THE COGNITIVE NEUROSCIENCE OF RELIGIOUS EXPERIENCE

The Cognitive Neuroscience of Religious Experience, now updated and expanded in a new edition, updates key topics covered in the first edition including: decentering and self-transformation, supernatural agent cognitions, mystical states, religious language, ritualization and religious group agency. It expands upon the first edition to include major findings on the brain and religious experience over the past decade, focusing on methodology, future thinking and psychedelics. It provides an up-to-date review of brain-based accounts of religious experiences, and systematically examines the rationale for utilizing neuroscience approaches to religion. While it is primarily intended for religious studies scholars, people interested in comparative religion, philosophy of religion, cultural evolution and personal self-transformation will find an account of how such transformation is accomplished within religious contexts.

PATRICK MCNAMARA is Distinguished Professor of Psychology at Northcentral University, California. For twenty years he was based at Boston University School of Medicine where he was Associate Professor of Neurology. He has published extensively on the topics of neurology and psychology of religion, including *Religion, Neuroscience and the Self: A New Personalism* (2020). He is a founding editor of *Religion, Brain and Behavior* and co-founder of the Institute for the Bio-cultural Study of Religion.

THE COGNITIVE NEUROSCIENCE OF RELIGIOUS EXPERIENCE

Decentering and the Self

SECOND EDITION

PATRICK MCNAMARA
Boston University and Northcentral University

CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781108833172
DOI: 10.1017/9781108973496

First published as *The Neuroscience of Religious Experience* 2009
Second edition 2022

A catalogue record for this publication is available from the British Library.

ISBN 978-1-108-83317-2 Hardback
ISBN 978-1-108-97789-0 Paperback

To Ina Livia McNamara

Contents

Preface to Second Edition

This second edition of my *Neuroscience of Religious Experience* is practically a whole new book. It is rightfully called a second edition, however, because it is based upon, and updates, all the key topics covered in the first edition. But it does more than mere updating:

- It provides an up-to-date review of the neurology of religious experiences.
- It reviews latest findings on religious experiences associated with psychedelics.
- It reviews empirical examinations of the decentering mechanism presented in the first edition and updates neuroscience findings on decentering.
- It applies predictive processing and free energy principles to every key topic treated in the book.
- It provides a consistent evolutionary biology grounding for all the key religion and brain topics covered in the volume.
- It provides a new neurobiology and theoretical treatment of ritual and the ritualization process.
- It systematically examines implications of evolutionary genetic and sexual conflict for all key religion and brain topics examined in the volume.
- It systematically examines the psychology, neurobiology and phenomenology of mystical states and experiences.
- It presents a systematic theoretical neurobiology of the self, the divided self and relations of these to religion and religious experiences.
- It presents a systematic psychology, philosophy and neurobiology of self-transformation in relation to religious practices.
- It provides a new theory of religious group effects rooted in evolutionary neurobiology and examines its relevance for functions of religion.
- It provides evidence for, relevance to religion of, and an exposition of the new "Theory of Group Mind" (ToGM), which stipulates that humans (and brains) aim to cognize both individual and group minds.

- It updates empirical and theoretical work as well as neural correlates of religious language.
- It systematically examines the evolutionary background, clinical neurology and philosophical phenomenology of the relation of schizophrenia to religion and brain topic areas.
- It incorporates insights of cultural evolutionary models to religion and brain topics.
- It incorporates insights of the embedded, extended, enacted and embodied (4E) paradigm to examine the extent to which religion and brain processes are embedded, extended, enacted and embodied.
- It systematically reviews work on, and incorporates the effects of, supernatural agent (SA) cognitions and "encounters" with respect to all key topics in religion and brain.
- It systematically incorporates rapid eye movement (REM) sleep neurobiology and dreams into topics on religion and brain.
- It attempts to bring religious studies insights to bear on selected religion and brain topics.
- It evaluates the value and significance, as well as the limitations, of neuroscience approaches and neuroscience data on religion.

I tried to write each chapter in such a way as it could, as much as possible, stand on its own without having to have read all the rest of the chapters. That commitment to standalone chapters inevitably entailed some amount of repetition across chapters. I managed, however, to keep that repetition to a minimum. But to get the full treatment on any single topic, say schizophrenia, you would need to read all chapters. For example, the chapter on evolution of religion and brain treats evolutionary approaches to schizophrenia while the chapter on neurology of religious experience treats the neuropsychiatric aspects of the disorder and the chapter on the divided self treats its phenomenology and so on.

In Chapter 1 I examine why neuroscience is not only desirable but a necessary approach to use for understanding religion. The central role of the brain in religious phenomena follows from its central role in human life history. Briefly put, a key (and perhaps *the* key) life history trait among human beings, that is, the trait that influences all other life history variables in the standard catalog of life history traits (e.g., average lifespan, body size, length of juvenile period, gestational period, interbirth intervals, fertility rates) is brain size and complexity. The greater the brain complexity the greater its metabolic demands and the more behavioral resources are organized around those metabolic demands. I also assume and show in this book that the best way to understand the role of the brain in religious experiences is to view the brain as a product of natural selection and

cultural evolution. Within the evolutionary sciences, the most applicable selective force that influences a range of religion and brain topics is, I argue, sexual conflict theory. Sexual conflict occurs when the genetic interests of males and females diverge. I add to the sexual conflict framework Dunbar's evolutionarily informed social brain hypothesis to understand religion and brain data. I also adopt and assume some, but not all, of the claims of "4E cognitive science" (suitably modified to take into account relevant brain functioning and constraints), namely that the mind, and the religious mind in particular, is embodied, enacted, embedded and extended. A final background framework I assume and adopt in this book (and introduce in Chapter 1) is the so-called predictive processing framework (PPF).

In Chapter 2 I systematically reexamine and update empirical work on "decentering." Religion, I insisted in the first edition, could profitably be seen as a neurotechnology for personal transformation in service to potentially positive or negative cultural outcomes depending on socioecological contextual factors. But it all hinged upon this decentering mechanism or process. Decentering includes (1) taking offline the self-concept, or disengaging executive control systems such that the sense of self or agency is transiently diminished and the individual is more open to sensory input and to cultural influences; (2) then the self-concept or structure is placed into a suppositional space or possible-worlds box where it can be edited or worked-upon using available cultural materials; (3) then a search in memory and semantic stores ensues, looking for materials to update the self-structure and guided by existing cultural scripts or narratives, until a more computationally efficient self (given current environmental challenges) is found, or failing identification of adequate self-concept match in semantic stores, construction of a new self-concept is cobbled-together out of available cultural scripts or from entirely new experiential materials; and finally (4) instantiating or binding the new self-concept into a position of executive control in the neural system that is matched to some extent to a culturally appropriate or ideal cultural script, resulting hopefully in a wider, better-adapted sense of self than the old self. Steps 2 and 3 are typically experienced phenomenologically as a kind of liminal or in-between space with high uncertainty and anxious affect.

In updating this schema, I treat decentering as a special case of Bayesian "surprise," where the surprise event in question exhibits special properties because the mismatch between expected and obtained data is large enough that it effectively calls into question the accuracy of the modeling strategy itself, its "Bayesian" priors. Therefore, the individual's sense of self becomes the object of the updating process. When this happens, the likelihood that the experience will be deemed religious or spiritual by the individual and

his or her cultural surround, increases. In Chapter 2 I systematically review what is known about decentering and related cognitive processes as well as their neurologic correlates. In the case of "surprise" and decentering I also show that the surprise event and error signal is extreme enough to trigger so-called pontine-geniculo-occipital (PGO) waves and REM intrusion as part of its "stop and reorient" or orientation reaction. In other words, normal cognitive processes are not strong enough to cognize the information delivered by the surprising event and thus REM sleep is recruited to help. REM then intrudes into waking consciousness, and presumably later that night REM intensity indices are stronger in an attempt to more effectively integrate the surprising information. This REM-based integration process is accompanied by cognitive events we call dreams. It is in these dreams that the cognitive materials for production of SAs emerge. In REM sleep, dreaming perception is decoupled from action as the dreamer is motorically paralyzed and incoming sensory information is blocked. Thus, belief updating and model reparameterization can proceed without interference. PPF requires an offline model reparameterization process and that process is REM. The mind is free to edit and update models during REM free of the necessity of responding to ongoing sensory feedback. Bottom-up sensory input and top-down prediction are decoupled. Dreaming embodies *counterfactual simulation* or *virtual reality generation; that is, predictive simulations*. Chapter 2 concludes with a consideration of recent data which suggests that genes acquired from matings with Neanderthals significantly enhanced the evolutionary role of REM sleep in the neurobiology of anatomically modern humans (AMH).

In Chapter 3 I examine new empirical and theoretical work on the so-called divided self and its relation to the religious mind/brain. I show that a sense of a divided self necessarily flows directly from the principles of the PPF. Generation of predictive simulations and error minimization operate at all levels of the neural hierarchy. Simulations at one level can sometimes not be fully convolved with, and may in fact be actively opposed to, simulations at another level. This is one source of the sense that the self is riddled with competing and conflicting desires and motivations. Each level of the hierarchy aims to predict the input of the level below, and violations of expectancies between predictions and the input (i.e., prediction errors) are propagated up the hierarchy, presumably producing conflicting impulses within consciousness. The endless generation of counterfactual scenarios about self and world may also generate conflicting impulses when they deliver information about hard choices or impossible situations. Another important driver of divided consciousness is evolutionary

genetic conflict between the sexes. I review recent evidence that neocortical brain networks, and specifically social brain networks, are largely built by/regulated by maternal line genes while limbic system networks were built by/regulated by paternal line genes. Thus, neurodevelopmental disorders that are influenced by these imprinted genes display symptom profiles that tracked evolutionary interests of maternal vs paternal line genes. I review Crespi and Badcock's suggestion that psychosis spectrum disorders (especially some forms of schizophrenia) and autism spectrum disorders represent two extremes on a cognitive spectrum with normality at its center. There is a form of hypofunctioning of the social brain in autism, and conversely a form of hyperfunctional social brain activity in psychosis. The autistic brain is said to manifest an extreme version of the systematizing style and a preference for reasoning in terms of mechanical forces associated with inanimate objects, whereas the schizophrenic brain tends to see agency and minds everywhere; it exhibits a hypermentalizing bias. I then review data that shows distinct religious expressions and interests as a function of these two sex-differentiated cognitive styles. I next review the theory of the "dialogical self" as it gives us a good model within which to understand the divided self and the ways in which the religious brain heals divided consciousness. In addition, a pluralistic, dialogic self also gives us a principled way to link the individual up with cultural forces and religious groups. Both the first edition and this updated chapter emphasize the role of the subjective sense of agency in unifying internally conflicted subselves. Agency is a target for the religious mind as large-scale cultural, legal and economic models are built upon assumptions concerning agency. If we assume, as some religious traditions do, that the individual is an autonomous and sovereign agent with a large scope for agency, then it is a threat to the cultural foundations of such a system when individuals report brain-related lapses in agency or significant changes in scope for their agency. The final topic for Chapter 3 is the theory of "possible selves." These are images of what people hope to become, expect to become, or fear becoming in the future. The ideal self is special in that it is crucial for agency, self-regulation and resolution of conflicts in the divided self.

In Chapter 4 I examine data and theory concerning evolutionary accounts of the religious brain. I evaluate several possibilities, including: the physiologic process of self-domestication, heterochronic shifts in ontogeny (i.e., paedomorphism or neoteny), *hypermorphosis* or the extension of growth times, the social brain hypothesis, the links between evolution of language, religion and brain, the accented development of executive control networks in the brain related to tool use and other capacities, the

development of new forms of behavioral plasticity utilized by cumulative cultural creation, the development of special social learning capacities, ultra-sociality, and the special development of REM sleep neurobiology among AMH during the upper Paleolithic. Recent evidence suggests that among the Neanderthal genes preserved in AMH populations are genes (e.g., ASB1, EXOC6) that enhanced REM sleep processes in several ways but also resulted in a higher risk for narcolepsy – a disorder wherein REM neurobiology is dramatically disinhibited, resulting in REM processes seeping into daily waking consciousness. REM neurobiology therefore became available in a new way for AMH peoples of the upper Paleolithic – indeed, it is likely that REM became an intrusive presence for some persons predisposed to dissociative states. This new access to REM neurobiology and states then allowed development of a new form of creativity and religiousness that relied on manipulation of an array of visionary states of consciousness we today call shamanism. I next review the evidence that shamanism was and is a root source for certain forms of religiosity and argue that REM neurobiology contributes to visionary forms of religiosity such as shamanism and mystical experiences. I conclude the chapter with a review of the evidence and the claims that schizophrenia, and its neurobiology, is related to visionary forms of religious experience.

In Chapter 5 I systematically examine the evidence on brain correlates of religious experiences. I begin the chapter with a short history of the first studies on brain correlates of religiosity. I then systematically examine those brain disorders that are associated with *increased* or hyperreligiosity. Some forms of temporal lobe epilepsy (TLE) are associated with hyperreligiosity. I lay out the interesting case of Kumagusu Minakata (1867–1941), a Japanese genius devoted to natural history and folklore. He kept meticulous diaries and, unusually, his postmortem brain was preserved for scientific study. In the 1990s, both his extensive diaries and his brain were studied, revealing extensive evidence of lifelong TLE. In his diaries there were detailed accounts of seizures, auras, déjà vu experiences, premonitions and headaches. His diaries and other written works also contained reams of material on spiritual, religious and mystical themes. He specialized in the study of slime molds, fungi and mushrooms, discovering several new species and reflecting on the difficulties of classifying these entities as plants, animals or some other form of being that exhibited extraordinary forms of intelligence. His religious and spiritual writings are studied intensively today, especially his long letter detailing his spiritual views that he wrote to a Buddhist monk in 1903. The "letter" filled a roll of paper more than 10 meters long by the time it was finished. He expounded at length on the Buddhist doctrine of

pratitya-samutpada – known as *engi* in Japanese – which refers to the well-known doctrine of codependent origination wherein everything is implicated in and dependent upon everything else. Minakata used higher-order logic, and extraordinarily dense arguments, pictograms and drawings including the "Minakata mandala," to make the case for a new spirituality and science. He exhibited extraordinary productivity, publishing on a variety of subjects: fifty articles in *Nature*, 324 articles in *Notes and Queries*, and 1,142 Japanese articles. He was fluent in many languages and had a working knowledge of many others including Latin, Greek, Arabic, Persian and classical Chinese. Murai et al. (1998) performed a volumetric analysis of his brain and found evidence of significant right hippocampal atrophy. Survey studies of TLE patients suggests that the increased religiosity is rare but when it occurs it is often associated with ictal activity in right temporal lobe along with hippocampal atrophy. There has been at least one case where the hyperreligiosity disappeared after right temporal lobectomy. Right temporal loci are also occasionally associated with ecstatic seizures but these also implicate right anterior insula pathology. Interestingly, right-sided anterior temporal and frontal degeneration is sometimes associated with the frontotemporal dementing (FTD) process. About 15 percent of right-sided FTD patients express hyperreligiosity. Even in apparently normal aging, greater (both right- and left-sided) hippocampal atrophy over time was predicted by baseline identification as born-again Protestants, Catholics or no religious affiliation, compared with Protestants who were not born again. Greater hippocampal atrophy was also predicted by reports at baseline of having had life-changing religious experiences. Both right and left hippocampal atrophy significantly predicted religiosity in aging subjects. Some patients with schizophrenia evidence persisting religious delusions and other changes in religiosity. Neuroimaging studies of schizophrenia demonstrate aberrant connectivity patterns between three large-scale brain networks: the default mode network (DMN), the frontal-parietal central executive network (FPN) and the salience network (SN). Between 10 and 30 percent of patients with obsessive–compulsive disorder (OCD) also evidence religious delusions such as scrupulosity. From a PPF point of view, scrupulosity is fascinating because whereas most people according to PPF are looking for the levels of uncertainty that will maximize information in the error signal (uncertainty is good), people with scrupulosity are characterized by an intolerance of uncertainty. Their uncertainty tends to trigger aversive responses only. They need certainty to function. So the belief updating system must be tuned to look for absolute precision in sensory sampling and must be set on absolutely rigid priors.

Neuroimaging studies suggest abnormally increased activity in orbitofrontal cortex, in right temporal cortex and in subcortical basal ganglia (particularly in the caudate) and limbic circuits in OCD. There are other disorders associated with increased forms of religiosity. Decreased function of the right parietal lobe (RPL) was associated with increased sense of closeness to a transcendent being. In addition, alterations in the inferior parietal lobe, usually on the right, is also associated with self-transcendence. Disorders that decrease religiosity or access to religious concepts, such as left-onset Parkinson's disease, are less well studied. Neuroimaging studies of various aspects of religious behaviors or tasks tend also to recruit those three major brain networks that are implicated in schizophrenia, the FPN, DMN and the SN. It is interesting that very few or no functional imaging studies have simply compared the resting state, task-free brains of highly religious people to atheists.

In Chapter 6 I begin to engage with the flood of new data emerging on religion and brain topics from the renaissance of work on psychedelics. After reviewing brain and experiential effects of serotoninergic psychedelics, I argue that psychedelics can indeed induce genuine religious experiences. I then systematically review neuroimaging studies of psychedelics, looking specifically for brain correlates of mystical experiences and encounters with SAs. In addition to the consistent findings of reduced DMN functionality, SA encounters and mystical experiences are associated with decreased functional connectivity between the hippocampus and both the SN and the FPN. I then evaluate three theoretical accounts of psychedelic effects on brain functioning: the REBUS model, the cortico-striato-thalamo-cortical (CSTC) model and the claustrum model, and find that all carry some truth but are weak in accounting for appearance of SAs in mystical experiences. I next argue for an "epistemic account" of the brain-based psychedelic experience which suggests that real knowledge is gained from religious experiences on psychedelics. The psychedelic experience is so richly detailed and so complexly structured, its cognitive structure and content implies some amount of real knowledge acquisition secondary to the experience. I build on work by Benny Shanon, and Andrés Gómez Emilsson, who detailed various forms of knowledge gained via psychedelic experiences. I focus specifically on religious content of psychedelic experiences – namely entity or SA encounters. These are typically explained away as defective attributions of agency. But the entities encountered in both "ordinary" mystical and psychedelically inspired mystical experiences do not merely mirror the individual's mind, desires or movements. Instead, the entities operate independent of, and often

against the will of, the individual. They often know things about the world that the individual does not know. There are also commonalities of entity characteristics across individuals – even individuals who do not or did not know one another. We cannot build a complete naturalistic account of entity encounters on the idea of agency misattributions alone – the mere decision that an action originated outside of me.

In Chapter 7 I focus specifically on brain bases of mystical experiences. I take a Wittgensteinianism family resemblance approach to the problem of defining mystical experiences, thus avoiding the claim that there is a common core of mystical experiences that are always and everywhere present when people claim these experiences; or conversely avoiding the claim that there is no consistent unity at all within this family of experiences. Several alterations of brain network connectivity have been associated with various elements of mystical experiences. For example, individuals with damage to the dorsolateral prefrontal cortex (dlPFC), with diminished executive functioning, report more mystical experiences than individuals with damage elsewhere in the brain. Selective lesions to left and right inferior posterior parietal regions specifically *increase* reports of self-transcendence. Within the predictive promising framework, what may promote mystical experiences is that a mismatch signal or degree of surprise becomes sharp or extreme enough that it triggers an entire dismantling of existing priors associated with the executive self and construction of a new set of priors to support the agentic self and its active inferencing activities. However, the dislodging of the executive self is not yet enough to produce a mystical experience. Instead the construction of the updated beliefs and sense of self has to perfectly hit that sweet spot between resilient but flexible "priors" *and* then a sense of control over the noise or uncertainty/precision levels experienced during sensory sampling during active inferencing. I conclude the chapter with a review of mystical and brain correlates of near death experiences (NDE). Candidate brain mechanisms for NDEs include electrical spikes in the temporal lobes, intrusion of REM sleep into wakefulness, endogenous release of internal opiates and global demodulation of serotoninergic transmission as seen after ingestion of psychedelics such as DMT. Existing data strongly support the REM intrusion theory of NDEs. The prevalence of substantial REM sleep intrusion is at least 60 percent among people with a history of NDEs and 24 percent in controls. A crowdsourcing study of >1000 unprimed laypeople from thirty-five countries found that people with REM intrusion were much more likely to report NDEs than those without (OR 2.85, $P < 0.0001$). A brain model of mystical states suggests disruption of DMN along with disinhibition

on medial temporal lobe (MTL) activity. Similarly, atrophy of right hippocampus would also have disinhibitory effects on the SN and on MTL and medial prefrontal cortex (mPFC). MTL activity is also enhanced in humans during REM sleep and pathological increases in MTL activity due to TLE can result in hyperreligiosity. Finally, dreamlike experiences can be elicited by direct electrical stimulation of the MTL/hippocampus. The brain, dreaming, mystical states relationships run quite deep.

In Chapter 8 I look at transformative experiences as a crucial part of the equation between religion, brain and the self. In self-transformational experiences it is not at all clear what self undergoes the transformational religious experience. "I" am not a single unified self with one consistent set of preferences and values. "I" hold inconsistent beliefs, values, motivations, urges, desires, thoughts and information and therefore my decisions reflect this disunity. Religion-assisted, self-transformative experiences can create or restore a sense of unity. The sense of unified self that transcends the dialogic self is related to activity in the network of midline structures including the DMN, the mPFC, the anterior cingulate cortex (ACC), the anterior insular cortex (AIC) and the precuneus – all regions mentioned in previous chapters concerning brain correlates of religious experience. As in PPF, dialogic self-theory assumes that the brain/mind is a hierarchically organized network of simulations or agents that together function like a society or task-oriented group. To facilitate self-transformation toward a sense of unity, so-called promoter positions within the dialogic self hierarchy function to arrange the subordinate self/agents within a small world network that then allows for a central hub that becomes an "I" with a unified sense of agency. The dialogic self tends to have a monological vs. a disorganized and cacophonous organization in people with schizophrenia. Only transformative experiences can dislodge these aberrant self positions.

A transformative self optimizes the balance between the self positions in an individual psyche. It does so by aiming for an "ideal" self. In dialogic self theory terms the "I" position decenters itself by refusing to own its current position and attempts to own a position of the ideal, imagined or simulated self. Thus, it places all other positions within the psyche in small-world network hierarchical relationships relative to the *ideal self position*. Culture directly shapes intrapsychic functioning via the insertion and subtraction of self positions with the individual plural/dialogic psyche. Inserted self positions obviously begin to interact with other self positions and thus alter the dialogue within the psyche, ultimately influencing decisions taken by the individual. Religion, when it is operating normatively, that is, to buttress existing societal norms, constrains the self

positions inserted into the individual to positions that are promoters of an "I" that adjusts itself to those norms, thus making cooperation within and without possible. I next discuss the neurology of the conversion experience. In terms of the dialogic self theory, what is occurring is the gradual introduction of new voices or positions as habits into the economy of the plural psyche, with these new voices becoming orchestrators of the overall consensus among voices in the psyche. I conclude the chapter with a discussion of the neurology of death as a transformative experience orchestrated via REM dreaming.

In Chapter 9 we examine the psychology and neurology of SAs–supernatural agents. Under PPF, mental states are represented higher in the cortical hierarchy than lower-level causal effects like sensory features of the environment features. When we model/simulate a mind causing an event we presumably start with the physical sensory features of the event and ask what forces could have produced it and then infer what kinds of motor outputs and motor commands could have had those effects and then infer the kinds of intentions that could have created those motor commands and so on. To reason about other minds we have to depend on this hierarchy of inferred causes. But that is not all. When reasoning about other intelligent agents we have to factor in the fact that they know that we are thinking about them and that they will adjust their actions accordingly and so we must do the same and so on. In addition, the 3D theory of mind (ToM) model argues that when people think about others' mental states, they consider three key features: the rationality, social impact and valence of each state.

In short, in reasoning about other minds/agents arms races quickly start spiraling out to levels of complexity that defeat even the most astute strategic thinkers. It is within the complexities associated with this mentalizing realm that we encounter SAs. SAs are one of the things that make religious cognition a unique form of cognition. Unlike ordinary agents, SAs have all kinds of counterintuitive properties and superhuman powers. They also tend to demand intense levels of commitment or sacrifice from us ordinary humans. Naturalistic theories of SAs tend to dismiss them as compensatory fictions for anxious psyches. There is indeed empirical evidence that SAs do sometimes reduce anxiety. But as we all know they can also induce intense levels of anxiety.

Another psychological theory of SAs is built upon attachment theory. It too suggests a "compensation" hypothesis such that individuals with insecure relationships may use to SAs compensate for poor relationships with ordinary people. Another theory concerning the emergence of SAs is

that the cognitive materials for SAs come out of REM dreams. There is a growing body of evidence that systematically catalogs the steps in productions of SA within dreams or via use of dream images.

In Chapter 10 I focus on brain correlates of religious rituals. Rituals too can be said to be a source of construction of SAs. I take a different tack in my coverage of rituals than do other students of ritual. To properly develop a neurology of ritual I argue that the focus needs to be on the process of ritualization. Ritualization is the process by which selected behavioral processes are pulled out (by natural selection, repeated reinforcement learning or cultural selection) from the background of other physiologic and behavioral processes and then stylized into repetitive and sequentially ordered behavioral and motor stereotypies, and then made to perform certain functions or to signal certain messages to conspecifics or adversaries. Dissanayake argued that ritualization involved: formalization (stereotypy), repetition, exaggeration and elaborations of behavioral displays of various kinds. During the course of ritualization, particular changes occur in the original behavior pattern so that the resulting signal becomes prominent, distinctive and unambiguous, and consequently is not confused with its precursor or opposing behaviors. The ritual behavior then functions as an honest display or signal that can unambiguously communicate a message to an adversary. In terms of the neurology of ritualization I use the still viable model of the emergence of stereotypies involving a "contention scheduling system" (CSS), mediated by basal ganglia pathways, that selects and sequences behaviors on the basis of external reinforcing stimuli, and a "supervisory attentional system" (SAS) mediated by striatal-anterior caudate-prefrontal dopaminergic circuits. These interacting systems modulate the action of the CSS on the basis of internal context.

I review Liénard and Boyer's argument that religious rituals are at least partially rooted in activation of human threat detection psychology. I find more empirical evidence to support Whitehouse's classification of religious rituals into two broad cultural subgroups: high-arousal, intensely imagistic but low-frequency rituals vs. the high-frequency, more verbal-centric, doctrinal rituals. The former are characterized by dysphoric experiences (e.g., via painful or terrifying initiation experiences), while the latter doctrinal rituals, by contrast, are very frequent and are less emotionally intense and may even be quite tedious. I argue that these two broad families of rituals are driven by sexual conflict and ritualization. Men and women typically build different kinds of group alliances and this fact may help to explain the two different modes of ritualization. A majority of ancestral human populations exhibited female bias in dispersal – that is,

females left the local group at reproductive age. They then sought out new groups with which to live and to create families. But that dispersal pattern meant that until they had children they lived among low-trust strangers who were genetically unrelated to them. Given the low-trust environment, the female's interests would dictate group and coalitional structures that emphasized direct and indirect reciprocity, lots of verbal negotiating and mind-reading, surveillance of, and harsh strictures against free-riders, supernatural punishment of free-riders by moralizing gods and similar norm-enforcing mechanisms. Thus, female ritualization strategies would promote these kinds of doctrinally based religious rituals. Males, however, who stayed within the local group came of age among genetic relatives. The groups they formed would be high-trust "enterprise associations" or coalitions – that is, task-oriented groups that would form and dissolve based on tasks at hand. Although their within-group situation was stable and high trust, the situation with respect to outgroups was different. There was a lot of intergroup conflict and outright warfare among early human groups. Therefore, the types of groups males had to form had to do with the tasks imposed on them by ancestral conditions of intergroup conflict and the hunt; that is, the ability to plan strategically to outfight and outwit adversaries and competitors. Therefore, the ritualization process favored by male groups would likely be shamanistic and visionary forms of ritual. These forms can enhance out-of-the-box thinking that is so crucial for the instrumental goals of task- oriented groups like war parties and hunting teams. These differing ritualization and sex-related group strategies are reflected to some extent in the brains of males and females. Females are better at verbal tasks than men. They have proportionally larger Wernicke and Broca regions compared to males. They have larger corpus callosums than males and they exhibit less cerebral lateralization than males (more bilateral representation of language and other functions). They are better at learning second languages. This makes sense if they had to disperse out of their natal groups, find and be accepted into a foreign group and learn their languages and customs.

Rituals are intimately related to religious myths and cosmologies. One major myth-ritualist theory was exemplified in the several volume compendium of worldwide mythology called *The Golden Bough* (1890/1959) by James George Frazer. I discuss some of the evidence concerning the Neolithic successors to the Paleolithic shamans: the divine kings. These are essentially SAs who could be seen with the naked eye. The divine kings inherit the shaman's myriad roles of diviner, healer, master of ceremonies, visionary, leader and so forth. As societies became more complex, the kings in turn delegated

some of these healing, religious and leadership functions over the course of centuries to priests and prophets. Divine kingship lasted, arguably, right up to the modern age. Interestingly, human sacrifice may have begun in earnest with the divine kings as victims. According to Frazer, the sacrifice of the divine kings was aimed at unifying the tribe and renewing resources associated with the spring resurrection. But if we base our approach to human and other forms of sacrifice on male ritualization processes then the function of sacrifice very likely had something to do with signaling something concerning aggressive intentions to outgroups, that is, to groups with whom one was at war with in the past. Peter Leeson points out that human sacrifice can be construed as a form of ritualized wealth destruction. There is no need for the enemy to attack you if you had no wealth to lose.

In Chapter 11 we take the study of mystical experiences one step further but now view it from with the realm of religious language more generally. Religious language can be defined as the language that occurs in religious contexts and is found in religious texts, sermons and discourse. Religion both shapes language and is shaped by language. Both language and the decentering mechanism (which I argue is key to religious cognition) described in this book highlight agency as a structuring linchpin for its major elements and operating principles. Agency roughly is the personal sense that I, a subject, can initiate actions and can cause things to happen in the world. Within language the basic structural unit – the sentence or phrase – pivots on the role of the agent. Actions are cognized in terms of what happens to the agent and what the agent causes to happen. The agent is theorized linguistically in terms of what has been called a thematic role: an agent, who does something to a patient, via an instrument and object. These roles capture most of the meanings typically expressed in religious sentences. Decentering as well depends upon what happens to the agent. All known languages display a variety of grammatical devices for representing agency and the ways in which agency operates in the real world. Indexicality, for example, would be impossible without a conception of agency. It requires fitting speech to context, through appropriate use of deictics like pronouns and demonstratives. I discuss implications for religious language and decentering of Chilton's deictic space theory to model how agents/speakers position various entities (other people, objects, events, SAs etc.) in relation to themselves – a deitic origin. Speech acts are another linguistic form that is ubiquitous in religious language. A speech act is often defined as a linguistic utterance that accomplishes some action. Brain systems' support of speech act comprehension and production can only be partially sketched at this point. Empirical studies with patients

suffering from Parkinson's and Huntington's disease point to the role of basal ganglia, left-sided perisylvian and right-sided prefrontal regions as crucial for speech act processing. Religious language also uses metaphor. "Conceptual metaphor theory" or CMT has been used to model metaphorical expressions that express religious content. Conceptual elements or representations in one semantic domain are related to or mapped into another conceptual domain. The source domain may concern physical objects for example while the target domain may involve something more abstract. All of religious language's tools, metaphor, deitic operations, speech acts, CMT and so on are required to understand mystical language or texts. Mystical utterances, more than most other parts of language, obey the 4E principles. Mystical utterances do not merely *refer* to the mystical, but *embody* and *enact* it. The utterances and mystical states are *extended* beyond the human frame. The mystic literally kneels or lies face down or opens his arms wide and chants incessantly or speaks in tongues and so forth. Other enactments of the mystical include silence or the use of paradox, or using only negations to "refer" to the divine. Because the mystic is pointing beyond existing language elements this pointing is also identification of the limits of the linguistic world the mystic inhabits. Mystical language therefore acts to cancel or supersede or overcome existing linguistic constraints on what is permitted to say or think. It moves beyond and therefore ends or overthrows existing cultural norms and breakthroughs to some new world where the "unknown unknowns" lie.

In Chapter 12 I examine recent evidence and theories concerning the groupishness of religion. People who worship the same gods tend to form cooperative groups. Members direct their prosocial and altruistic behaviors toward other members of their religious group and their hostility toward competing outgroups. Some theorists of religion have argued that moralizing high gods have made cooperation among large groups of people possible. It is very likely also the case that "religion" as defined in this book also played a central role in formation and evolution of particular types of small group formations that are uniquely culturally innovative and distinctive to humans. The modern ethnographic record testifies to the near universal occurrence among hunter-gatherer and small-scale horticultural societies of the all-male secret societies within which lore about the hunt, weapons, initiation rituals and SAs was the order of the day. In small-scale hunter-gatherer societies these all-male groups within the tribes were organized around the purpose of optimizing the hunt by creating specific interdependent relations among group members based on skill-sets of each member in the group. Some members were good at tracking animals, others

at spearing them, others at chasing them, others at planning large-scale stampedes and so forth. These all-male groups virtually created the class of groups known as "enterprise associations" characterized by internal division of labor, interdependent relationships among members, long-range strategic planning, regular methods for generating creative associations among disparate ideas and subordination of all within the group to the overriding group purpose. Importantly, you typically could only become a member of a male secret society/group via an initiation ritual. These primary male-specific groups tended to evolve into task-oriented groups of enterprise associations. It was these enterprise associations that decisively shaped key aspects of religious cognition. Enterprise association/groups are formed around a task or purpose for the group, while civil associations are not organized around a single purpose. Instead, they are held together by common recognition of all members of the association of locally prevailing norms, customs, agreements and laws that govern interactions between members of the civil association. Enterprise or task-associated associations, however, are animated by purpose and teleologic aims. That teleologic structure then has downward effects on the internal structure of the within-group relationships among members of the group. These enterprise groups fostered interdependent decision procedures that promote group goals and the striking phenomenon of group agency or group mind. Group agency/mind decisively influenced religious forms of cognition. These group forms facilitated the rise of *distributed forms of cognition* where individual members draw upon the pool of expertise and shared information across group members to expand their cognitive capacity into an extended mind. This is also what occurs in religious rituals. Members are forced to acquire some metaknowledge about the team (i.e. knowing who knows what) and when that separate knowledge is to be deployed to solve the task at hand. Team members also form a kind of identity around their shared destiny or endpoint when the problem gets solved. Each member must acquire *shared task representations* in order to fulfill their roles on the team. By creating shared mental models within the team, the coordination of unique expertise afforded by team members is further enhanced. In addition, it is within the early enterprise associations and secret male societies where *leadership* and charismatic forms of leadership emerged. Given that decision-making procedures are organized around action plans that undergo systematic evaluation via presentation and evaluation of counterfactual scenarios they are strategic *and rational*. Reasons can be cited for any given action plan adopted by the group, thus making group mind possible. The rise of enterprise associations among

ancestral populations also promoted a new religious form of the so-called ToM capacity – namely the theory of the group mind capacities – that is, the ability to read the mind of these enterprise groups or ToGM.

After completing the book, after systematically reviewing recent work in the evolutionary, cognitive and neuroscience approaches to religion, my overall conclusions with regard to the phenomenon of brain and religious consciousness or mind are that the religious brain/mind is structured or functions in such a way as to seek out the "unknown unknowns" or those so-called ineffable experiences that extend beyond everyday human consciousness by creatively accessing previously unused or unexplored combos of brain networks and brain states in order to discover the most information-rich events available to it. It is particularly interested in information-rich events related to the self. It uses the "self" structure or process to both seek out these information-rich events and to enrich self and others, including its local group. Its neurocognitive tool in these efforts is the decentering mechanism (which overlaps with the neurocognitive systems underlying "surprise"). The decentering mechanism is unique to religious cognition and is used to update self-models while looping in the REM sleep/dreaming system to integrate its findings concerning the self and the ineffable into long-term memory systems.

Acknowledgments

I would like to thank Stephen Acerra from Cambridge University Press for his advocacy and support of this project. I would also like to thank my colleagues Jordan Grafman, John Balch, Wesley Wildman, Nick Gibson, Bettina Shapira and James Billings for all kinds of intellectual and moral support that made this project possible.