The Cognitive Neuroscience of Religious Experience, 2nd ed. Patrick McNamara. New York, Cambridge University Press, 2022. Pp. 264.

Patrick McNamara is an American neuroscientist who works primarily as an independent researcher. He considers religious experiences to be at the heart of all religion, and argues that religious experience can be subject to scientific inquiry through the lens of cognitive neuroscience. Much of McNamara's research focuses on the evolutionary origins of REM sleep, a focus which greatly influences his understanding of religious experiences. Broadly speaking, McNamara considers religious experiences to be adaptive neurological mechanisms which serve a concrete evolutionary function, and thus attempts to place religious experiences within a wider unified model of human cognition.

McNamara's *Cognitive Neuroscience of Religious Experience* (2022) is the second edition of a previous text by the same name. His principal focus is to ground contemporary neurological literature on religious experiences within the Predictive Processing Framework (PPF) of cognition. The PPF, a unified theory of brain functionality, has been widely adopted by psychologists and cognitive neuroscientists in the past decade due to the significant explanatory power the framework provides within the cognitive sciences. McNamara's work is a detailed survey of contemporary literature on the cognitive neuroscience of religious experiences, which simultaneously nests the phenomenon of religious experience within the PPF.

McNamara's text is divided into twelve chapters. In chapters 1–4, he presents what he believes to be the function of religious experiences, grounding these experiences in both the PPF and in human evolution. Chapters 4–7 review the literature on the neuroscience of religious experiences in detail. These chapters exam-

ine the effects of serotonergic psychedelics, the biology of near-death experiences, and certain neurological and psychiatric conditions that elicit pathological forms of hyperreligiosity. Chapters 8–12 explore the neurology of various religious phenomena, particularly through the lens of predictive processing and evolutionary frameworks developed in chapters 1–4. In these final chapters, McNamara examines religious self-transformations, the perception of supernatural agents, religious language, ritual, and the social functions of religious experiences.

In chapters 1–4, McNamara argues that religious experiences are the result of mental processes that serve a concrete evolutionary function. McNamara argues that religious experiences are cognitive tools that allow for the transformation of the self. Self-transformation allows individuals to modify deeply ingrained patterns of their own behavior, which could in turn prove evolutionarily advantageous when reacting to extreme changes in one's environment. In order to modify the complex patterns of behaviour that constitute who we are, one's self-concept has to be taken "offline" through a process McNamara calls "decentering."

McNamara uses the renowned neuroscientist Karl Friston's formulation of the PPF to describe the process of decentering, a process which allows self-transformation to occur. According to the PPF, the brain is continuously receiving "bottom-up" information in the form of sensory input from its external environment. However, since the brain is constrained in its processing powers, it actively generates "top-down" predictions about the information it is going to receive from the outside world. By predicting incoming information more accurately, the brain can selectively ignore easily predictable sensory inputs from the external world. When there is a mismatch between bottom-up input and top-down prediction, the discrepant information propagates upward through a nested hierarchy of predic-

tive systems that generate "prediction error." Evolutionarily, the brain is motivated to minimize the amount of prediction error that it propagates, it is thus incentivized to generate increasingly accurate internal representations of its external environment. That said, small amounts of prediction error allow the brain to refine prior assumptions about its external environment, therein leading to more effective predictions. Although small amounts of prediction error are generated continuously, extreme events in the environment that the brain failed to predict can result in unmanageable amounts of prediction error. McNamara likens this extreme prediction error to a form of surprise which can be so unexpected that it results in a "transient decrease in the sense of agency, executive control, and self-control we normally have" (25). Given such intense prediction error, the validity of the brain's most broad-scale predictive models (or "priors") are called into question; when this occurs, McNamara argues, it places one's very sense of self into a "suppositional space for editing and updating [which is] subjectively experienced as a liminal space for the individual" (25). When one's self-concept is suspended, it needs to be reconstructed using new models to replace the old ones which were shown to be insufficient by the large propagation of prediction error. At this point, the individual becomes highly receptive to cultural scripts that could aid in the reconstruction and transformation of the self.

McNamara believes that the suspension of one's self-identity in response to extreme levels of prediction error requires neurological mechanisms which are themselves associated with the evolutionary development of REM sleep. Specifically, he notes the appearance of genes in certain human populations during the upper paleolithic period (c. 35,000–10,000 BCE) which loosened the neuronal constraints around which REM sleep can occur. These new genes are thought to have allowed for the intrusion of REM

sleep neural mechanisms into one's waking life, therein predisposing their carriers to narcolepsy and sleep paralysis. McNamara further notes that the emergence of these genes in the upper paleolithic is temporally and geographically correlated with archeological evidence of early shamanic practices. This correlation, McNamara argues, suggests that religious experiences are associated with the incursion of REM sleep neural mechanisms into one's waking life, resulting in the ability to dramatically restructure self-identity in the event of unmanageably high amounts of prediction error. Consequently, McNamara argues that religious experiences are cognitive tools that recruit REM sleep mechanisms to modify the sense of self in those extreme cases where one's sense of self is called into question.

Throughout chapters 5–7 McNamara examines the neurological foundations of hyperreligiosity, psychedelic experiences, mystical experiences, and near-death experiences. He reviews literature on hyperreligiosity in frontotemporal dementia and temporal lobe epilepsy, noting that dramatic increases in religiosity are often correlated with hyperactivity in the right temporal lobe and hippocampal atrophy. He also examines religious delusions and obsessions associated with schizophrenia and OCD respectively. Importantly, with each neurological correlate of religious experience, McNamara places the relevant neurological changes within the PPF of religious experiences he developed in chapters 1–4. McNamara considers the mental states elicited by serotonergic psychedelics to be genuine forms of religious experience, and he unpacks the emerging body of literature on changes in brain activity associated with the altered states of consciousness induced by psychedelics. Finally, McNamara reviews the literature of mystical states and near-death experiences, both of which he associates with intrusions of REM sleep mechanisms into waking life.

Chapters 8–12 deal with different facets of religious experiences including ritual, religious language, and group behaviour. McNamara argues that the self-transformation elicited by religious experiences create and/or restore a sense of internal unity, since they allow the organization of competing conceptions of the self to be optimized by aligning them with an idealized version of the self. McNamara argues that supernatural agents are the result of the ordinary processes of reasoning about other persons mental states, spiraling out of control when trying to account for particularly complex instances of cause and effect. He further asserts that the cognitive mechanisms for generating supernatural agents stem from REM sleep. In the same way that dreams involve the projection of agency onto dream characters, this same projection of agency can occur when REM sleep intrudes on waking life in response to extreme prediction error. On the topic of religious ritual, McNamara adopts the anthropologist Harvey Whitehouse's division of ritual into two categories: high-arousal/low-frequency, and low-arousal/high-frequency. He places these two families of ritual into an evolutionary framework, arguing that they emerged as a result of differing group survival strategies. The unique nature of religious language McNamara relates to a loss of agency associated with decentering, which renders typical linguistic representations of agency inadequate, resulting in language that seems to reach beyond typical categories of agent-centred semantics. Finally, the group aspects of religion are associated with the formation of all-male "enterprise associations," whose initiation rituals and inclinations to generate strong intra-group bonds shaped key aspects of religious cognition in early humans.

To summarize, McNamara's work provides a clear and up-to-date overview of existing literature on the neuroscience of religious experiences. Not only is this growing body of scientific

literature carefully summarized, but the unusual nature of religious experiences are thoroughly considered via the most cutting-edge theoretical frameworks of human cognition, and are buttressed throughout with anthropological and evolutionary data. McNamara's work, importantly, does not detract from the mystery and complexity of religious experiences, but rather legitimizes them in the eyes of the sceptic by placing this unique form of human behaviour carefully within a nuanced naturalistic framework.

Daniel Miksha, *McGill University*