided this information. For human minds, this sort of information comes from our natural and cultural environment. When functioning ("thinking"), computers receive inputs from the human users (or other computers) and then process the information to produce outputs. Similarly, human minds receive information from the immediate situation around them (including from other humans) and then process the information to produce outputs (facial expressions, speech, actions, etc.). This metaphor of the mind as computer has been enormously productive in cognitive science.

Perhaps the "mind as computer" characterization has been so useful in part because it isn't wholly metaphorical. When I add 2 + 3 or when I cut a cake into approximately equal slices, my mind is doing computations. We know too that brains, like other biological systems, can be accurately characterized as doing computations. If minds reflect this computational aspect of the biological substrate that gives them shape, then we shouldn't be surprised if minds too are computational. We might say that minds *are* computers if by "computers" we mean things that do computations.

Nevertheless, it could be that not all mental activities are usefully characterized as computational, and even those that are might be importantly different in the type of computation they do. Cognitive scientists have used different characterizations of human minds depending upon the type of function that they are studying. Philosopher Paul Thagard notes that cognitive scientists have regarded the mind as working in at least six different ways depending upon the problem under consideration: by using logic, rules, concepts, analogies, images, or connected networks of units.[5] These approaches are not mutually exclusive. When deciding whether to buy an article of clothing for my wife, I might imagine what it would look like on her, I could use rules (e.g., "orange doesn't go with red hair"), or I could think conceptually ("this is my wife's kind of thing"). Cognitive scientists try to determine how people normally tend to think in various situations. In solving certain types of problems, for instance, do people predominantly use logic or analogy? By and large, cognitive scientists do not try to use one approach to address all questions in cognitive science, but are happy to take a piecemeal approach.

In addition to deciding which cognitive activities can be fruitfully regarded as computation and which cannot, characterizing the mind carries the heavy burden of linking mental activities to various types of conscious experiences. Even well before the cognitive revolution, psychologists such as Freud and Jung recognized the need to model human minds as having both conscious features and activities and nonconscious or unconscious ones. The problem of linking these two types of mental activity remains with us. I will discuss an instance of this problem concerning the formation of beliefs in chapter 3, leaving aside the even thornier issue of how both conscious and nonconscious activities might map onto brains.

How do we connect minds and mental states to brains and bodies? As I suggested above, brains and minds are not the same thing. Explaining something on the level of brain activity is not the same as explaining it on the cognitive or psychological level. If you hang upside down, you might be right to say that "Blood is rushing to my brain," but you wouldn't say that "Blood is rushing to my mind." If someone "changes their mind," we don't suppose they have swapped brains. Beliefs can be true or false, right or wrong, good or bad; but can any of these evaluations be applied to electrical and chemical processes of the brain? When I say a scene is "breathtaking," I refer to my subjective experience of the scene, not the particular activation of my visual cortex. Brains and minds are not equivalent, but they aren't wholly independent either. If part of my brain is damaged (or stimulated), I may lose the ability to speak, or the ability to recognize people, or I may feel someone touching my body when no one is doing so.[6] A blow to the head can disrupt memory not because the mind has been jarred, but because the body (brain) has. Just how the mind and brain are related is an active area of concern in cognitive science, particularly among philosophers and neuroscientists.

I will say more about these matters in the next chapter, but at no point will I attempt to "solve" the mind-body problem or commit to a definitive position on the status of minds in contrast with bodies. Rather, I adopt a pragmatic position in which we recognize that explanations in terms of minds and those in terms of bodies (including brains) are not the same level of explanation. For the purposes of seeking understanding, minds are not the same as brains, but they are not wholly unrelated either.[7]

A related problem concerns whether our biology deterministically causes our thought. If minds are just functional properties of bodies, and bodies operate by deterministic biological and physical laws, then might minds too be causally determined? This philosophical problem has potentially important consequences for everyone, but it may have especially pointed conflict with many traditional, religious views of human nature. I return to this issue later in this book.

Applied Problems

Perhaps because of the intimate involvement of computer scientists, cognitive science has always had a strong applied face concerning Artificial Intelligence systems, from building intelligent machines to human-computer interactions. Cognitive science applications have also readily extended to education, law enforcement (e.g., the dangers of memory distortion in eyewitness testimony), product design (e.g., arranging a machine's controls to capitalize on conceptual predilections), and advertising (how can attitudes be shaped and preferences formed?), to name just a few. At the heart of these varied applications are at least three core applied questions: how can we build thinking machines, how can we get people to think (and learn) better, and how can we make tools or systems best fit with what we know about human cognition so that people can use them most effectively?

Toward a Cognitive Science Relevant to Religion and Theology

When I ran cross-country in high school, my coach taught us that when you run a long uphill, don't watch the top of the hill. Doing so can encourage bad running form, lead to missteps, and be demoralizing too. Rather, keep your gaze fixed on the bit of course just ahead, only occasionally glancing up. This strikes me as good advice for cognitive science as well. Cognitive science has some huge problems looming large ahead—such as the mind-body problem, and determining whether anything general can be said about how the mind works—but fixating on those will only discourage strong progress on the more manageable problems at hand. In this book, I'll mostly pay attention to the problems that cognitive scientists do seem to be solving, and I'll try to draw implications for understanding religion and theology rather than spending too much time speculating on what the more mountainous problems might mean. Many of the implications I discuss will come from an area of research called *cognitive science of religion* (CSR).

You will notice too that unlike introductions to many science disciplines, I do not (and will not) tick through lots of facts of the field. The reason is simple: cognitive science is a very young science with a lot to discover. Unlike the old big three sciences (physics, chemistry, and biology), cognitive science is only a little over fifty years old. The birth year of the *cognitive revolution* is often set at 1956, the year Elvis Presley hit number one with "Blue Suede Shoes" and "Hound Dog" and helped boost rock and roll into the music mainstream. Cognitive science is about the same age as rock and roll. We might (perhaps somewhat arbitrarily) say that modern physics was "born" with Newton's *Principia* in 1687. That was when Giovanni Battista degli Antoni was hot on the Baroque music scene with his music for cello. A very different age indeed! Telling you all of the "facts" uncovered by cognitive science would be a bit like a textbook laying out the "facts" discovered by physics in say, 1740. Some ideas would be fine, but others would be importantly missing the mark. Physics has changed, and so will cognitive science. There is no way to avoid being embarrassed by history, so I beg readers to realize that all of the findings and theories presented here are bound to be elaborated, expanded, modified, or even rejected, but I will do the best that I can with the state-of-the-art as I see it and stick to relatively solid facts and theories.

I opened this chapter with the observation that the human mind gives people a special place in the natural world—an observation not lost on secular and religious thinkers. To appreciate what it is that is so special about the human mind requires a robust science of the mind, precisely what cognitive science aims to offer.