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COMMENTARY

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Predictive processing and situation models: constructing and reconstructing religious experience

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Taves and Asprem propose an integrated theory of event cognition and predictive coding and they apply their framework to the study of religious experience. We would like to commend the authors for their excellent initiative in further integrating the fields of religious studies and cognitive science. However, we also note two important challenges for the model related to (1) the precise role of predictive processing in religious experience and (2) readers' bias and the reconstruction of situation models (Radvansky & Zacks, 2011).

First, in Taves and Asprem's article, classical theories of event cognition are extended and integrated within a predictive coding framework, according to which event models are updated based on prediction error signals. The authors propose that these event models are hierarchically organized, which applies well to event models for concrete actions (e.g., coffee making) that are characterized by a highly structured sequence of goals and sub-goals (e.g., van Elk, van Schie, & Bekkering, 2014). Eventually, religious ritual actions could also be considered as hierarchically organized such that a high-level goal (e.g., becoming a full member of the church) is achieved through a number of sub-goals (e.g., baptism, first communion), which in turn consist of low-level concrete actions (e.g., pouring water). However, when it comes to experiences, and even more specifically religious experiences, it is less clear that these are governed by hierarchically organized event models. Religious experiences differ in important ways from religious actions (i.e., experiences are often more passive, less structured, and less spatially and temporally constrained than actions), and do not entail a hierarchical organization of the features involved (e.g., such as "hearing God's voice," "loss of self," "feeling ecstatic," etc.). We argue that, although predictive coding indeed provides a powerful framework to account for a wide range of different effects and experiences, more specific predictive neurocognitive models are needed to account for key aspects of religious experiences instead. Specifically, predictive neurocognitive models of hallucinations (Fletcher & Frith, 2009), of the bodily self (Apps & Tsakiris, 2014), and of interoceptive inference and emotion (Seth, 2013) may be applied and extended to a religious context. For instance, auditory hallucinations in schizophrenia have been associated with decreased precision in efferent copy signals in association with self-generated inner speech (Fletcher & Frith, 2009). The accompanying difficulty in dissociating self-generated from externally generated effects could play a role in self-transcendent experiences as well (van Elk, 2015), which are often characterized by a blurring of the distinction between self and others. As a consequence of this proposed extension of the model, there is no unitary predictive coding account of religious experiences, but different aspects of experiences (e.g., feeling connected, ecstatic emotions, etc; cf. Piedmont, 1999) call for specific neurocognitive explanations that do not necessarily entail a hierarchical structure.

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Second, the authors argue that event models account for the role of culture-specific knowledge and effects of prior expectations on the emergence of religious experiences. For instance, an auditory hallucination may be interpreted as the "hearing of a ghost" in a religious context but as a clinical symptom of schizophrenia in a medical context. Furthermore, the authors propose that, based on narratives, the original event working model can be (partly) reconstructed through a process of integrating historical and contextual information and by relying on information about the event boundaries. The authors envisage the historian's reconstruction as proceeding in two steps. The first step is to reconstruct from a public event representation (an event narrative) the mental event representation of the narrator at the time of narration (a memory). The second step is to reconstruct from this event model (of the remembered event) a (hypothetical) earlier working model of the initial event. However, rather than reconstructing an *event working model* of the original experience, we suggest that during language and text comprehension readers construct a *situation model*, involving a representation of the actors, and the space and time of the event (Zwaan & Radvansky, 1998). The distinction between event and situation models is crucial: the event model represents a first-person account of a specific experience interpreted based on relevant background knowledge. A situation model represents a reader's understanding of a specific situation as related by an author. The situation model is based in part on information conveyed by the text itself and, importantly, in part by the reader's background knowledge. Thus, situation models are highly dependent on the prior expectations and expertise of the reader. For instance, expectations regarding the genre of a text (e.g., literary story vs. news story) impact the type of information that is subsequently memorized (e.g., surface vs. situational information; Zwaan, 1994). In elementary school students, for instance, domain expertise was a stronger predictor of text recall than grade level (Schneider & Körkel, 1989). Also, when reading about sports events, only athletes showed evidence of engaging in a sports-specific mental simulation of the events described (Holt & Beilock, 2006). Accordingly, the notion that original event working models can be reconstructed through a process of "inference to the most likely event model" that was at the basis of the narrative overlooks the role of personal expertise, and thus bias, in constructing situation models. Given the idiosyncratic nature of religious experiences, different readers will likely arrive at different situation models of the experiences described, building on their own relevant background knowledge and experiences that best approximate the situation described.

In sum, we suggest that the proposed model is too unspecified regarding (1) how religious experiences come about through predictive processing and (2) how readers' biases affect the reconstruction of a situation model of religious experience. To remedy the inherent difficulty in tracing back the origins of reported religious experiences, a multidisciplinary approach may be necessary involving neuroscientists, religious scholars, and linguists. Only then could one hopefully arrive at an account of which core experiences and which neurocognitive mechanisms may ultimately have been at the basis of the events described in a text.

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