

The Neuroscience of Religious Experience

PATRICK McNAMARA

Boston University School of Medicine



CAMBRIDGE
UNIVERSITY PRESS

Contents

| | |
|--|----------------|
| Preface..... | <i>page ix</i> |
| Acknowledgments..... | xv |
| 1 God and the Self..... | 1 |
| 2 On the Self and the Divided Self..... | 21 |
| 3 Mechanisms and Dynamics of Decentering..... | 44 |
| 4 Neurology of the Self..... | 59 |
| 5 Neurology of Religious Experiences..... | 80 |
| 6 Neurochemistry of Religiosity..... | 131 |
| 7 Self-Transformation as a Key Function of Performance of Religious Practices..... | 145 |
| 8 Self-Transformation through Spirit Possession..... | 167 |
| 9 God Concepts..... | 193 |

| | | |
|-----------|---|-----|
| 10 | Religious Language..... | 206 |
| 11 | Ritual..... | 212 |
| 12 | Life-Span Development of Religiosity and the Self..... | 229 |
| 13 | The Evolution of Self and Religion..... | 246 |
| | References..... | 259 |
| | Index..... | 291 |

Preface

Religion is a defining mark of humanity – as emblematic of its bearer as the web for the spider, the dam for the beaver, and the song for the bird. It is, at least partially, created by human beings, and we can learn much about ourselves by studying it as a product of our minds and bodies. Humanity not only creates religion but is also created by it. Religious beliefs and behaviors exert a profound impact on mental and physical health, dietary habits, mating preferences, and economic behavior. They sustain many lethal conflicts and help to heal many others. For billions of people the world over, religious experiences and beliefs influence who they marry, how they rear their children, whom they spend time with, and how they comport themselves in daily life. It may well be that we would not be as we find ourselves in the twenty-first century if our ancestors had not been intensely religious for most of the “life” of our species. It is high time that we have a real science of religion, and thankfully, breakthrough research on religion begun in the last decades of the twentieth century has culminated in the first decade of the twenty-first century in what is arguably the birth of a new science of religion rooted in detailed anthropologic, cognitive, and neuroscientific studies of the manifold features of religious experiences and in evolutionary approaches to religious experiences and behaviors.

This new science of religion has built on work by previous anthropologic, sociologic, psychologic, and “religious studies” investigations conducted throughout the twentieth century by scholars in those fields. Cross-talk between the cognitive neurosciences and the religious studies field needs to increase, however, as most studies of religion by neuroscientists (mine included, I’m afraid) are too focused on the theistic forms of religion common in the West. We need to teach ourselves something about the richness and complexity of religious phenomena before we make any grand claims about its putative functions.

Although cognitive neuroscience has much to offer to the scientific study of religion or religion studies, religion, in turn, has much to teach the cognitive neuroscientists. As far as I can see, none of the extant cognitive or neuroscience models of human nature or of the Mind/brain can adequately account for the range of behavioral and cognitive phenomena associated with religion. The empirical facts with which religion scholars have been grappling for decades, or better, centuries, simply cannot yet be adequately handled by the current models of the Mind/brain in the cognitive neurosciences. I have, therefore, elected in this book to emphasize the empirical data before us in a few selected domains of religious phenomena. I have wherever possible quoted extensively from original sources so that readers and future investigators can get a feel for the kind of behavioral and experimental changes one sees in religious people and in religion-related disorders.

My overall aim in this book is a modest one: I wish to contribute to the emerging cognitive neuroscientific study of religious experiences and practices. Although I attempt to take some account of non-Western, non-theistic, as well as ancient and ancestral forms of religious phenomena, my focus is mainly limited to the theistic forms of religious experience common in the West. My only justification for doing so is my own ignorance of religious traditions other than my own. One has to start somewhere if one is going to make any progress. I have nevertheless attempted to bring into the discussion those aspects of non-Western traditions that I believe can be profitably illuminated by the cognitive and neuroscience perspective that I adopt in this book. I therefore review the available literature on the neurology and neurochemistry of religious experiences

of individuals from East and West as well as more traditional forms of religiosity such as shamanism and ancestor worship. Although the range of variance in religious experiences across cultures and time epochs is unknown, I find that changes in religious experiences in the sample of subjects that have been studied with cognitive and neuroscientific techniques are, in fact, reliably associated with a complex circuit of neural structures. This, of course, is a remarkable fact. The fact that a particular circuit of brain regions is consistently associated with religious experiences may tell us something about the nature and functions of religion. Whatever else it is, religion is an integral part of human nature and thus religion is not mere delusion. The functionally integrated religion-related brain circuit involves a widely distributed set of neural regions (depending on particular religious behaviors) but nearly always includes the key nodes of the amygdala, the right anterior temporal cortex, and the right prefrontal cortex. Sometimes the subcortical amygdala is not part of the picture, but the hippocampus is. Sometimes one portion of the prefrontal cortex does not “light up” in association with religious practices, whereas another region of the prefrontal cortex will. Sometimes the parietal lobes are implicated, and so on. Nevertheless, in hundreds of clinical cases and a handful of neuroimaging studies, it is a striking fact that the amygdala, large portions of the prefrontal lobes, and the anterior temporal cortex are repeatedly implicated in expression of religious experiences.

Next, I examine the impact of religious practices on the “Self” and on self-consciousness. I define what I mean by the Self in [Chapter 2](#). Interestingly, there is considerable anatomical overlap between the brain sites implicated in religious experience and the brain sites implicated in the sense of Self and self-consciousness. I then show that religious practices often operate to support transformation of the Self such that the Self becomes more like an “ideal Self” that the individual hopes to become. This hoped-for Self is a more centralized and unified sense of Self. Religious practices also help one to avoid becoming a “feared Self.” This combination of a positive “approach” motivational element toward a hoped-for Self and a negative “avoidance” motivational element away from a feared Self makes religion a powerful tool for processes of self-regulation more generally. In short, I argue that religious practices

contribute to the creation of a unified self-consciousness and an ideal “executive Self.”

Why create an executive Self? The executive Self is better able than a disunified Self to compete, to cooperate, to plan, to think, and to make war. The executive Self can also better process highly complex forms of information; thus it is a better “platform” than is a divided Self for development of various forms of intelligence.

Some might agree with the claim that religions help to construct an executive or centralized form of the Self but add that that is an unfortunate fact. They see the centralized Self as authoritarian, repressive, and intolerant and therefore not desirable. My demonstration that religion helps to create a centralized executive Self, these critics would argue, is just one more reason to dispense with religion altogether.

I do not agree with that assessment. Although some forms of religion undoubtedly do contribute to some form of the Self that might be dubbed “authoritarian,” I do not think that most forms of religion and religious practices do so. Instead, when religions are operating normally, they tend to create a healthy, unified, integrated sense of Self. Most religions aim at and are successful in creating mature, autonomous persons, capable of inhibiting their own impulses, planning wisely for the future, and extending service and kindness to others. Religions take as raw material the average man with all of his pettiness, selfishness, blindness, and violence and then create gold out of this unpromising raw material.

Religions accomplish this feat by promoting a cognitive process I call decentering. In this cognitive process, the “Self” (i.e., the Self-construct or the Self-concept) is temporarily taken “off-line” or decoupled from its control over attentional and behavioral goals of the individual while a search is conducted in semantic memory or a suppositional space (or in a “possible worlds” space) for a more ideal or complex Self-concept that can better match the needs and behavioral goals of the individual. When decentering occurs in religious ritual contexts, the ideal Self against which the old Self is compared may constitute a powerful ancestor, a saint, or a god. In these contexts, the old Self is replaced and integrated into a more ideal Self. Story or narrative grammars help to integrate the old into the new Self. New meaning is created, and the individual is enriched by

the experience. I show throughout the book that this decentering process shapes many religious phenomena from healing rituals, to religious language, to possession states, and to prayer and religious experiences themselves.

The decentering process, however, can also go terribly wrong. One of the sequential steps in the process (e.g., decoupling, placing the old Self in suppositional space, the search in semantic memory for a more complex ideal Self, or integration into the ideal Self) can be blocked, damaged, or skipped, thus producing aberrant religious phenomena. Fanaticism or dedication to cult leaders, to take just one example, may result from failure to posit an ideal Self or from premature termination of the search process or fusion and integration into a cult leader's personality rather than an ideal Self. Negative spirit possession, to take another example, may involve fusion with a "feared Self" or identity and a failure to find, move toward, or integrate into an ideal identity.

Religious experiences are among the most powerful experiences that human beings can have. They can produce both awe-inspiring saintliness and horror-inspiring maliciousness. They can elicit the most profound pouring out of the Self for others in some people and the most abject self-absorption in others. They are often life changing and are certainly life-sustaining for those who profess them. The extremes produced by religion are all too obvious to require recitation here.

In the process of my work I have developed a fascination and respect for this most powerful of human experiences. I am not interested in debunking religion's supposed pretensions or calling it "nothing but . . ." Nor am I interested in becoming an ideologically motivated partisan for religion. Rather, I hope to offer readers a serious attempt to understand a wide range of religious phenomena and the powerfully transformative effects of religious experience.

1 God and the Self

The personal in man is just that in him which he does not have in common with others, but in that which is not shared with others is included the potentiality of the universal. But personality is not part of the universe, the universe is a part of personality, it is its quality. Such is the paradox of personalism.

– Nikolai Berdyaev, 1949, p. 22

In the quote above, the Russian philosopher Berdyaev hints at the “personalist” idea that the Self, while utterly unique, nonetheless contains a universal content that makes the Self an end in itself. The Self is something that cannot be regarded as a means to some end no matter how praiseworthy, but rather is an end that is irreplaceable, precious, and infinitely valuable. Its dignity lies in its rationality, its universal content, its irreplaceability – a consciousness that can deliberate rationally about moral ends and choose the good and the true.

This book will examine religion through the eyes of this Self. There are, of course, many ways to study religion, but I believe an approach to religion through the lens of the Self will prove especially fruitful because one of religion’s major self-proclaimed aims is the salvation of the individual Self. Despite the Self’s great dignity and worth, it is treated by religion as conflicted and in need of salvation. The sacred texts of both

the theistic and nontheistic forms of religion explicitly claim that they provide a “way” or set of practices that will eventuate in individual salvation. Thus, by studying religion through the eyes of the individual Self, we will be taking religion’s own claims about itself seriously.

A second reason for studying religion through the eyes of the Self is that, on the face of it, many religious forms and practices are about transformations of the Self. This focus on transformation of the Self, of course, follows logically from religion’s claim that the Self is in need of salvation. Many religious rituals, practices, texts, and institutions are very clearly oriented toward transforming the individual from one state or status into another state or status. For example, many religions in ancestral or traditional societies practiced rites of initiation that would transform an adolescent into an adult. Religions both East and West provide a multitude of individual devotional practices that allow an individual to communicate with and receive guidance from a God and that help to inspire confidence, resilience, and courage. Other ritual practices include healing an individual who has become sick, forgiving an individual who has become lost, and comforting an individual who has become bereft. Many of the prayers, rituals, devotional practices, chants, and hymns found in all the world religions are formulated in the voice of the individual “I.” Thus, our focus on the Self when studying religion has face validity. Whatever else it is, religion is very much about transforming the Self and is addressed to the needs of the Self.

A third benefit of looking at religion through the eyes of the Self is that the method will require that we give due regard to the role of the brain in the shaping of religious experiences. There is no human Self that is not embodied. Because no body can function without a brain, there is no human Self without the brain. Consequently, no account of religion’s impact on the Self will be complete without an account of how the brain helps to shape expression of both religion and the Self. Obviously, this does not mean that both the Self and religion are only products of the brain. Rather, it means that the brain matters. It counts. To fully understand religious experience, particularly at the individual level, we will need to take into account the brain regions that support religious expression. In the West, the contrary idea that matter and embodiment

do not matter was an old Gnostic idea that the Church Fathers fought against and refuted in the first centuries of the Common Era. Despite the ancient roots of the debate, there are still some authors who argue that the body and brain do not matter or at least are of no real importance relative to “things of the spirit,” like culture. A careful examination of religion’s impact on the Self will demonstrate the crucial importance of the brain in shaping religious experience and that the old Gnostic position on “matter” and embodiment is scientifically untenable.

A fourth benefit of looking at religion through the eyes of the Self is related to this idea of the importance of the brain in understanding religious experience and expression. It is obvious to anyone who has ever reflected on religion’s effects on individuals that some of those effects can be quite harmful and even dangerous. Religion produces its share of saints and sinners, as well as visionaries and fanatics. As the events of September 11, 2001, and the international response to those events clearly demonstrate, religion can effectively inspire the most heinous of crimes. Why does religion have this ability to create the most desperate fanaticism and the most sublime saintliness in individuals? I will suggest that part of the answer to that question lies in a detailed understanding of how the brain and cognitive system support the interaction of Self and religious experiences.

A fifth benefit of looking at religion through the eyes of the Self is that we will be obliged to study a whole range of disorders involving changes in religious expression that afflict real people. If we can extend knowledge in this area, it may actually help people with these disorders. We will see in the chapters that follow that there are several disorders of the mind/brain that centrally involve religion in one way or another. Take, for example, schizophrenia with religious delusions. These unfortunate people can experience the most horrific auditory “command” hallucinations involving voices of supernatural agents who demand that the patient harm him- or herself or others. Or take the case of temporal lobe epilepsy (TLE). There have now been dozens of studies that convincingly demonstrate a link between some forms of TLE and heightened religiosity in some TLE patients. During preictal and ictal states, when seizure activity is building up or commences, the religious symptomology may

escalate into delusional states during which the patient claims that he or she is God or has seen God face to face. These beliefs may prompt the patient to engage in dangerous or reckless behaviors. Or take a subclass of patients with obsessive-compulsive disorder – namely, the subclass of patients with scrupulosity. These patients may be riddled with anxiety and may spend hundreds of hours each week attempting to say a single prayer “correctly.” Or take the case of so-called “demonic possession” states. These patients may become utterly convinced that they are controlled by an evil and alien agent that means them harm. Some patients may be so tortured by the possession experience that the state can be life threatening. Whatever the multifarious causes of these various psychiatric and brain disorders, the patients’ religious beliefs are absolutely central to the phenomenology and clinical outcomes of the disorders. Thus, we will need to bring in an understanding of how religion works at the level of the mind/brain to understand and help someone with these sorts of disorders. To the extent that our study of religion’s effects on individuals reveals clinical mechanisms of these religion-related disorders, our work may actually benefit some persons with these disorders.

A sixth benefit of looking at religion through the eyes of the Self is that you can test various theories of religion by careful examination of the predictions of those theories for the life of the individual Self. For example, suppose you theorize, as did Durkheim (1954) and many others after him, that religion functions to create within-group cooperation and solidarity. If true, the solidarity theory would predict that religious individuals would develop signaling strategies to identify and cooperate with in-group members. In other words, the solidarity theory predicts specific individual-level effects that can be tested by looking at individual behaviors. Signaling behaviors in particular must rely on the brain to be expressed, so once again, study of the Self’s brain can illuminate theoretical constructs in the science of religion, in this case signaling theory. Another way to look at this benefit is to consider this fact: If you think religion promotes within-group cooperation, you can certainly test the theory by comparing religious groups to nonreligious groups on some measure of within-group cooperation. If you found that the religious group evidenced greater within-group cooperation than the nonreligious

group, you would certainly have evidence that religion does indeed promote cooperation. What you would not have is an explanation as to how, at the individual level, religion promotes within-group cooperation. To obtain that sort of evidence, you would do well to look at the individual.

For all of these reasons, we will use the Self to probe potential core properties and functions of religion. Conversely, we will also examine the ways in which religion helps to produce and shape the Self. In the process, we will cover a fair amount of ground on both the properties of the Self and of religion. In doing so, we will end up with the materials that will motivate a new theory of both the relation of the Self to religion and the functions of both the Self and religion.

To forecast the main contours of the new theory of religion's effects on the individual, I will propose the following in this book: Insofar as religion is concerned with the Self, it functions to provide a range of techniques that have the effect of transiently "decentering" the agentive or executive Self. Decentering will be explained more fully in [Chapter 3](#). Suffice it to say here that decentering involves a temporary decoupling of the Self from its control over executive cognitive functions and a search for some more effective controlling agency over cognitive resources and mechanisms. The idea is that religious practices create a decentering effect that transiently relaxes central control but that leads ultimately to greater self-control. Depending on the intensity of the decentering mechanism effected by a particular religious practice, operations and consciousness of the central executive Self are transiently suspended, and thus the individual enters a liminal state. That liminal state is filled with potentially positive and negative consequences. On the positive side, decentering puts the individual into a receptive and integrative mode, allowing the individual to perform a lot of off-line maintenance and integrative information-processing tasks. Religious practices and rituals provide the protective cognitive scaffolding to promote integration of all kinds of cognitive and emotional content in such a way as to put that content into the service again of the executive or agentive Self. This Self is enriched, transformed, and transfigured by religious beliefs and practices – depending on the intensity of those beliefs and practices. Another positive benefit of the decentering process is that the individual enters

a kind of transient, trance-like state that promotes healing capacities of the organism. On the negative side of the ledger, the decentering process can, depending on context, lead to dangerous, disintegrative psychic states including fanaticism and psychotic and delusional states.

I will show that one can observe the mechanics of the decentering process by examining disorders that include a change in religious expression as part of the clinical picture. One can even see decentering at work in brain-damaged patients who spontaneously express changes in their religious interests. Studies of these same patients, along with studies of healthy research participants, are yielding a picture of the ways in which the brain shapes and mediates both normal and extreme religious experiences. These neuropsychological data also demonstrate considerable overlap between brain regions implicated in the Self-construct with regions implicated in religious experiences.

I claimed earlier in this chapter that the examination of religion from the point of view of the Self would also yield a new theoretical perspective on the nature and functions of the Self. This is what I mean: When we look at how the decentering process works and what its functional effects are, it soon becomes clear that the central executive Self functions to unify a range of capacities possessed by the individual so that the individual can more effectively pursue goals and desires. The Self is a tool that is specialized for accessing and orchestrating skills and processing resources and knowledge domains in service to the individual. Selves can access, create, orchestrate, and realize new human capacities and powers. They should be seen, in part, as tools or perceptual devices created by cultural beliefs and practices and put in service to an individual such that that individual can vastly increase his fitness by enhancing his cognitive and behavioral capacities. Insofar as religion is about individuals, it can be seen as an exquisitely attuned set of cultural practices that assists Selves in the process of creating new human cognitive powers and capacities. I will support all of these claims in the course of this book.

First I will begin by laying out a general picture of the relationship between religion and the individual, between religion and reason. Recall that the individual, the Self, is defined by its universal content – its ability to reason, to act as a rational agent. Thus, the relationship between

religion and the Self will be defined by the relationship between religion and reason.

Fides et ratio. Reason and religion have more often been seen as enemies than as friends ever since the emergence of philosophy among the peoples of the ancient world. As the religions of the “Book” (Judaism, Christianity, and Islam) emerged and came into interaction with the philosophers of Greece in the West and India in the East, Jewish, Christian, and Muslim theologians attempted to find ways to reconcile reason with the revealed truths of their respective traditions. These efforts climaxed in the twelfth century of the Common Era in the universities of Paris and in the land of Al-Andalus when Andalusia was still ruled by the Muslim Almoravids. An accommodation between reason and religion was reached during this era such that religious truths were seen as consistent with reason. When inconsistencies were noted, it was assumed that more work needed to be done so that the inconsistencies could be overcome. It was assumed that inconsistencies were due to our own ignorance rather than to any supposed inherent flaws in either reason or religion.

In the West, the inconsistencies between reason and religion became more pressing and sharp with the rise and spectacular successes of science and technology beginning in the sixteenth century.

During the Age of Enlightenment in Europe, it became fashionable to excoriate religion as an absurdity and an infamy. The scientist, in turn, was cast as a kind of lone hero, working courageously against the ignorance, stupidity, and willful superstitions of the communities around him . . . and, despite almost overwhelming odds and great self-sacrifice, the courageous scientist was able to achieve intellectual breakthroughs of the first magnitude that benefited the very people opposed to his scientific research.

The irony of such myth-laden accounts of the “struggles between reason and religion” is that most of the early scientists were profoundly religious men. Whatever the truth and merits of this standard myth regarding the role of the scientist in society, it has certainly helped to recruit armies of young men who want to be seen as heroes fighting in the noble cause of “the battle against religion, superstition, and ignorance.” These young “heroes,” despite their self-infatuation, have certainly made enormous contributions to knowledge and indeed to all of humanity. These

contributions, however, have to be attributed, at least in part, to the greatness of the scientific method rather than to any particular heroic efforts of the scientists themselves. Despite big egos, petty political agendas, and huge economic influences, reason and fact tend to win out in science. Again, this is due to the greatness of the scientific method. This is not to neglect the ways in which scientific and technical advances can be put in service to some pretty destructive political purposes. Science produces both technical marvels and a monstrous technics (such as nuclear and chemical weaponry) as well. As Lewis Mumford (1966) pointed out, unless humanity controls its machines, the machines will control humanity. It may be that only religion can control the machine.

If the three great monotheistic religions arrived at a consensus understanding of the relationship between reason and faith during the Middle Ages, that consensus did not survive the period of the Renaissance. What happened to that consensus? How did religion get painted as antisience and irrational? How did religion get branded as irrational?

As just mentioned, the standard answer to that question has been that religion repeatedly opposed scientific advances and thus was seen as a retrogressive and fundamentally irrational force. Again, that explanation cannot be correct given the fact that many scientists were religious men and many churches and religious groups supported the advancement of science in myriad ways from the founding of universities to funding huge scientific research projects. So then, how did religion get branded as irrational?

There are very likely many factors that fueled the reason–religion divorce in the West that began at the time of the Renaissance and the Enlightenment. During the Reformation, for example, some religious people began to call themselves irrational. The principle of “*sola scriptura*,” or the use of scripture alone rather than tradition and reason to guide behavior, could be seen by some as an antirational trend in religion. The overemphasis on personal faith as the primary route to salvation had the side effect of valuing a stance (trust, faith) over rational deliberation about moral choices and so forth. The *sola scriptura* doctrine shifted the accent away from rational interpretative traditions and argument onto the individual with his idiosyncratic interpretative tendencies and his haunted, lonely conscience. That move alone would

not have been fatal to the reason–religion relationship had it not been for the second idea – that faith alone saves. If faith was all that really counted, then you did not need established and rationally justified doctrines, traditions, priests, rituals, or institutions. Indeed, these things were even considered harmful. Faith was explicitly analyzed by some religious thinkers (e.g., Calvin; Kierkegaard) as fundamentally an irrational process, but religion need not be fundamentally irrational or antiscience. Scientific and technical innovation can proceed quite nicely without claiming that religion is irrational. Indeed, science has developed in all cultures on the planet regardless of their position on the reason–religion relationship.

As seen from the point of view of the Self or the individual, reason and religion cannot be opposed. Scientific work on the anthropology, psychology, and biology of religiousness has shown that religiousness is deeply embedded in the human psyche. Religiousness appears to be a human cultural universal and may even turn out to be a trait that is strongly influenced by standard, nonmysterious, evolutionary forces like any other biologic trait. Like that other quintessentially human skill, language, religiousness displays many of the telltale signs of a classic, evolutionarily shaped adaptation or suite of adaptations. Belief in supernatural agents, for example, appears to be acquired relatively effortlessly by children. Children do not need to be force-fed religion; they naturally develop religion's basic component processes. Religiousness, furthermore, varies continuously, as does any other personality trait. Some families and persons are "better" at religiousness than others. Religiousness is heritable. When one twin is religious, the other will likely be religious as well. There are genes that are consistently associated with high scores on religiousness scales. Religiousness, finally, has a definite biology: Some drugs enhance religiousness whereas others diminish it; some brain regions are more consistently associated with religiousness than are others, and so on. We will review all of this evidence in the pages to come.

If we assume, as I think we should, that all of this psychobiological evidence suggests that religion has some sort of functional benefit for individuals, then it follows that whatever else religion is, it is NOT merely irrational or a delusion, unless of course delusions are functional. Although there may be some delusions (e.g., positive illusions about the Self)

that might be functional and therefore positive for the individual, these do not rise to the level of organization characteristic of religious ideas. My illusions about my wonderful abilities and character are not always shared by those people who interact with me on a daily basis. My religious beliefs, however, often are shared. They are more elaborate, more developed, and more demanding than are my personal illusions. My personal illusions accommodate my self-conceit, whereas my religious beliefs demand a better me. Religion therefore cannot be considered a personal illusion – even a positive one.

Instead, religion appears to serve some functional purpose for the individual. How do we identify that purpose? One way to identify potential functional benefits of religion for the individual is to investigate its mechanisms or how religious experiences are mediated by the brain and the cognitive system. By observing how something works, we can sometimes make reasonable inferences as to its function. Although it is clear that we can often better understand the mechanism of a thing by first understanding its function, in many instances we do not know the function of the thing. All we have before us is the thing itself or some basic knowledge about its workings or mechanisms. We can sometimes observe the workings of a thing to get clues about its functions. In these cases we can “reverse engineer” a mechanism to discover clues as to its function. This situation is the one we are in with respect to religion. By observing which brain regions are engaged during religious experiences or behaviors, we can get some clue as to what types of information are being processed and what types of information are not being processed during the experience. Attention to brain mechanisms of religious experiences and behaviors can therefore yield critical clues as to potential functions of religion.

There are problems, however, with basing a scientific enquiry on the reverse-engineering strategy when subjective experiences of a person or persons are involved. First, we can't see subjective experiences, and thus it is a bit harder (although not impossible) to measure them. We are one step removed from the object of study because we have to measure reports about experience instead of experience itself. Here is where the focus on the brain really helps. With modern neuroimaging technology,

we can identify what parts of the brain are activated and deactivated when someone reports a religious experience or engages in a religious practice. Brain activation patterns can be measured. We can subtract the “reporting” portion of the report on religious experience by comparing reports of religious experience to reports of a similar form of experience (e.g., a happy intense experience). Because “reporting” effort is equated across the two forms of experience, any differences in brain activation pattern must be due to or at least associated with the experience itself.

Even when not using the control of neuroimaging technology to look at brain support of religious experience, we can use a similar experimental logic to look at the features of religious experience. We once again simply compare reports of religious experiences to similar reports of equally intense and memorable experiences. Differences in the two forms of report may be due, at least in part, to the features of the experiences themselves because the vividness, intensity, valence, and memorability of the reports have been equated. Even when we are able to note what brain regions are activated in association with subjective reports of religious experiences and not activated in association with equally intense and memorable nonreligious experiences, we are still left with the problem that all we have is a correlation or an association – the report and the experiences or the experience, the report about the experience, and a pattern of brain activation. Correlations, of course, cannot speak to causation, but no one here is claiming that the brain causes religious experiences. My claim is more modest: Religious experiences are realized via the brain in human beings, and knowing how the brain mediates religious experiences can tell us something about potential functions of religious experiences.

Now consider the following case: Suppose that we find that a patient X developed an intense religiousness whenever he used a drug that stimulated only region Y in his cortex. We could legitimately conclude, it seems to me, that because the religious experience was reliably associated with stimulation of cortical region Y it would be reasonable to further investigate the role of region Y in religious experience. We would not be justified, however, in saying that region Y caused the religious experience because all we have is an association among the experience, region Y, and the drug.

Now suppose further that patient X (who, of course, had consistently been producing religious experiences via the drug that stimulates region Y) suddenly suffers a stroke. Upon recovery from the stroke in region Y, he goes back to the drug expecting to have a religious experience, but no such religious experience ensues after ingestion of the drug. The only thing that has changed for patient X is that he lost region Y. It is reasonable to ask, it seems to me, that given that religious experiences ensue after stimulation of region Y and are lost after damage to region Y that region Y may mediate religious experience?

Furthermore, when the doctors perform a computed axial tomography (CAT) scan of the brain, they find that region Y, and only region Y, has been obliterated by the stroke. They conclude that the drug (which normally stimulates region Y) no longer works because region Y no longer exists. Can we therefore conclude that region Y (or the drug) produces religious experience?

No, we cannot. We can, however, make a stronger causal statement about the connection between region Y and religious experience than we could make before. Before the stroke, all we had before us was the association between a brain activation pattern produced by the drug and the emergence of religious experience. After the stroke, we have more information about the three-way relationship among drug, region Y, and religious experience. The stroke tells us that loss of region Y clearly is related to loss of religious experience. Patient X apparently needs region Y to produce religious experiences.

Now suppose we discover another collection of patients, all of whom had been profoundly religious before they died and on inspection all had extra-large region Ys. That piece of information would further support the causal link between region Y and religious experience. If we found a third collection of patients who had once been religious and then had strokes that destroyed region Y and only region Y and then they lost their religiousness . . . then we would have yet further evidence for a causal link between region Y and religious experience. The link was not peculiar to patient X or to patients like patient X . . . it is a human-wide finding.

Now suppose that we learned that region Y was composed of a group of special neurons – call them von Economo neurons, which occur only in humans and only in region Y – and that it was these neurons the destruction of which was associated with loss of religiousness and the presence and number of which were associated with strength and depth of religiosity – the greater the number of von Economo neurons, the greater the level of religiosity. Can we not conclude that region Y is causally implicated in religious experience? Unfortunately, no. The added finding, however, advances the science of religiosity, making the link between region Y and religiosity even stronger.

Finally, suppose that stem-cell science is sufficiently advanced that von Economo neurons could be added to region Y, and when they are, subjects experience enhanced religiosity. Or suppose that stem cells could be used to grow new von Economo neurons that could be implanted into region Y after a stroke to that region. When the new cells are implanted, religiosity is restored.

To sum up, we have a drug that reliably “produces” religious experiences and is known to stimulate only von Economo neurons in region Y. The greater the number of von Economo neurons in region Y, the greater the religiosity. Destruction of von Economo neurons in region Y results in loss of religiousness. Adding von Economo neurons enhances religiosity and restores religiosity when it was lost. With all of these data, can we then conclude that von Economo neurons are causally responsible for religious experiences?

I would say, “No.” All we can conclude from this data set is that von Economo neurons in region Y are required for realization of religious experiences. Region Y must be a key node in the brain network that realizes religious experience.

Although the above set of suppositions regarding a mythical region Y “God module” is all pure fancy, the thought experiment is informative. I will show in this book that the same logic we used in the thought experiment to link region Y to religious experience works in the real world. Although there is no region Y, there is a network Y – a region of the brain that, when stimulated by a drug or seizure activity or by

behavioral practices, produces religious experiences and when lost after brain damage inhibits religious experiences.

Although reports of subjective religious experiences have all of the inevitable shortcomings of reports on other types of experiences, such reports should not be entirely dismissed. We accept this kind of evidence in other realms of human experience (e.g., introspective reports of cognitive processes, reports of dreams, and reports concerning memories, imagination, etc.), and it may be worth accepting secondhand reports here as well. I will show that the experiential evidence is particularly important for an understanding of religion's effects on individuals. Individuals believe in God because they experience Him. Believers claim that they can detect God's actions in their lives and that constitutes real evidence... but only for the believer. Yet it is entirely legitimate to take these reports seriously.

For example, just as we can sometimes accept reports as true reports given by other people when they speak about their inner experiences, we can also accept reports from these same people when they speak about their experiences concerning God. It should be obvious, however, that first-person reports about inner experiences cannot always be accepted as true. We cannot accept reports, for example, from persons who are inebriated, insane, or motivated to deceive. Are religious persons any of these? Not on the face of it. Most religious people are perfectly sane, sober, and reliable individuals. They, at least consciously, are not motivated to deceive.

Just as with other realms of investigation that are dependent on first-person reports of inner experience, reports of religious experience by many individuals can be sorted and studied using standard scientific and rational approaches. Results of this sort of patient, rational approach to religion and religiousness are summarized in the many texts and journals dedicated to the study of the psychology of religion. Among the plethora of findings described in these sorts of texts is the fact that there are commonalities across individuals in the experience of religiousness.

For example, hundreds of controlled analyses of the phenomenological properties of so-called religious mystical experiences are characterized by a consistent set of properties. William James (1902) summarized some

of these properties in his varieties of religious experiences. Pahnke in 1967 built on James's summary. He described properties of all kinds of religious experiences, including those derived from ingestion of hallucinogens. Each religious experience varies in intensity and in the following nine properties:

1. unity or a sense of integration within oneself and with others;
2. transcendence of time and space;
3. deeply felt positive mood;
4. sense of sacredness;
5. a noetic quality or feeling of insight;
6. paradoxicality or the ability to respectfully hold opposing points of view;
7. alleged ineffability (the experience is felt to be beyond words);
8. transiency of the euphoria, but
9. persisting positive changes in attitudes and behavior (Pahnke, 1967).

We can add to the list of nine James/Pahnke features of religious experience eight other features derived from more recent analyses:

10. an enhanced sense of personal power or even that one has been specially blessed by God;
11. enhanced "theory of mind" capacities (these are capacities to accurately guess the mental states and intentions of others);
12. changes in sexual behaviors (these can be enhanced or dramatically diminished);
13. changes in reading/writing behaviors . . . most often these manifest as an enhanced interest in writing (In pathological cases, this becomes a form of hypergraphia.);
14. enhanced awareness and appreciation of music (Despite the recognition by many religion scholars of deep connections between religious rituals and music, the enhanced appreciation of music as a feature of religious experience itself has been neglected in discussions of religious experience.);

15. complex visual and metaphoric imagery (These complex visual metaphors are usually related to the sense of noetic insight that accompanies intense religious experiences. The religious ideas are felt as so meaningful that only complex symbolic visual imagery could capture them.);
16. ritualization (This is the propensity to perform ritual actions when religious experiences are heightened.); and
17. encounter with God or spirit beings.

Now, not every religious experience will contain all seventeen of these elements or be associated with all of these features, but many of them will be present most of the time when you hear a report of a religious experience from an ordinary and healthy person. You tend to get the whole suite of these experiences in mystical or intense states and only a few of them in mundane, everyday forms of religious experiences.

Most religious persons, for example, do not on a daily basis experience paradoxicality, awestruck wonder, or ineffability. They do, in contrast, very often experience a quiet joy (positive mood), persisting efforts at positive changes in attitudes and behavior toward Self and others, noetic insight or a sense of meaningfulness of life, ritualization, and a quiet, unassuming but abiding sense of the sacred in everyday life.

Interestingly, many of the experiential properties of religious experiences flow logically from property #17 (encounter with God), assuming that that encounter is significant for the supplicant. Other properties seem to reflect assimilation of the encounter experience into consciousness. The attempt to relate to God and “read the mind” of God may lead to ecstatic states, ritualization of behavior, and enhanced theory of mind capacities, but it may also lead to a sense of ineffability. Assimilation of the experience may lead to noetic insight and long-term changes in behavior. Remarkably enough, when we examine clinical cases of changes in religiousness in an individual’s life, we find alterations, usually enhancement, in many (if not most) of these phenomenologic features of religious experiences.

When the religious experience is induced by brain disorder, however, there is a crucial difference. The change in the sense of Self is usually

not positive – instead, the sense of Self may be distorted either upward (grandiosity) or downward (the Self is viewed as evil). This special effect of brain injury on the sense of Self in relation to religion is further evidence of the intimate ties between Self and religion that we will be exploring in this book. In healthy cases, the Self is enriched by religion. In cases of brain injury and in cases of psychological dysfunction, the sense of Self is distorted, and religiousness may fuel the distortion unless help intervenes. Nevertheless, even when a brain disorder is present, one may still derive a lot of positive mental content from spiritual experiences. There is usually a positive mood, a sense of sacred awe, a heightened appreciation of beauty and music, and certainly a sense of meaningfulness. There may even be a new compassion for others in these patients.

In terms of the themes of this book on religion and the Self, one of the most important characteristics of the mystical religious experience is the fact that the effects of the experience are long lasting, and they lead to what the individuals themselves who have undergone the experience claim is a form of personal growth – although nothing like the “personal growth” encountered in the pop psychology literature.

I am particularly interested in reports of personal growth in the religious life. The reports are most reliable in individuals who can be called “mystics” or in those who undergo a conversion or who rediscover their religious life as mature adults. In all these cases we have mature, thoughtful, sober, sane individuals describing their experiences when they turned toward God and actively sought a relationship with Him. When reading these reports of religious experiences and lifelong personal religious histories, one is impressed by the range of variation of expression of religious sentiments. What is equally fascinating is that many common themes emerge from this literature.

There are regular patterns in religious transformation. Most people who recount their history of a relationship with God report a kind of journey. Much of this journey can be understood in terms of the attachment dynamics at play in any relationship. There have been several attempts to apply the attachment perspective to religious phenomena (see Kirkpatrick, 2005; Granqvist, 2006). In the God–Self relationship journey, there is an initial period of infatuation, bliss, and love, then a dry period

when it seems as if God is nowhere to be found. Then there is a period of purification (St. John of the Cross's famous "dark night"), when one leaves behind the things that separate him or her from God, and then finally a long period of quiet joy, freedom, peace, tranquility, vibrancy, contentment, generosity toward others, patience with self and others, and a quiet determination to do "God's Will." Given that these "gifts of the spirit" are the usual products of the spiritual life, it is bizarre to say, as some skeptics do, that religiousness is rooted in irrationality and delusion. Throughout the journey, there may be experiences of ineffable happiness and joys when one experiences a kind of forgetfulness or dissolution of Self and a corresponding union with God. Whereas this sort of progression of affective states does happen in some rare (happy) cases of human relationships, most human relationships do not eventuate in these "gifts of the spirit" – so the attachment framework, as helpful as it is, may not be up to the task of fully characterizing religious experience.

Even in the absence of these sorts of mystical experiences, people on the religious journey typically go through the sort of sequence of experiences mentioned above: initial bliss, a period of dryness, a period of growth and purification, and all along a growing sense of freedom, peace, joy, generativity, stillness, compassion, and strength. If the attachment perspective cannot account for this set of experiences, perhaps other frameworks might help.

As Batson, Shoenrade, and Ventis (1993) point out, the cognitive concomitants of this emotional sequence of this "quest" aspect of religious experience mimic to some extent the experience of problem solving and sudden insight and creativity concerning the solution to the problem after a period of impasse. There is an initial period of information gathering, concentrated effort, and intense focus on the problem at hand. After a while it becomes apparent that the problem is much too complex and may even be unsolvable. Then the individual gives up, puts the problem aside, defeated. The feeling of defeat gradually gives way to renewed thoughts about the problem – the "fixation." This is a kind of incubation of new ideas and generation of new approaches to the problem . . . the individual is flooded with new insights and new energy, new enthusiasm,

then again defeat when the problem's real complexity is revealed. There then follows a long period of dryness around and aversion to the problem. The individual completely forgets about it and then one day the solution springs into mind. The individual experiences real insight now.

The religious journey is similar. There is a pattern of regular, repeatable experiences that everyone experiences when they enter the religious life. This pattern of experiences is different from any other domain of life. The religious strain in experience has its own internal logic and pattern – its own intrinsic rationality. There is the initial enthusiasm and explosive growth, then a period of testing, and finally a period of breakthrough and steady maturity. The fact that these sorts of experiences are “regular,” repeatable, and common across all kinds of individuals who undertake the “journey” suggests that religious experience is not random. There is rationality to the process, and that rationality must depend on particular cognitive processes. Now, that rationality, of course, is a practical form of rationality, but as Kant showed during the period of the Enlightenment, practical reason and epistemic rationality must at some point meet and inform one another.

To the extent that (as Sterenly, 2004, has recently pointed out) rationally formed beliefs are counterfactually sensitive, then (contra Sterenly) belief in the veridicality of individual religious experience can be rational. We can modify Sterenly's counterfactual test of rationality as follows: Had the world a religious person experiences been different for that person, his views would be different. Had the world or his experiences NOT included the types of experiences I described above, then he would have concluded that no God existed. But because, in fact, his experiences did include those experiences described by many others on the religious journey (initial euphoria, then a period of dryness, then a period of growth and purification, and all along a growing sense of freedom, peace, joy, generativity, stillness, compassion, and strength), then the test of counterfactual sensitivity is passed. Sterenly and others point out, however, that just because you have brain circuits that reliably produce religious experiences, which in turn are not random, you nevertheless cannot conclude anything about the truth content of those experiences, particularly if they involve a proposition like “God exists.” Even if God does not exist

(counterfactual test), the stimulation of the circuits would, Sterenly might argue, nonetheless produce religious experiences of one kind or another. This argument seems false or untestable to me as it relies on the assumption that God does not exist. There are plenty of examples of specialized or evolved brain circuits that “fire” or function in the absence of their preferred input (e.g., theory of mind circuit), but we do not therefore conclude that other minds do not exist, that mind reading is irrational, or that the firing of the theory of mind circuit in the absence of any direct stimulus says anything about the ontological status of the intended target (other minds) of the circuit. In fact, we use the existence of the theory of mind brain circuit as evidence that other minds exist and to study minds in general. If other minds did not exist, why would Mother Nature create a circuit to detect them? We can only observe the counterfactual (occurrence of religious experiences in the absence of God) if God does not exist, but that is precisely what is in dispute. Whatever the value of the counterfactual sensitivity test as a test of rationality, we have before us a set of human experiences reported by otherwise rational, sane, accomplished, smart, creative people. It’s time that those experiences and the individuals who report them are taken seriously.