player stops stacking and re-stacking his chips, not because they are finally in order, but because recalibration has finished). As such, in some OCD patients, an impairment in some component of recalibration may cause closure to be less frequent.

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Does meditation swamp working memory?

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Abstract: Religionists often presuppose that "mysticism" aims at somehow emptying the mind. In the light of evidence, however, meditation seems rather to consist of ritualized action without an explicit emphasis on subjective experience. Boyer & Lienard's (B&L's) theory of ritualized action as "swamping" working memory thus might help explain the effects of meditation without postulating experiential goals the "mystics" obviously do not have.

Rituals of meditation exemplify cultural rituals such as the ones Boyer & Lienard's (B&L's) hypothesis is meant to explain. They are of particular interest here because in religious studies meditation is a paradigmatic example of an activity that aims at emptying the mind (see Almond 1982; Andresen & Forman 2000; Tart 1969).

Scholars of meditation and mysticism are roughly divided into two camps. "Perennialists" (see Huxley 1946/1959) argue that meditation aims at a "mystical" experience that is everywhere the same, irrespective of culture and tradition (Forman 1990; 1993; Stace 1960). "Constructivists" argue that all experience is culturally constructed and that there thus is no pure experience, apart from its conceptualization (Gimello 1983; Katz 1983; 1985; Penner 1983; Proudfoot 1985).

Many authors also make a distinction between introvertive and extrovertive "mysticism." The basic idea is that one can strive for an experience of unity either by focusing attention on some external object, or by "diving inwards" as it were (Almond 1982; Pahnke & Richards 1969; Stace 1960). Robert Forman (1990, 1993) argues that the "pure consciousness" that Stace regards as the outcome of the introvertive way, is a state in which one is conscious, although one's consciousness is not directed towards any object and thus does not have any content.

In the light of neuroscience, it is more probable that what is known as "pure consciousness event" is an *un*conscious but wakeful state (Pyysiäinen 2001, p. 114). One cannot, however, use contemporary practices as "transparent windows to the past" in trying to find or reconstruct a timeless "mystical" experience (Sharf 1995, p. 235). Sharf has amply shown that the widespread idea of Eastern religions as laying a heavy emphasis on subjective, "mystical" experience is an unfounded Western projection (Sharf 1995; 1998).

Whether it is Theravada Buddhism, Tantrism, or Zen, historical and ethnographic reports clearly show that the emphasis is nearly always on rigid ritual practice and faithful repetition of the doctrine, not on any "altered states of consciousness" (Sharf 1995; 1998). As Robert Buswell (1992, p. 219) observes, the "testimony of Korean [Zen] monastic community [. . .] suggests that a disciplined life, not the transformative experience of enlightenment" is the most important element in this form of religion. Stephan Beyer (1973) argues likewise that in the Tibetan Tantric rites he had observed, the visualization of deities always took place in a ritual context, while rhythmically reciting a text; this made visualization so difficult that even high-ranking incarnate lamas admitted that they really could not master it.

In Theravada Buddhism, the so-called *mārga*-texts ("path texts"), regarded as meditation manuals, function "more as sacred talismans than as practical guides" (Sharf 1995, p. 241). Prior to the 19th century "Protestant Buddhism," which was a counter-reaction to colonialism and Christian missionary efforts, meditation mostly meant the recitation of Pali texts pertaining to meditation. Even today, most monks consider nirvana to be unattainable and rarely engage in meditation (Sharf 1995, pp. 241–42; 1998, pp. 105–106; see also Bond 1988; Gombrich 1988).

Also, in Zen monasteries the monks are primarily interested in ceremonial repertoires and mastering vast collection of *kôans*. Even the Japanese terms for "experience," *keiken* and *taiken*, were actually coined at the end of the 19th century to translate the German *Erlebnis* and the English "experience." Words such as *satori* do not originally refer to "enlightenment" as an unmediated experience, but rather, to the full comprehension of the Buddhist doctrines. Physical discipline and ritual competence are emphasized at the cost of inner experience (Sharf 1995, pp. 247–49). It is the faithful transmission of bodies of doctrine or of ritual practice that is important. The texts that speak of meditative experience are not first-person reports but rather elaborations of doctrinal ideals. Buddhist monks are explicitly forbidden from vaunting their spiritual accomplishments in public (Sharf 1995, p. 236).

We may thus conclude that in the Buddhist traditions meditation is a heavily ritualized practice. An explicit emphasis on some kind of transformative subjective experience as the ultimate goal of this activity is a modern Western idea having its roots in the Protestant ideal of lived experience at the heart of true religion (Proudfoot 1985). Sharf, however, says nothing of the effects that this practice might have on individuals without their knowing.

B&L's hypothesis, for its part, is based precisely on the assumption that ritualized behavior cannot be explained with reference to persons' explicit motives. First, rituals have effects of which the people concerned are not conscious; second, rituals cannot be explained by their effects alone. Rituals involve familiar actions (walking, etc.) that have been turned into difficult tasks requiring such cognitive control which "swamps" working memory.

It seems that the *kôan* rituals of Zen might work precisely this way. A novice is given a paradoxical problem to be solved, such as the question "what is the sound of one hand clapping." After pondering the question in meditation, the novice meets with the master and tries to provide a solution. There is no correct solution, however; the whole point seems rather to be in that one keeps going with the ritual process. At some point, the master may accept some solution as the correct one, but the "correctness" seems to be based on the master wishing to terminate the process rather than on anything in the details of the solution itself (see the classic collections of *kôans*, *Hekiganroku* 1961; *Mumonkan* 1966; cf. Buswell 1992, pp. 59, 150–58).

Thus, B&L's theory might help explain some of the psychological effects of rituals of meditation, without that we need to ascribe to people motives and goals they obviously do not have. Speculative interpretations can be replaced by an empirical explanatory strategy to explore whether religious rituals actually do swamp working memory.

One important implication for the study of religion is the effect such swamping might have for persons' attitude towards the doctrines in question. Sharf (1995, p. 236) points out that the prohibition to vaunt one's spiritual accomplishments has enabled Buddhists to attribute spiritual experiences to past masters without a need to find living masters claiming to have attained to these experiences. Whitehouse (2004, pp. 67–68) argues in the same vein that a frequent public rehearsal of religious

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teachings ensures that persons will not try to provide novel and unorthodox interpretations of the doctrine. Whereas Whitehouse presupposes that such blocking of "spontaneous exegetical reflection" takes place through a heavy routinization, B&L argue exactly the opposite: it is precisely the non-routine nature of rituals that does the swamping of working memory. Whether this leads to a blocking of unauthorized doctrinal innovation, is yet another empirical question that deserves to be explored.

Habit formation in Tourette Syndrome with associated obsessive-compulsive behavior: At the crossroads of neurobiological modelling

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Abstract: Tourette Syndrome (TS) and Obsessive-Compulsive Disorder (OCD) are highly associated and often it is difficult to differentiate their symptomatology. In TS, habit forming neuronal systems may form habits of their own – sometimes similar to ritualized behavior. However, whereas in OCD merely the "affect-loop" is touched, in TS the "sensorimotor-loop" plays the major role, although some overlap can be seen in the clinical spectrum between TS and OCD. The latter is mainly related to the "just-right" phenomenon which shows a clear developmental course. An analogous behavioral model for TS and OCD with reference to "just-right" is suggested.

Tourette Syndrome (TS) is frequently associated with, and is pathophysiologically closely related to, obsessive-compulsive behavior/disorder (OCB/OCD; Roessner et al. 2005). TS, with its covert drumbeat of sensorimotor urges and its overt motor and vocal tics (which may give relief from the urges with the consequence of a "just-right" feeling), reveals that in this disorder habit forming systems may form habits of their own (Leckman & Riddle 2000; Leckman et al. 2006) – sometimes similar to ritualized behavior.

Habits are assembled routines that link sensory cues (either external or internal) with motor actions. Although no direct causal link between TS/OCD and habits has been established, there exists some evidence that patients with TS have impaired habit learning. This is probably because of their striatal deficit, which is based on a decreased inhibitory influence of the fast spiking neurons (FSNs) over matrisomal cells (MSs). This could allow the cortical sensorimotor inputs to more easily activate MSs, eliciting the premonitory urges experienced by individuals with TS (Banaschewski et al. 2003; Leckman et al. 2006). It is also suggested that FSNs are instrumental in orchestrating the oscillatory activity of the MSs in the dorsal lateral striatum. This seems to be related to normally occurring rhythmic oscillatory activity within basal ganglia circuits, which plays a key role in the emergence and performance of regular voluntary actions and habits. Further, these oscillations appear to be linked with oscillations from cortical regions (e.g., prefrontal, mesiofrontal) during the repetitive performance of learned behaviors and tic suppression (overview in Leckman et al. 2006).

Hence, different regions of the basal ganglia seem to oscillate in synchrony with specific cortical, cerebellar, and thalamic regions to guarantee neuronal homeostasis. It also implies that irritations in basal ganglia functions may lead to dysbalanced thalamocortical activity and thus to problems in habit forming and/or habit execution, as it seems to be the case in TS. This view is supported by the fact that electrical deep brain stimulation (e.g., thalamus) may work by re-establishing more normal tic/OCB suppressing oscillatory patterns via its effect on striatal neurons (Leckman et al. 2006). In this respect, the error detection system of the anterior cingulate cortex (ACC) may play an important role for the monitoring of such processes. Its activity is increased in OCD and TS (Fitzgerald et al. 2005; Johannes et al. 2001; 2002).

In attempting to explain OCB and its abnormal control processes, Boyer & Lienard (B&L) give an interpretation of Szechtman and Woody's (2004) motivational model of OCD, trying to investigate emotions, perceptions of specific information, typical actions, and inhibition or disinhibition of automatic routines. The model is focusing on the "detection of potential danger" and the following steps. Unfortunately, B&L's interpretation of the model did not have a look at the association of OCB with TS but, fortunately, a slightly modified version of the model itself can be developed for TS as well (Fig. 1). The main difference is the first step where in OCB/OCD the detection system recognizes a cognitive-emotional dissonance, whereas in TS a sensorimotor dissonance is prevailing without any anxiety. As a consequence, the "affect-loop" is not touched in TS while disturbances in the "sensorimotor-loop" are counter-balanced by repetitively acting out the tics which sometimes may mimic ritualized-compulsive behavior, but do not reflect activity of a "security-related-program-loop."

Similarly, this seems to be the case for another core process of ritualized action, namely *safety motivation triggered arousal* (see target article, sect. 3.3). The authors assume that the arousal state may bias the appraisal system in such a way that "just right" or "closure" experience is delayed. Although the latter assumption is close to what happens in patients with TS who show hyperarousal (Kirov et al., in press; Kostanecka-Endres et al. 2003), here again the aspect of danger/safety does not play any role concerning the "just-right" phenomenon in TS.

Thus, the link between OCB/OCD and TS is quite complex (Roessner et al. 2005) and it yields that the disorder specificity

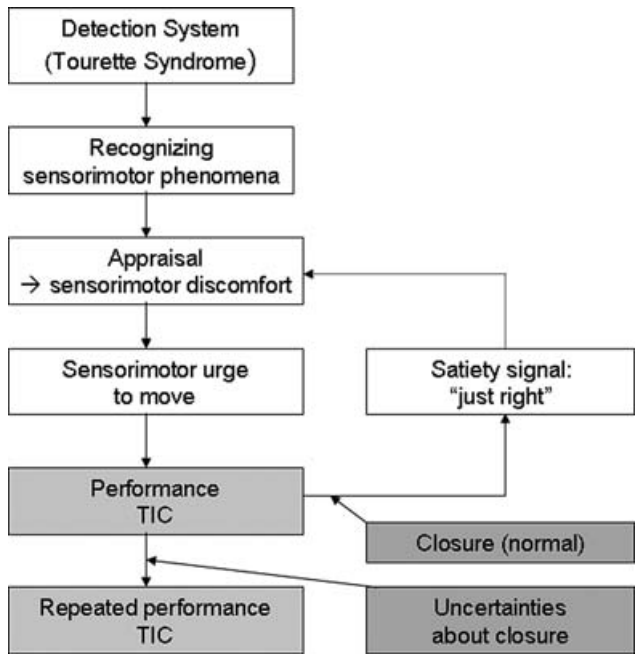


Figure 1 (Rothenberger et al.). Cognitive-Sensorimotor Model of Tic-performance. Adapted from Szechtman and Woody's (2004) Emotional Model on obsessive-compulsive behavior as interpreted by Boyer & Lienard. White rectangles correspond to distinct systems activated, light grey boxes to behavioral results and dark grey boxes to aspects of the processing. Suppression of tics by activating frontal lobes is possible at any stage of the process.

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