Developing the Mystical Mind

Hans Van Eyghen

Abstract: I argue that harder, more advanced forms of religiosity, which include profound mystical experiences and a developed religious mindset, can be fostered by engaging in devotional practices. By engaging in contemplation, fasting, and sleep deprivation, subjects can move from intuitive, basic forms of religiosity to more advanced forms similar to those exemplified by Christian mystics. In support of the argument, the paper gives examples of the role of contemplation, fasting, and sleep deprivation in devotional practices of Christian mystics. It also looks closer at the effects of such practices on the neural cognitive level.

Keywords: cognitive neuroscience; contemplation; mysticism; natural religion; neuroplasticity; spiritual practices

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Every major religion has a (small) group of religious experts. Some of these are ritual experts with more knowledge of proper ritual behaviour. Others are theological experts with advanced knowledge of doctrines and the nature of divine beings. Some have a different expertise. They are more prone to profound mystical experiences and appear to have a vastly different outlook on the world from the rest of their fellow believers. Christianity has a long and venerable tradition of mystics who fit this picture remarkably well. They report visions of God or angels, and appear to live in very close relationship with God. Often, these mystics inspire large groups of followers, and a considerable number have been canonised, or proclaimed saints.

Quite often, mystics are called spiritually or differently *gifted.* The word "gifted" signals a commitment to the idea that such individuals were born with different skills or abilities, or that they differ because of something beyond their own will and actions. In this paper, I aim to challenge this idea at least to some extent. The main claim of this paper is that there are steps that individuals can take to transform their cognitive functions and foster profound changes in their religious experience. These changes amount to moving beyond what humans are endowed with by nature. The claim thereby aims to support the idea that religiosity is to a considerable extent the result of nurture and not merely nature. The steps relevant here are often part of devotional practices.

In support of the main claim, I look at evidence from cognitive neuroscience for cognitive change due to undertakings that resemble devotional practices. Given that the array of devotional practices is vast, the focus lies on contemplation (in connection to attention), fasting, and sleep deprivation. Although similar projects have been conducted before,[1] bringing together perspectives from history of religion and cognitive neuroscience is still quite rare.

1 See Jerome Kroll and Bernard Bachrach, *The Mystic Mind: The Psychology of Medieval Mystics and Ascetics* (Routledge, 2006). Their project, however, differs from mine in that their focus is more on psychology and less on cognitive neuroscience. Another example is Fraser Watts, *A Plea for Embodied Spirituality:*

The paper is exploratory in nature. Much more can be said regarding devotional practices and their cognitive effects. The discussion below gives a preliminary indication of how religious practices can foster different religious beliefs, experiences, and mindsets. A fuller investigation will need to look at the broader context of devotional practices and at their effects on the neural level in greater detail. This lies beyond the scope of this paper.

This paper is structured as follows: First, I compare two forms of religiosity, which I call "easy religiosity" and "hard religiosity." Then, I discuss three devotional practices, contemplation, fasting, and sleep deprivation, and give examples from the history of Christian mysticism. After that, I consider the effects of these three practices on human cognition from a neuroscientific perspective. The last section concludes the paper.

Easy and Hard Religiosity

Scholars of religion are aware of the ease with which terminology can get confused. For example, they seem to have many, sometimes rather different, phenomena in mind when they use the term "religion." The same goes for religiosity, religious belief, religious idea, and religious practice. This section serves to clear up some of the confusion and distinguishes two different kinds of religiosity. One I call "basic" or "easy religiosity." The other I call "advanced" or "hard religiosity." The latter is the religiosity of mystics and the former that of most common believers.

Both kinds of religiosity pertain not so much to a collection of beliefs or ideas stored in a given human mind, but rather to a mindset or skillset of humans in general. How to define "religiosity" accurately is a matter of debate, with varying definitions used depending on one's goals.[2] For reasons of scope and simplicity, herein I consider religiosity

The Role of the Body in Religion (Eugene, OR: Wipf and Stock Publishers, 2022). Watts focuses more on psychology as well.

2 For a discussion, see Barbara B. Holdcroft, "What Is Religiosity," *Catholic*

to be an ability to have a specific religious mindset and to elicit religious experiences.

Both points merit some elaboration. Having a religious mindset refers to how religious ideas or behaviour permeate one's life. Having a different religious mindset may involve having different beliefs, but that is not necessary. For some people, the religious mindset pertains to moral inclinations and daily practices such as prayer. For others, it might encompass the idea that God has a plan for them or the sense of being guided by God in most of their activities. Religious experiences include profound mystical experiences, where subjects are personally in direct contact with God (or angels and saints), and vaguer experiences such as the sense that God is present.

Presenting a contrast between easy and hard forms of religiosity (see below) is to some extent reductive. A more elaborate account would need to be a continuum of various intermediate forms of easier and harder forms of religiosity. Again, for reasons of scope and simplicity, I adopt a contrast where "easy religiosity" captures the most basic forms of the continuum, while "hard religiosity" includes more complex forms.

Easy Religiosity

Overall, religiosity appears to come easily. Common sense shows that many people easily obtain religious ideas, religious behaviour, and perhaps have vague religious experiences. Many people seem to acquire religious beliefs easily through inculturation. Testament to this is the fact that many accept the religious ideas that are dominant in their environment. They appear to develop these forms of religiosity rather spontaneously or organically, without much effort.

The idea that some forms of religiosity come easily has some scientific basis. Defenders of cognitive and evolutionary accounts of

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Education: A Journal of Inquiry and Practice 10:1 (2006), 89–103, https://ejournals.bc.edu/index.php/cej/article/view/733.

religion tend to underwrite the claim that religion is natural.[3] Claiming that religion is natural can mean various things.[4] Defenders of cognitive accounts tend to use the term "natural" as meaning intuitive or easily acquired. For some theories, a belief is natural in this sense that it is the outcome of one or more cognitive mechanisms that are left unimpeded or unaltered by cultural influences.[5] Other accounts allow for cultural alterations to cognitive mechanisms but merely stress the ease or intuitiveness by means of which beliefs are produced and adopted.[6]

Some add that the ease by which people gain basic religiosity is the result of natural selection. Because having religious beliefs is evolutionarily advantageous, religious beliefs are easily acquired. The same goes for other basic forms of religiosity, which do not require much effort. Important reasons for selecting religion as evolutionarily advantageous might have been its role in social monitoring,[7] fostering cooperation,[8] and increasing the odds of procreation.[9] Important for

3 A fuller summary of key ideas in cognitive and evolutionary science of religion lies beyond the scope of this paper. For overviews, see: Claire White, *An Introduction to the Cognitive Science of Religion: Connecting Evolution, Brain, Cognition and Culture* (London and New York: Routledge, 2021); Luther H. Martin and Donald Wiebe (eds), *Religion Explained? The Cognitive Science of Religion after Twenty-Five Years* (London: Bloomsbury, 2017).

4 For an overview of various meanings, see: Aku Olavi Visala and Justin Barrett, "In What Senses Might Religion Be Natural," in *The Naturalness of Belief: New Essays on Theism's Reasonability*, ed. Paul Copan and Charles Taliaferro (Lanham: Lexington Books, 2018), 67–84.

5 This is roughly the account of McCauley. He distinguishes maturationally natural from practiced natural beliefs where the former are beliefs that are produced by unimpeded cognitive mechanisms. See Robert N. McCauley, *Why Religion Is Natural and Science Is Not* (Oxford: Oxford University Press, 2011).

6 See for example: Marc Andersen, "Predictive Coding in Agency Detection," *Religion, Brain & Behavior* 9:1 (2019): 65–84.

7 Ara Norenzayan, *Big Gods: How Religion Transformed Cooperation and Conflict* (Princeton, NJ: Princeton University Press, 2013).

8 Robin Dunbar, *How Religion Evolved: And Why It Endures* (Oxford: Oxford University Press, 2022).

9 James A. Van Slyke and Konrad Szocik, "Sexual Selection and Religion: Can the Evolution of Religion Be Explained in Terms of Mating Strategies?" *Archive for the Psychology of Religion* 42:1 (2020): 123–41.

our discussion is that evolutionary accounts of religious phenomena are usually tied to the ease of basic religiosity. Reaping the evolutionary benefits of basic religious beliefs or behaviour does not require too much effort or energy from the subject. Certain researchers connect evolutionary accounts to cognitive theories, arguing that natural selection selected cognitive mechanisms that easily yield religious beliefs. Others argue that natural selection fostered the cultural spread of religion.[10]

Hard Religiosity

While few will object that some forms of religiosity come easily to many people, basic forms of religiosity are not all there is to religion. Some researchers object to the crude representation of religion in cognitive accounts of religion. They argue that cognitive theories cannot account for all religious phenomena, especially those that are very costly in terms of energy and time consumption.[11] Some cognitive accounts also point to how spirituality can be trained by various practices.[12] In any case, there is a large number of religious experiences that require considerable effort on behalf of the believer.

The evidence for more advanced or harder forms of religiosity again comes in two forms: common sense and more systematic insights. It is clear from common sense that some subjects have different religious experiences, beyond the vague sense of God's presence.

10 See Norenzayan, *Big Gods*.

11 See, for example, Konrad Szocik and Hans Van Eyghen, *Revising Cognitive and Evolutionary Science of Religion: Religion as an Adaptation*, vol. 8 (Cham: Springer, 2021). Some defenders of cognitive theories argue that their ideas account for extreme rituals that require much effort. They argue that highly costly rituals can serve as a means to signal allegiance to prosocial norms and thereby increase evolutionary fitness. See Dimitris Xygalatas, "Extreme Rituals," *The Oxford Handbook of the Cognitive Science of Religion*, ed. Justin L. Barrett (Oxford: Oxford University Press, 2022), 237. However, such theories tend to focus on rare extreme rituals (often, these are rituals that occur once a year or perhaps once in a lifetime) and not on enduring, effortful forms of religiosity.

12 See, for example, Tanya M. Luhrmann, *When God Talks Back: Understanding the American Evangelical Relationship with God* (New York: Knopf, 2012).

Others have a different religious mindset, involving living in much closer perceived proximity with God. Ample evidence for hard religiosity and religious experts is of an historical nature. To this I must now turn.

Most religious traditions have religious experts. They report exceptional life stories and tend to have more profound religious experiences. Christianity has mystics. While many Western readers immediately think of medieval or early modern mystics like Hadewijch (13th century) or Theresa of Avila (1515–1582), Christianity has always known such exceptional figures. Early examples are desert fathers or desert ascetics like Paul of Thebes (227–341) and Anthony of Egypt (251–356). They chose to live a very simple and austere life devoted to prayer and contemplation.[13] Saint Anthony of Egypt reported visions of God, angels, and demons. He and other desert fathers exerted great admiration and authority among Christian believers.[14]

Well known medieval mystics are Beda Venerabilis (673–735) and Meister Eckhart (1260–1328). Beda Venerabilis was a monk for most of his life and spent his time in prayer and contemplation. He was also a prolific writer and exerted great authority as a teacher. His work includes commentaries on Bible books and a new monastic rule.[15] Furthermore, he showed a great interest in otherworldly visions. These led him to theological insights on the history of salvation and the unknowability of the time of the eschaton.[16] In turn, Meister Eckhart's works illustrate changes in the religious mindset and experiences. Meister Eckhart is best known as a mystic but he was also

13 Marilyn Dunn, *The Emergence of Monasticism: From the Desert Fathers to the Early Middle Ages* (Hoboken, NJ: John Wiley & Sons, 2008).

14 Louis Groarke, "Anthony of Egypt and the Desert Fathers," in *Meet the Philosophers of Ancient Greece*, ed. Patricia F. O'Grady (London and New York: Routledge, 2021), 227–29.

15 Scott DeGregorio, "Bede (Beda Venerabilis), c. 673–735 CE," in *Oxford Research Encyclopedia of Classics*, 2016, https://www.sciencegate.app/source/565749172.

16 Sharon Rowley, "The Role and Function of Otherworldly Visions in Bede's *Historia Ecclesiastica Gentis Anglorum*," in *The World of Travellers: Exploration and Imagination: Germania Latina VII*, ed. K. Dekker et al., Mediaevalia Groningana (Leuven: Peeters Publishers, 2009), 165–83.

a highly respected theologian in his lifetime. He developed the idea that humans are intimately conversant with God in the depths of their soul. His preaching was aimed primarily at achieving inner union with God.[17] Eckhart's theological ideas were likely influenced by his mystical experiences. He describes the first stage towards mystical experience as follows:

> First, the soul experiences within itself the growth of fear, hope and desire—i.e., of natural human emotions. Secondly, these emotions are altogether extinguished from the soul. Thirdly, the soul becomes oblivious to all temporal things. And, fourthly, it enters into God as he exists and rules eternally. In this fourth state it never thinks about itself or temporal things, being immersed in God as God is immersed in it; whatever it does, it does in God.[18]

Religious experts or people with different, more advanced forms of religiosity are also to be found in different traditions. Judaism has a venerable tradition of mysticism. Practitioners of Qabalah or other forms of Jewish mysticism report profound mystical experiences with God and angels.[19] Some also develop different beliefs like the *Tikkun Olam* idea of repairing creation.[20] The best-known Islamic mystics are Sufis. Through various practices, they aim at nondual experiences of Allah. Many Indian mystics aim at a similar state of *samadhi*.[21] Although there are differences between mystical experiences cross-culturally and certainly between beliefs obtained by mystics, they all are very different from the basic forms of religiosity we discussed above.

17 Alessandro Palazzo, "Meister Eckhart (Updated Version)," in *Encyclopedia of Medieval Philosophy: Living Edition* (Cham: Springer, 2018), 1–7.

18 Richard Kieckhefer, "Meister Eckhart's Conception of Union with God," *The Harvard Theological Review* 71:3-4 (1978): 203–225, esp. 220.

19 See Moshe Idel, "Astral Dreams in R. Yohanan Alemanno's Writings," *Accademia* 1 (1999): 111–128.

20 Gerald J. Blidstein, "Tikkun Olam," *Tradition: A Journal of Orthodox Jewish Thought* 29:2 (1995): 5–43.

21 See Richard Shankman, *The Experience of Samadhi: An In-Depth Exploration of Buddhist Meditation* (Boulder, CO: Shambhala Publications, 2008).

On a more general level, one might argue that there is such a thing as *spiritual intelligence.* Like other forms of intelligence, spirituality involves relationality, the development of moral values, and participation in transcendent realities. There is some discussion on whether spiritual intelligence is a distinct kind of intelligence, different from other forms.[22] In any case, the term "spiritual intelligence" implies a certain degree of differentiation. As some people have more general intelligence, others likely have more spiritual intelligence than others.

Devotional Practices and Changing Religiosity

So far, we distinguished two forms of religiosity. One is rather basic, consisting of simple beliefs, mindset, and rather vague experiences. The other encompasses more elaborate beliefs, a more intimate relationship to God, and more profound experiences.

There is a tendency in the literature on religious expertise to regard it as closely tied to a person's (innate) personality. Some persons would simply be more spiritually gifted or more prone for such forms of religiosity. On strong readings of this idea, hard religiosity would be exclusively preserved for such spiritually gifted people. Non-gifted people then do not have access to hard forms of religiosity. If that is the case, such forms of religiosity may not be hard at all. Advanced forms of religiosity might come easily to gifted individuals. They may be as prone to more advanced forms of religiosity as most people are to easier forms of religiosity. Evidence for this view may come from accounts of people who enjoy profound experiences at a very early age. Given that they did not have the time to take effortful steps to take their religiosity to the next level, their abilities are likely innate. Additional evidence may be gained from evidence of close links between dispositions for hard religiosity and genetic predispositions. While this may be the case for some individuals, there is sufficient reason to believe that subjects can move from easier forms of religiosity to

22 Harris Wiseman and Fraser Watts, "Spiritual Intelligence: Participating with Heart, Mind, and Body," *Zygon* 57:3 (2022): 710–718.

harder forms. In this section and the next, I look closer at that movement. After discussing some practices that are often pointed to in order to develop greater spiritual abilities (e.g., devotion, prayer, fasting), the next section discusses what may be going on at the neural or cognitive level.

The discussion below does not serve to show that all examples of hard religiosity are the result of engaging in spiritual practices. Even if (some) spiritual practices can help people achieve harder forms, it remains a genuine possibility that some people are born with special spiritual gifts. Hard forms of religiosity may come naturally or fairly easily to them. The discussion serves to argue against stronger claims that hard religiosity is exclusively preserved for spiritually gifted individuals.[23]

The mystics or religious experts I discussed above often had similar ways of living. A large number spent most of their lifetimes away from society, often in convents or in isolation. Hermits spent their lives in seclusion in Egypt's desert. Beda Venerabilis spent a number of years in a monastery in Monkwearmouth. Often, these people engaged in similar spiritual practices. Saint Anthony of Egypt led a hermit's life of prayer and devotion to God. Beda spent much of his life in monasteries where he likely partook in devotional practices.

Devotional practices regularly included forms of contemplative prayer. The desert fathers practiced an early form of what the Byzantines called "hesychasm," the path of serenity. They recited short prayers repetitively and recited psalms. In doing so, they tried to block out other thoughts.[24] During the Middle Ages, systematic treatises were written to teach devotional practices.[25] Medieval forms of contemplation also involved repetitive prayer and focus on God or sacred images.

23 I thank an anonymous reviewer for pointing this out.

24 John Wortley, "Prayer and the Desert Fathers," *The Coming of the Comforter: When, Where, and to Whom*, ed. Carlos A. Segovia and Basil Lourié (Piscataway, NJ: Gorgias Press, 2012), 109–129.

25 One of the best known is the anonymous treatise *The Cloud of Unknowing*.

More than before, the practice became emotionally charged.[26] The Middle Ages saw the rise of *lectio divina* in monastic circles, a practice in which Scripture is read in a meditative, devotional way, to foster communion with God.

Another recurring element in the practice of mystics is fasting. Fasting was and is a common element of the lives of Christian monks and nuns.[27] Fasting is seen as a way of imitating Christ[28] and of purifying one's soul and body. Subjects sometimes practice fasting for shorter periods (e.g., in preparation for the Eucharist) or longer periods (e.g., in preparation for Easter). Fasting may merely consists in abstaining from certain kinds of food (e.g., not eating meat on Fridays in Roman Catholicism). It may also consist in altogether abstaining from food. Fasting is observed more strictly in some religious orders like the Carthusians.[29] Some of the desert fathers were known for their "heroic fasting."[30] A direct motivation for fasting among medieval monks and nuns was a belief that fasting would set right the wrongness inflicted by sin. Fasting was regarded as a way to purify the body and make it holy. In extreme cases, some consumed only the Eucharist and abstained from all other forms of food. An example of such extreme fasting is found in the life of Catherine of Genoa (1447–1510).[31]

26 Karl Baier, "Meditation and Contemplation in High to Late Medieval Europe," in *Yogic Perception, Meditation and Altered States of Consciousness*, ed. Eli Franco (Leipzig: Austrian Academy of Sciences Press, 2009), 325–349.

27 For more examples of fasting practices in Christian mysticism, see Kroll and Bachrach, *The Mystic Mind*.

28 See Christ's fasting for forty days and forty nights in the desert before being tempted by the devil (Matthew 4:1–11).

29 See Mathilde van Dijk, "Baking the Bread and Roasting the Meat: Dorlandus's Saint Lawrence as a Model for Carthusians," *The Medieval Low Countries* 4 (2018): 189–214.

30 Gerald L. Sittser, "The Battle Without and Within: The Psychology of Sin and Salvation in the Desert Fathers and Mothers," *Journal of Spiritual Formation and Soul Care* 2:1 (2009): 44–66.

31 Fernando Espi Forcen and Carlos Espi Forcen, "The Practice of Holy Fasting in the Late Middle Ages: A Psychiatric Approach," *The Journal of Nervous and Mental Disease* 203:8 (2015): 650–653.

Fasting is also a common element in non-Christian traditions. Some Hindus fast on regular days.[32] Many Muslims fast during the month of Ramadan. Some also refrain from food in preparation for feast days.[33] Many observant Jews fast on Yom Kippur. Buddhists sometimes observe fasting during periods of intense meditation.[34]

Another technique that is regularly employed to foster mystical experiences and a different mindset is sleep deprivation.[35] The desert fathers saw sleep as an enemy of devotion. Though they did not go altogether without sleep, they limited it as much as possible since it got in the way of prayer and other devotional practices.[36] For medieval mystics, sleep had an ambiguous status. On the one hand, sleep could be a time of peaceful closeness to God. On the other hand, sleep also provided an occasion for demonic temptation. For example, fear of demonic temptation led Marie of Oignies (1177–1213) to refrain from sleep. She received visions and stigmata wounds. Sleep deprivation was a common element in the ascetic practice of other medieval mystics as well,[37] and is also part of practices in different traditions, like Zen Buddhism and forms of Hinduism.[38]

32 Debjani Chatterjee, "Apara Ekadashi 2021: Date, Ekadashi Fasting Time, Rituals and Significance," *NDTV*, 6 April 2021, https://tinyurl.com/3kf5auu2.

33 Emmanuel Sivan, "Sunni Radicalism in the Middle East and the Iranian Revolution," *International Journal of Middle East Studies* 21:1 (1989): 1–30.

34 Yujin Lee and Michael Krawinkel, "Body Composition and Nutrient Intake of Buddhist Vegetarians," *Asia Pacific Journal of Clinical Nutrition* 18:2 (2009): 265–271.

35 For more examples of Christian mystics depriving themselves of sleep, see Kroll and Bachrach, *The Mystic Mind*.

36 John Wortley, *An Introduction to the Desert Fathers* (Cambridge: Cambridge University Press, 2019).

37 Macmillan Sarah, "'The Nyghtes Watchys': Sleep Deprivation in Medieval Devotional Culture," *Journal of Medieval Religious Cultures* 39:1 (2013): 23–42.

38 Núria M. Farré-i-Barril, "Sleep Deprivation: Asceticism, Religious Experience and Neurological Quandaries," *Religion and the Body: Modern Science and the Construction of Religious Meaning*, ed. David Cave and Rebecca Sachs Norris, Numen Book Series 138 (Leiden and Boston: Brill, 2012), 217–234.

Other common ascetic practices include reclusion, chastity, fortitude in illness, and flagellation.[39] Still others are engagement in ritual activities, reading and study of texts, and social transmission such as initiation or discipleship.[40] All are found within and outside of Christianity as well. Although many practices share common elements, like a changed attitude towards the physical body, they are profoundly different. As Jerome Kroll and Bernard Bachrach note, spiritual practices do not occur in a cultural vacuum.[41] How they are practiced and experienced, and what effects they have is often heavily influenced by their culturally specific embedment. The effects of cultural "embeddedness" lie beyond the scope of this paper. Regardless, similar practices will likely have similar effects across cultures. Future study may reveal how far the similarities go.

In the next section, I look closer at the neural and cognitive effects of focused contemplation, fasting and sleep deprivation.

Neural and Cognitive Effects of Ascetic Practices

This section looks closer at the cognitive effects of contemplation, fasting, and sleep deprivation. All three are common elements to (Christian) religious devotion. This discussion will serve to argue that devotional practices can foster more advanced forms of religiosity, even unbeknownst to practitioners.

Focused Contemplation

Of the three elements of devotion under consideration here, contemplation is harder to match to bodily or mental behaviour that can be studied empirically or neurologically. This can be overcome by noting how contemplation is closely tied to attention. Etymologically, the word

39 Sarah, "The Nyghtes Watchys."

40 I thank an anonymous reviewer for pointing me to these practices.

41 Kroll and Bachrach, *The Mystic Mind*; Watts, *A Plea for Embodied Spirituality*, 48–49.

"contemplation" is derived from the Latin *templum,* which traditionally signified the place marked out by a seer as a location for his observation. Later it came to designate the actual observations made by the seer. Contemplation usually involves focused observation and admiration of an object or subject.[42] A clear example is the Roman Catholic practice of Eucharistic adoration. During Eucharistic adoration, a consecrated host is displayed in sight of worshippers. Worshippers use the host as object of focus during prayer. Contemplation frequently involves focus on prayers, like the "Jesus prayer," or on images of saints. It is clear from these examples that contemplation involves attentiveness. During contemplation, worshippers try to focus on an object and block out other sensory stimuli or thoughts. The focus during contemplation may lead to cognitive changes. The discussion below looks at cognitive effects on cognition from general attentiveness.

Much of the recent work on attention in neuroscience is set in the background of predictive processing or related accounts of human cognition. In predictive processing, human experience and cognition are heavily influenced from top-down constraints. Humans would have an internal model of the world, which is gradually built up by experience. This internal model contains information about the likelihood that humans will encounter something, and it generates predictions about what humans will experience. If the predictions match the sensory input, the model runs its course and informs experience. If there is a mismatch, the internal model is updated to prevent future mismatches.[43]

Attention has a straightforward role in predictive processing. By attending carefully to an object, more sensory stimuli of that object

42 J. Aumann, "Contemplation," in *New Catholic Encyclopedia,* second edition (Detroit: Thomson Gale, 1967), https://www.encyclopedia.com/philosophy-and-religion/philosophy/philosophy-terms-and-concepts/contemplation.

43 The whole process is governed by the free-energy principle. See Karl Friston and Stefan Kiebel, "Predictive Coding Under the Free-Energy Principle," *Philosophical Transactions of the Royal Society B: Biological Sciences* 364:1521 (2009): 1211–1221. The general idea is that human minds (like any system) aim to reduce entropy by ensuring a good fit between the internal model and sensory input.

are allowed in. In this way, attention alters the inputs to cognitive processing.[44] This increases the odds of sensory stimuli that do not match the internal model and consequently prompts revisions. Some argue that attention has a different role as well. For example, Harriet Feldman and Karl Friston argue that attention aids in inferring the level of uncertainty or precision. By attending carefully, the mind can gain a better measure of the uncertainty of the cause of sensory input.[45] Andy Clark argues that attention also has a role in precision weighting. Attention can optimise the relative influence of top-down predictions against sensory input. Altering the precision weighting on specific error signals alters the influence of one neural area on another or on how signals are processed.[46] Clark adds that much of the role of attention in precision weighing likely remains unconscious or subpersonal.[47]

How could this apply to contemplation? By focused attention on an object, subjects could become more mindful of mismatches between their internal model of the world (including, but not limited to, their beliefs) and sensory input. This could open the door to revision of the internal model with an openness for new ideas regarding God or the divine. An altered internal model could in turn allow new experiences. It could also lead to different forms of behaviour and a

44 Firestone and Scholl discuss this possibility but dismiss it. They claim that changes in sensory input through attention are compatible with accounts where cognition is not (or far less) constrained by top-down influences. See Chaz Firestone and Brian J. Scholl, "Cognition Does Not Affect Perception: Evaluating the Evidence for 'Top-Down' Effects," *Behavioral and Brain Sciences* 39 (2016): e229, DOI: 10.1017/S0140525X15000965. Clark does see a role for attention in altering sensory inputs but also assigns it a greater role. Andy Clark, "Attention Alters Predictive Processing," *Behavioral and Brain Sciences* 39 (2016): e234, DOI: 10.1017/S0140525X15002472.

45 Harriet Feldman and Karl J. Friston, "Attention, Uncertainty, and Free-Energy," *Frontiers in Human Neuroscience* 4 (2010): 215, https://doi.org/10.3389/fnhum.2010.00215.

46 See Hanneke E. M. den Ouden et al., "Striatal Prediction Error Modulates Cortical Coupling," *Journal of Neuroscience* 30:9 (2010): 3210–3219, DOI: 10.1523/JNEUROSCI.4458-09.2010.

47 Clark, "Attention Alters Predictive Processing."

different outlook on the world. In that way, contemplation could lead to new forms of advanced religiosity.

Fasting

The cognitive effects of fasting are much better understood and require less speculation. Most studies support the idea that fasting has mostly beneficial effects on cognition, even benefitting diseases like ischemic stroke, autism spectrum disorder, and mood and anxiety disorders. From an evolutionary point of view, beneficial effects of fasting make sense as well. Periods of food scarcity were the rule rather than the exception for most of human history.[48]

The effects of fasting on cognition are mediated by a number of neural processes. Changes in metabolism are one of them. Around twelve to thirty-six hours after fasting begins, the body switches from preferring to extract energy through glycogenolysis (breakdown of glycogen into glucose) to lipolysis (breakdown of stored fat as lipids from adipose tissue). Released lipids are further metabolised to free fatty acids, transformed into acetyl CoA and transformed to the ketone bodies β-hydroxybutyrate (BHB) and acetoacetate (AcAc). Ketones become the preferred fuel for the brain. One of the roles of ketones is regulating transcription factors in neurons. Ketones lead to an up-regulation of neurotrophic factors, which are associated with the promotion of mitochondrial biogenesis, synaptic plasticity, and cellular stress resistance in animal models. This triggers repair of neural matter by stimulating autophagy, a process in which neurons remove dysfunctional or damaged components.[49]

By changing the brain's diet to ketones, fasting leads to removal of neural waste and, importantly, to synaptic plasticity (i.e., the capacity of neurons to change the strengths of their connections). This can

48 Jip Gudden et al., "The Effects of Intermittent Fasting on Brain and Cognitive Function," *Nutrients* 13:9 (2021): 3166, DOI: 10.3390/nu13093166.

49 S. Reddy et al., "Physiology, Circadian Rhythm," *StatPearls* (2018), https://www.ncbi.nlm.nih.gov/books/NBK519507/2018.

lead to new neural pathways allowing for different forms of cognition. In the right setting, this can foster new, advanced forms of religiosity.[50]

Fasting also has effects on the circadian clock mechanism (which regulates the cycle of alertness and sleepiness by responding to changes in lighting).[51] Consuming food at different times than the normal eating rhythm may set the internal clock out of phase. One way in which fasting can affect the circadian rhythm is through hormonal synchrony. The peak of insulin secretion is usually reached in the early morning and is further heightened during and after food intake. Fasting can decrease post-meal and average insulin levels, leading to an overall increased sensitivity for insulin.[52] Acute high levels of insulin may have beneficial effects on human cognition while persistently high levels have negative effects on memory and other cognitive functions.[53]

Finally, fasting affects the gut microbiome. Gut microbiome influences the brain through neural, endocrine, and immune pathways, which are collectively called the microbiota-gut-brain axis. Roughly 15% of microbiota dynamically oscillates in activity and abundance throughout the day in accordance with circadian and hormonal fluctuations. These are affected by dietary intake. In one study, fasting enriched the gut microbiome composition and led to improved cognitive functioning.[54]

Fasting thus has multiple effects on human cognition. Most important for our purposes is that fasting can alter cognition (because of increased neural pathways, plasticity, or enriched gut microbiota). Thereby fasting can allow for new experiences and new beliefs. The latter may inform a different outlook on the world.

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50 Reddy et al., "Physiology."

51 Reddy et al., "Physiology."

52 Gudden et al., "The Effects of Intermittent Fasting."

53 Brenna Cholerton et al., "Insulin, Cognition, and Dementia," *European Journal of Pharmacology* 719:1–3 (2013): 170–179, DOI: 10.1016/j.ejphar.2013.08.008.

54 Zhigang Liu et al., "Gut Microbiota Mediates Intermittent-Fasting Alleviation of Diabetes-Induced Cognitive Impairment," *Nature Communications* 11:1 (2020): 1–14, https://doi.org/10.1038/s41467-020-14676-4.

Sleep Deprivation

Unlike focused attention and fasting, sleep deprivation is commonly associated with diminished cognitive performance. Especially deprivation of rapid eye movement sleep (REM: a phase of sleep characterised by the rapid movement of the eyes, low muscle tone, and a tendency for vivid dreams) has effects on neural behaviour. NREM (non-rapid eye movement) sleep deprivation reduces the release of specific neurotransmitters which affect the ability of neural receptors to refresh and restore sensitivity. The result is reduced cognition. Subjects with sleep deprivation also have reduced functional connectivity between the amygdala and medial prefrontal cortex. The latter is known for producing strong inhibitory projections to the amygdala. In addition, sleep deprivation leads to higher connectivity in the autonomic areas of the locus coeruleus and amygdala. Therefore, lack of sleep can lead to increased amygdala hyperlimbic reactions that result in stimuli with negative emotional connotations. The brain misses a corrective reaction from the medial frontal cortex, causing inappropriate behavioural responses, like lack of rational decisions and social judgments.[55]

Sleep deprivation also has detrimental effects on memory. It disrupts memory consolidation in the hippocampus, resulting in fewer permanent memories being consolidated in the brain. Furthermore, sleep deprivation down-regulates the mammalian target of rapamycin signalling, which is a regulatory protein required for memory consolidation.[56]

Sleep deprivation also negatively affects attention and alertness because of imbalanced inhibition between the frontoparietal network and the amygdala. A final negative effect of sleep deprivation concerns

55 Mohammad A. Khan and Hamdan Al-Jahdali, "The Consequences of Sleep Deprivation on Cognitive Performance," *Neurosciences Journal* 28:2 (2023): 91–99, DOI: 10.17712/nsj.2023.2.20220108.

56 Khan and Al-Jahdali, "The Consequences of Sleep Deprivation."

clearing of waste in the central nervous system. This can lead to toxic build-up, which can negatively affect cognitive performance.[57]

While all effects we discussed so far are negative on cognitive performance, some evidence suggests that sleep deprivation can contribute to cognitive change. During the slow wave stage of NREM sleep, synapses are decreased in the brain to counterbalance the net strengthening of network synapses, such as those that occur during learning. Without the normalisation on synaptic power, however, sleep deprivation increases the weight of plasticity on the nerve cells, and these thereby fail to reestablish neural selectivity and learning performance.[58] Sleep deprivation can thus have detrimental effects on a subject's ability to learn.

Sleep deprivation alters the connection between neurons. Under normal circumstances (i.e., without sleep deprivation) relevant connections are strengthened, and irrelevant ones weakened. Because of sleep deprivation, external stimuli and information are processed poorly or not at all. This impairs learning as well.[59]

Other evidence for change caused by sleep deprivation is its effect on serotonin release. Research on rats shows that REM sleep-deprived rats have a higher incidence of serotonin syndrome (a pathology which occurs because of high serotonin build-up) and a greater number of headshakes, when challenged with serotonin precursors. Increased turnover due to REM sleep deprivation could explain the stronger response to administered serotonin precursors. REM sleep deprivation could induce the supersensitivity of dopamine receptors in the brain.[60] While low levels of serotonin are associated with poor

57 Khan and Al-Jahdali, "The Consequences of Sleep Deprivation."

58 Khan and Al-Jahdali, "The Consequences of Sleep Deprivation."

59 Mohammad Ali Salehinejad et al., "Sleep-Dependent Upscaled Excitability, Saturated Neuroplasticity, and Modulated Cognition in the Human Brain," *Elife* 11 (2022): e69308, DOI: 10.7554/eLife.69308.

60 Ricardo Santos and E. A. Carlini, "Serotonin Receptor Activation in Rats Previously Deprived of REM Sleep," *Pharmacology Biochemistry and Behavior* 18:4 (1983): 501–507, DOI: 10.1016/0091-3057(83)90271-x.

memory and a depressed mood, higher levels have positive effects on memory and attention.[61]

The effects of sleep deprivation on memory are thus ambiguous. Most studies point to detrimental effects while some see a positive effect (mainly mediated through serotonin). Some studies report individual differences in effects on memory.[62] Thus far, the discussion does not readily support the idea that sleep deprivation can foster different forms of religiosity.

More relevant to our discussion is the well-established connection between sleep deprivation and psychosis (a pathology where subjects seemingly lose contact with reality and are prone to auditory and visual hallucinations). Subjects deprived of sleep are more prone to psychotic episodes or hallucinations. An overview of twenty-one studies notes that all except one reported perceptual changes caused by sleep deprivation. The changes include visual distortions, illusions, somatosensory changes, and hallucinations. In 90% of the studies, sleep deprivation affected the visual modality. In 52% of the cases, the somatosensory modality was affected, and in 33% of them the auditory modality. The effects on perception developed rapidly after one night without sleep and progressed in an almost predictable way. After twenty-four to forty-eight hours without sleep, perceptual distortions, anxiety, irritability, depersonalisation, and temporal disorientation started. After forty-eight to ninety hours of deprivation, complex hallucinations and disordered thinking followed. After seventy-two hours, delusions followed, and the clinical picture began to resemble acute psychosis or toxic delirium. After three days without sleep, hallucinations in all three sense modalities were reported. The symptoms

61 Trisha A. Jenkins et al., "Influence of Tryptophan and Serotonin on Mood and Cognition with a Possible Role of the Gut-Brain Axis," *Nutrients* 8:1 (2016): 56, DOI: 10.3390/nu8010056.

62 Jacqueline T. Weiss and Jeffrey M. Donlea, "Roles for Sleep in Neural and Behavioral Plasticity: Reviewing Variation in the Consequences of Sleep Loss," *Frontiers in Behavioral Neuroscience* 15 (2022): 777799, DOI: 10.3389/fnbeh.2021.777799.

usually resolved after periods of sleep.[63] Some studies also note effects on paranoia apart from hallucinations. These were likely mediated by negative effects, like fear or a bad emotional mood.[64]

While not all forms of psychosis are well understood, the increased number of hallucinations[65] can explain changes in cognition after sleep deprivation. Lack of sleep can open the doors for new experiences, which may lead to lasting changes in cognition. New experiences may prompt an update of the internal model of the world (see above). These may, in turn, foster new experiences and a different outlook.

This section supports the claim that all three devotional practices have effects on human cognition. The evidence for increased neuroplasticity is stronger for contemplation and fasting. Some evidence also suggests that sleep deprivation can lead to increased plasticity or other forms of change as well. Increased neuroplasticity can, in turn, explain changes in experiences and mindset. Sleep deprivation can also make subjects more prone to different experiences.

A mere increase in neuroplasticity or mere changes in experiences are not enough to have changes in line with what was called above "hard religiosity." The mind also needs specific input to have the kinds of mystical experiences and different mindset common in mystics. The

63 Flavie Waters et al., "Severe Sleep Deprivation Causes Hallucinations and a Gradual Progression toward Psychosis with Increasing Time Awake," *Frontiers in Psychiatry* 9 (2018): 303, DOI: 10.3389/fpsyt.2018.00303.

64 Sarah Reeve et al., "Disrupting Sleep: The Effects of Sleep Loss on Psychotic Experiences Tested in an Experimental Study with Mediation Analysis," *Schizophrenia Bulletin* 44:3 (2018): 662–671, DOI: 10.1093/schbul/sbx103.

65 An important question regards the veracity of experiences due to sleep deprivation. Hallucinations are usually defined as erroneous or misguided experiences. If that is the case, sleep deprivation may set subjects astray. A thorough discussion of the veracity and reliability of sleep-deprivation-induced experiences lies beyond the scope of this paper. I merely note here that not all psychotic hallucinations are caused by lesions or brain damage. See Femi Oyebode, "The Neurology of Psychosis," *Medical Principles and Practice* 17:4 (2008): 263–269, DOI: 10.1159/000129603. Experiences of this kind might merely be *altered* experiences rather than erroneous experiences. For a discussion, see Hans Van Eyghen, *The Epistemology of Spirit Beliefs*, Routledge Studies in the Philosophy of Religion (New York and Abingdon: Routledge, 2023), 79–82.

required input can be infused by the setting. Mystics usually live in religious settings where religious visual imagery is common. They are also frequently exposed to religious writings or sermons which can also serve as sensory input fostering a new mindset.

Conclusions

The main argument of this paper is that humans can take active steps to achieve different, more advanced forms of religiosity. In support of this claim, evidence for the role of three religious practices (contemplation, fasting, and sleep deprivation) was surveyed. Evidence from cognitive neuroscience supports the idea that these practices can alter human cognition.

Engaging in practices of this sort is not a gift or an innate property of practitioners. Usually, engaging in such practices is a willed act. If engaging in the practices can lead to more advanced forms of religiosity, such a transformation can therefore be a conscious, willed act. As noted, a considerable number of practitioners likely engaged in these practices for different reasons than their contribution to cognitive change. Nonetheless, the discussion shows that transformation of religiosity (willed or not) is a genuine possibility.

Other important questions, such as how practices foster specific forms of religiosity or moral problems when the practices that require substantial time and energy (and therefore likely support from others), were beyond the scope of this paper.[66] It also remains an open question whether engaging in devotional practices will have the same effect on everyone. Increased knowledge of the cognitive effects of these practices can benefit future discussions of these questions as well.

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66 For a discussion of moral arguments against certain spiritual practices, see Watts, *A Plea for Embodied Spirituality*, chapter 4.