

God Is in the Gaps:
The Neurobiology of Spirituality
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The pith phrase, “God is in the gaps” has been employed by creationists of a Christian fundamentalist flavor to attribute to God all of the inexplicable phenomena of existence which have not been or cannot be described by science. Contrastingly, this phrase has also been employed by spiritualists of an Eastern flavor who utilize the phrase in reference to the freely arising ineffable and unknowable which is seen directly only through the gaps in the I/me/mine consciousness, which is woven by all human beings as a veil between themselves and the infinite. Herein I propose a new use of the old pith phrase to describe direct spiritual experience, spirituality, and the continuity of the self in neurobiological terms. To support this notion, I will draw upon neurobiological examinations of the mechanisms of personality, past studies of hallucinogens, and findings from recent studies of spiritual experiences. Through a casual survey of these studies, we will see which aspects of neurobiology play the most significant role representing that “God is in the gaps,” as well as contextualize the significance of spiritual experiences in a larger spectrum of spiritual life.

For an inquiry into the neurobiology of spirituality, we must first clarify what spirituality is, and how it differs from religion. For a starting point, I refer to the anthropologist Clifford Geertz, who defined religion as “a system of symbols which acts to establish powerful, pervasive, and long-lasting moods and motivations.” For the purposes of this paper, I will disregard the symbol sets, which are more properly the domain of religion and well beyond the scope of our discussion. I use the term “spiritual experience” to refer to the general moods and “spirituality” to refer to the general motivations. “Moods” refer to transitory states, peak experiences, and feelings of love, bliss, and so on, when experienced as having spiritual import. These moods can be examined directly by neuroscientists utilizing devices to monitor brain activity. “Motivations” refer to the urge or desire to continue spiritual practice as well as to

engage actively in the world in a manner consistent with one's spiritual feeling. Humanistic and cultural schools of psychology may provide more qualitative study of motivations than neurobiology. However, the footprint of long-term practice, which arises from that motivation, may be seen on the brain (Austin, 1999).

With regards to a more qualitative view of spirituality, the Temperament and Character Inventory (TCI) is utilized in many studies to assess personality and describe it in seven dimensions, of which the most relevant to our discussion is that of Self-Transcendence. "Self-Transcendence quantifies the extent to which individuals conceive themselves as integral parts of the universe as a whole. Self-transcendent individuals are spiritual, unpretentious, humble and fulfilled" (Cloninger, n.d.). There is a significant relation between this particular TCI dimension and observed neurobiology. In a study titled, "The Serotonin System and Spiritual Experiences", Jacqueline Borg, et. al., found a correlation between the low density of a specific serotonin receptor site (5-HT_{1A}) and the TCI dimension of self-transcendence, but found no correlation for any other TCI dimensions (2003). According to Borg, et. al., this finding, "indicated that the serotonin system might serve as a biological basis for spiritual experiences" (2003, p. 1965).

Serotonin is vital to many human functions, so it is not too surprising that it is a key piece of the neurobiology of spirituality. Studies find that the human serotonin system is very complex, reaching almost every region of the brain, with receptors found throughout the body (Nichols & Sanders-Bush, 2001). Serotonin aids in processes regulating such diverse functions and experiences as emotional states, appetite, aggression, sleep and dreaming (Franzoi, 2004), as well as the formation of memory through learning (LeDoux, 2002). Because of serotonin's central role, drugs which keep serotonin active in the brain, either by increasing its production or inhibiting its reuptake, are prescribed to treat depression, overeating, violent behaviors, and sleep

disorders (Franzoi, 2004). The centrality of serotonin in both healthy and disordered human behavior and experiences, as well as learning and memory, seems to substantiate its role in spiritual experience (i.e. moods) and any predisposition toward the same (i.e. motivations).

The serotonin system's key role in spiritual experiences is also supported by observations of the effects of hallucinogenic drugs, such as LSD (lysergic acid diethylamide), psilocybin, DMT (N,N-dimethyltryptamine), mescaline, and others. Hallucinogens are known to affect the serotonin system in several brain regions (Borg, et. al. 2003). The molecular structures of many hallucinogens are very similar to serotonin, which makes hallucinogens uniquely useful tools in the investigation of the serotonin system (Nichols & Sanders-Bush, 2001). As hallucinogens are widely regarded as creating states that resemble authentic spiritual experiences, they are also referred to as psychedelics ("mind-manifesting") or entheogens ("god-manifesting"). However, there are notable distinctions when compared to spiritual experiences not hallucinogen-induced (Austin, 1999).

Serotonin's key role in spiritual experiences is taken as factual basis for observation in a study titled "The Neurobiology of Mystical Experience," which is currently underway at the University of Montreal. For the study, Dr. Mario Beauregard and his research team will monitor the levels of serotonin in the brains of Carmelite nuns who have experienced *unio mystica*, the Christian mystical union with God, which is generally experienced only once or twice in a lifetime (McIlroy, 2003). Notably, the researchers do not require that the nuns experience *unio mystica* in the lab. Instead, it is sufficient that the nuns relive their memory of the experience for the study, as there is substantial evidence supporting that remembering or visualizing an experience activates the same parts of the brain that are otherwise actively involved in the genuine experience (McIlroy, 2003). This capacity for activated recall may also be illustrated in

the processes of learning as influenced by emotion, which we will touch on later. Through this study, Beauregard hopes to understand the neurobiology of Christian mysticism specifically, which he suspects may involve a different mechanism than that of the meditative experiences of Buddhists (McIlroy, 2003).

With regard to the meditative experiences of Buddhists, in his weighty volume, Zen and the Brain, Dr. James H. Austin examines in minute detail the neurobiological functioning of consciousness and the temporary states produced by meditation. He compares the content of some higher meditative states with those induced by LSD, and finds that while there are noteworthy similarities, there are qualitative differences between the two. For example, citing a LSD study by Robert Masters and Jean Houston (1966), Austin describes the experiences of a very small percentage of subjects (3%) whose LSD experience met the study's criteria for the "integral level" of consciousness, which is the level where authentic religious experiences arise (Austin, 1999).

...[T]he subjects had remarkably stereotyped experiences. The episode usually began with ego dissolving into "boundless being" amid a perception of extreme light.

Categories of time vanished into eternity. The world was transfigured into an undifferentiated unity. Knower, knowledge, and known all became one. Thereafter, the person became more interested in, and more responsive to the basic phenomena of everyday existence (Austin, 1999, p. 429).

Austin points out that when a drug precipitated this rare kind of experience, of which the responsiveness to everyday existence is an essential Zen aspect, "it rarely went on to transform the person in the same radical way as did those other spontaneous religious experiences" (1999, p. 430). Why is that? From the perspective of Austin's Zen-centric work, a casual LSD

experience simply lacks the benefits of formal training in stabilizing the mind, and is without the context of a long developed, tried and tested, eloquent metaphysical worldview to utilize for integrating the experience into a lasting realization.

The import of these findings is with regards to the significance of spiritual experience, whether spontaneously experienced or precipitated by the use of hallucinogens, in the context of larger spiritual practice. As John Haught, professor of theology at Georgetown University put it, “It involves commitments and suffering and struggle – it’s not all meditative bliss. It also involves moments when you feel abandoned by God” (Vedantam, 2001, ¶ 19). To look at the significance of spiritual experience in another way, let us consider fiction through a review of the novel Lying Awake, in which a nun, diagnosed with temporal lobe epilepsy, is to undergo surgery. She is conflicted about choosing the surgery, which will end the spiritual ecstasies caused by her epilepsy. Michael Joseph Gross, the author of the review, quotes the novel at the point that the nun seeks counsel from a priest:

“Should I automatically assume that my mystical experiences have been false, or should I stand behind what my heart tells me? Is God asking me to let go of concerns for my health, or is he asking me to let go of my desire for his presence?” In response, the priest gently chastises her: “You allowed yourself to think that loving God meant enjoying His company, having ecstasies. It was all about you, wasn't it? But loving God is supposed to be all about Him. About trusting him, putting yourself in His hands completely.” (Gross, 2001, ¶ 15)

After the surgery, the nun loses her ecstasies, but instead finds a newly deepened faith. This story is echoed in the early findings of Beaugard’s study of the Carmelite nuns:

Sister Diane compares her love for God to the way two people love each other. When they fall in love, they feel a physical rush.... the kind of love young nuns feel for God when they experience *unio mystica*. But over time, the love deepens and matures... more like a marriage, solid, secure, but without the rush (McIlroy, 2003, ¶ 47).

Spiritual experiences can provide significant inspiration as well as insight into the workings of the human brain and how that relates to the mechanisms of the self, but are simply not the whole of spirituality. Spiritual experiences, or peak meditative experiences, as Austin points out, must arise and fall within a relevant context and then be integrated into the greater continuity of one's self (1999).

How does neurobiology speak to the integration of spiritual experiences? Since the serotonin system is pervasively involved in so many aspects of the human experience, the serotonin system changes involved in spiritual and hallucinogenic experiences cause shockwaves to reverberate throughout the body's normal functioning. The shockwaves of this temporary state also reverberate as the person actively works to integrate the experience into their being, as is demonstrated by Beauregard's study of nuns recalling their past mystical experiences. As I mentioned, the motivations of spirituality can leave their footprint on the brain. This footprinting is done via the continual development of synaptic relationships between the neurons in the ongoing wiring and rewiring of the brain, which happens with greater intensity and "coordinated parallel plasticity" during high arousal emotional states, such as those experienced during spiritual experiences (LeDoux, 2002, p 322). The synapse develops and redevelops over time through experience and learning, underlying the same changes human personalities undergo (LeDoux, 2002).

In his book Synaptic Self, New York University neuroscience professor Joseph LeDoux admits that although neuroscience cannot at this point develop a complete theory of personality, he states that it can provide a foundation based on study of the patterns of interconnectivity between neurons in the brain. Utilizing findings of the past few decades of recent neurobiological research, particularly in the areas of conscious and unconscious processes, learning and memory, he develops and supports his primary thesis: the self is synaptic. LeDoux leaves room for other perspectives, however. “The idea that the self is created and maintained by arrangements of synaptic connections...doesn’t diminish who we are. It instead provides a simple and plausible explanation for how the enormously complex psycho-spiritual-socio-cultural package of protoplasm we call our self is possible” (LeDoux 2002, p. 12).

It is not only experiences of God or ultimate reality that occur in the synapses via serotonin, but it is also ourselves that we there find. Whether an experience of an abstract transcendent wisdom, universal love, or an intimate deity, God is in the gaps. As we have seen through this brief survey of studies into the neurobiology of spirituality, there is an observable link between peak experiences and the pervasive serotonin system. Serotonin’s key role in so much of human functioning indicates the depths of experience and heights of development possible due to dramatic temporary changes in the serotonin system, as well as lights the pathway to the complex work of integration through learning and memory. “Advanced alternate states of consciousness exemplify the capacities of the human brain for change. Put simply, they help us cast off our outmoded, hard-shelled, stereotyped behavior patterns” (Austin, 1999, p. 688).

References

- Austin, J.H. (1998). *Zen and the brain: Toward an understanding of meditation and consciousness*. Cambridge, MA: The MIT Press.
- Arehart-Trieckel, J. (2004). Serotonin receptors may be linked to spirituality. *Psychiatric News*, 39:1, p. 33.
- Borg, J., Bengt, A., Soderstrom, H., & Farde, L. (2003). The serotonin system and spiritual experiences. *American Journal of Psychiatry*, 160, 1965-1969.
- Beauregard, M.D. (no date). *The neurobiology of mystical experience: Abstract*. In *Spiritual transformation: Scientific research program*. Retrieved November 11, 2004, from http://www.metanexus.net/spiritual_transformation/news/STP%20Grantee%20Abstract-Bios5.htm#awardee100.
- Cloninger, C.R. (no date). *Temperament & Character Inventory*. In *Sansone family center for well-being*. Retrieved November 11, 2004, from <http://psychobiology.wustl.edu/TCI/whatIsTCI.htm>.
- Gross, M.J. (2001). Hard-wired for god? *Salon Magazine*, February 1, 2001. Retrieved November 11, 2004, from http://dir.salon.com/books/feature/2001/02/01/god_part/index.html.
- Franzoi, S.L. (2004). *Psychology: A journey of discovery*. Cincinnati, OH: Atomic Dog Publishing.
- LeDoux, J. (2002). *Synaptic self: How our brains become who we are*. New York: Penguin Books.

McIlroy, A. (2003). Hard-wired for god. *Globe and Mail*, December 6, 2003, F1. Retrieved November 11, 2004, from

http://www.metanexus.net/spiritual_transformation/news/globeandmailstory.html.

Nichols, C.D. & Sanders-Bush, E. (2001). Serotonin receptor signaling and hallucinogenic drug action. *The Heffter Review of Psychedelic Research*, 2, 73-79.

Vendantum, S. (2001). Tracing the synapses of our spirituality: Researchers examine relationship between brain and religion. *The Washington Post*, June 17, 2001. Retrieved November 11, 2004, from <http://www.maps.org/media/vedantam.html>.