



# Why revelations have occurred on mountains? Linking mystical experiences and cognitive neuroscience

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**Summary** The fundamental revelations to the founders of the three monotheistic religions, among many other revelation experiences, had occurred on a mountain. These three revelation experiences share many phenomenological components like feeling and hearing a presence, seeing a figure, seeing lights, and feeling of fear. In addition, similar experiences have been reported by non-mystic contemporary mountaineers. The similarities between these revelations on mountains and their appearance in contemporary mountaineers suggest that exposure to altitude might affect functional and neural mechanisms, thus facilitating the experience of a revelation. Different functions relying on brain areas such as the temporo-parietal junction and the prefrontal cortex have been suggested to be altered in altitude. Moreover, acute and chronic hypoxia significantly affect the temporo-parietal junction and the prefrontal cortex and both areas have also been linked to altered own body perceptions and mystical experiences. Prolonged stay at high altitudes, especially in social deprivation, may also lead to prefrontal lobe dysfunctions such as low resistance to stress and loss of inhibition. Based on these phenomenological, functional, and neural findings we suggest that exposure to altitudes might contribute to the induction of revelation experiences and might further our understanding of the mountain metaphor in religion.

Mystical and religious experiences are important not only to the mystic himself, but also to many followers, as it was indeed with respect to the leaders of the three monotheistic religions. Yet, concerning its subjective character, mystical experiences are almost never accessible to the scholars interested in examining them. The tools of cognitive neuroscience make it possible to approach religious and mystical experiences not only by the semantical analysis of texts, but also by approaching similar experiences in healthy subjects during prolonged stays at high altitude and/or in cognitive paradigms. Cognitive neurosciences, in turn, might profit from the research of mysticism in their endeavor to further our understanding of mechanisms of corporeal awareness and self consciousness.

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## Introduction

Mountains play an important role in the symbolic geography of traditions. Thus, in Hindu and Buddhism mount Meru serves as the axis mundi; in China and Judaism mountains Scham and Zion, respectively, are described as the dwelling place of the divine; upon Japanese and native American traditions mountains are also charged with divine power [1,2]. Moreover, mountains often serve as a place of revelation. In fact, the revelations to the founders of the three western monotheistic religions – Moses, Jesus, and Mohammad – occurred on mountains (see Appendix). On mount Sinai Moses experienced his first revelation in the burning bush, and encountered the Hebrew God three more times (Exodus, 24: 10). Jesus was transfigured “up a high mountain apart” – identified as mount Tabor [3] or mount Hermon [2] – and appeared to Peter, John and James in a cloud of glory (Matthew 17: 1–8; Mark 9: 2–8; Luke 9: 28–36). In Islamic tradition, Prophet Mohammad had received the Qur’an while in solitude on mount Hira by a revelation of the archangel Gabriel (Al-Bukhari, 3) (see Table 1).

A mystical trend that invented a technique to induce revelation is the Hesychasm movement,<sup>1</sup> a monastic practice of prayer in the oriental church who trained many western mystics during the 5th to the 15th centuries [3–5]. This technique uses physical maneuvers such as breath patterns, head movements and repetitions on specific prayers, and was supposed to prepare the mystic to the experience of revelation. In addition, the Hesychasm movement had most of its centers on high altitude mountains – first at mount Sinai and then at mount Athos. Others have suggested that this might have contributed to the experience of revelation [3–6].

Modern reports on revelation-like experiences (i.e. experiences that include similar components to those described in revelations-experiences as below, without having a religious/mystical content) in high altitude mountaineers support the link between mountains and revelation. Thus, mountaineers have described the experience of feeling of a presence [7–10], hearing of a presence

<sup>1</sup> The movement established at mount Sinai, and had emerged while moved to mount Athos in 963AC, then became a monastic republic. Athos originated with orthodox monks from Greece, Turkey and the Slavic countries. Then, with Symeon the new theologian (949–1022), in the 11th century other Christian nations began to send representatives to Mount Athos. Another peak of this trend was in the 14th century, led by Gregory Palamas [4–6].

**Table 1** Mountains of revelation

Mountain	Location	Height (in meters)
Athos	Greece	2061
Hermon	Israel/Syria	2841
Hira (Jabal An-Nur)	Saudi Arabia	≈2000
Sinai	Egypt	2600
Tabor	Israel	588

Locations and heights of the discussed mountains of revelations.

[9,10], complex visual hallucinations [9], body photism [9], autoscopic phenomena [9–11], vestibular manifestations [9,12] and emotional manifestations, mainly fear [9,10]. The later two frequently accompany autoscopic phenomena [13–16]. In addition, these experiences appear especially in solitude [9,10]. Stressing this latter link, the revelation experiences of Moses, Jesus and Mohammad also manifest similar experiences. With regard to complex visual hallucinations, Moses saw an angel in the burning bush (Exodus, 3: 2), Peter, James and John saw the transfigured Jesus and the images of Elias and Moses (Matthew, 17: 2–3). Mohammed encountered the angle Gabriel while on the mountain (Al-Bukhari, 3).<sup>2</sup> All three experiences were accompanied by seeing of light or focal or diffuse increases in brightness:<sup>3</sup> Moses saw the angel “in flames of fire” (Exodus, 3: 2), the transfiguration of Jesus is described as “his face shone like the sun, and his garments became white as light” (Matthew, 17: 2). The light in Mohammad’s revelation even gave mount Hira its name: “Jabal an-Nur” (“mountain of light”). With respect to auditory manifestations, Moses heard a voice speaking to him from the burning bush (Exodus, 3: 5–10); Jesus’ disciples heard a voice from a cloud, and Moses and Elias speaking to their master (Matthew, 17: 3,5); Mohammad heard the angel’s commandment to read (Al-Bukhari, 3). Fear is described in all three experiences (Exodus 3: 6; Matthew 17: 7–8; Al-Bukhari, 3) and Moses and Mohammad had their revelation after a long time of solitude on the mountain (Exodus, 3: 1; 34: 28; Al-Bukhari, 3).

The similarities between these revelations on mountains and their appearance in contemporary mountaineers suggest that exposure to altitude might affect brain functions, thus facilitating the experience of a revelation. Brugger et al. [9] pro-

<sup>2</sup> On the appearance of an angel in the mystical experience as autoscopic phenomenon see Arzy et al. [36].

<sup>3</sup> The connection between the light and the body was also described in Hesychasm. For a general review of the light in mysticism see Eliade [37].

posed that stressful events, physically and emotionally while climbing mountains, cause release of endorphins, which are known to lower the threshold for temporal lobe epilepsy, which, in turn, may evoke revelation-like experiences such as hearing of sounds or voices, memory flashback, déjà vu, a sense that someone is nearby (feeling of a presence), autoscopic phenomena and emotional manifestations, most commonly fear [17]. Blanke et al. [18] suggested that feeling a presence, autoscopia, and hearing a presence might all relate to abnormal body processing or body schema. It has been proposed that such phenomena are due to interference with the temporo-parietal junction (TPJ) and adjacent structures [16,18–20]. Vestibular manifestations also accompany phenomena resulting from damage to this area [16,20,21] and multisensory integration in the temporo-parietal association areas at extreme altitude may be disturbed [10]. In addition, Brugger et al. [9] suggested that prolonged stay at high altitudes, especially in social deprivation, may also lead to prefrontal lobe dysfunctions such as low resistance to stress and loss of inhibition. Many of the latter dysfunctions are also frequently found during ecstatic experience [22]. Thus, although prolonged stay at extreme altitudes is associated with changes in many brain areas [23–25], the effects of acute and chronic hypoxia might preferentially affect two areas of the cerebral cortex, the TPJ and the prefrontal cortex, that have been linked to disturbed own body perceptions and mystical experiences.

Although the revelations discussed here had occurred in moderate altitude, it may be assumed that in subjects who are prone to mystical experiences, already moderate altitudes are sufficient to trigger revelation-like experiences and revelations. Accordingly, mountain-sickness has been reported in some individuals even in moderate altitudes [26,27]. Interestingly, although autoscopic phenomena are experienced by jet aviators that are flying alone especially at high altitudes, helicopter pilots can also experience similar phenomena already at altitudes of 1500–3000 m [28,29]. In fact, isolation in altitudes as well as sensory deprivation might add to pure altitude-related mechanisms, as the desert attracted various mystics throughout generations [30,31]. Furthermore, mental imagery of heights might be associated with vestibular dysfunctions and anxiety [32]. These different findings might suggest that the frequent appearance of the mountain metaphor in revelation experiences of mystics [22] might be related to interference with functional and neural mechanisms of corporal awareness as well as other corti-

cal functions at the TPJ and the prefrontal cortex. In addition, this suggests that mechanisms of corporal awareness and mystical experiences could scientifically be studied at high altitudes and compared to the same experiences and functions at lower levels of altitudes.

Mystical and religious experiences are important not only to the mystic himself, but also to many followers, as it was indeed with respect to the three religious leaders discussed here. Yet, concerning its subjective character, mystical experiences are almost never accessible to the scholars interested in examine them. Thus, some modern scholars of religious experience focused their inquiry on subjective experience or data, rather than theological data [33–35]. The neurocognitive approach we suggest here arms the mystical researcher with a new access to these experiences. The tools of cognitive neuroscience make it possible to approach religious and mystical experiences not only by semantical analysis of texts, but also by approaching similar experiences in healthy subjects<sup>4</sup> in certain physical conditions such as prolonged stay in high altitude as well as by approaching similar experiences in neurological patients. Combined with analysis of performance in experimental paradigms, neuropsychological methods, lesion studies and neuroimaging, our understanding of the mountain metaphor in religion, as well as mystical experiences in general, might be advanced. In the current case, high altitudes seem to evoke quite similar experiences as reported by different mystical and religious figures throughout time. Thus, as wide as the mind of the mystic is enlarged, and might be different from the religious follower, the core of the experience might be shared and relates to similar functional and neural mechanisms, which are available to further scientific inquiry.

## Appendix. Basic revelations of the three western monotheistic religions

### Judaism – the burning bush (Exodus, 3: 1–6)

Now Moses was tending the flock of Jethro his father-in-law, the priest of Midian, and he led the flock to the far side of the desert and came to Horeb, the mountain of God. There the angel of the Lord appeared to him in flames of fire from

<sup>4</sup> As had been initiated by psychologists, see James [38].

within a bush. Moses saw that though the bush was on fire it did not burn up. So Moses thought, "I will go over and see this strange sight-why the bush does not burn up." When the Lord saw that he had gone over to look, God called to him from within the bush, "Moses! Moses!" And Moses said, "Here I am." "Do not come any closer," God said. "Take off your shoes, for the place where you are standing is holy ground." Then he said, "I am the God of your father, the God of Abraham, the God of Isaac and the God of Jacob." At this, Moses hid his face, because he was afraid to look at God.

### **Christianity – the transfiguration (Matthew, 17: 1–8)**

And after six days Jesus took with him Peter and James and John his brother, and led them up a high mountain apart. And he was transfigured before them, and his face shone like the sun, and his garments became white as light. And behold, there appeared to them Moses and Elias, talking with him. And Peter said to Jesus, "Lord, it is well that we are here; if you wish, I will make three booths here, one for you and one for Moses and one for Elias." He was still speaking, when a bright cloud overshadowed them, and a voice from the cloud said, "This is my beloved son, with whom I am well pleased; listen to him." When the disciples heard this, they fell on their faces, and were filled with awe. But Jesus came and touched them, saying, "Rise, and have no fear." And when they lifted up their eyes, they saw no one but Jesus only.

### **Islam – the book of revelation (Al-Bukhari, 3: 'Aisha')**

The commencement of the Divine Inspiration to Allah's Apostle... He used to go in seclusion in the cave of Hira where he used to worship continuously for many days... suddenly the truth descended upon him while he was in the cave of Hira. The angel came to him and asked him to read. The Prophet replied, "I do not know how to read". The Prophet added, "The angel caught me (forcefully) and pressed me so hard that I could not bear it any more. He then released me and again asked me to read and I replied, "I do not know how to read". Thereupon he caught me again and pressed me a second time till I could not bear it any more. He then released me and again asked me to read but again I replied, "I do not know how to read". Thereupon he caught me for the third time and pressed me, and then released me and said, "Read

in the name of your Lord, who has created (all that exists) has created man from a clot. Read! And your Lord is the Most Generous." Then Allah's Apostle returned with the inspiration and with his heart beating severely. Then he went to Khadija bint Khuwailid and said, "Cover me! Cover me!" They covered him till his fear was over and after that he told her everything that had happened.

## **References**

- [1] Eliade M. *Le mythe de l'éternel retour*. Paris: Gallimard; 1989.
- [2] Eck DL. Mountains. In: Eliade M, editor. *The encyclopedia of religion*. New York: Macmillan; 1987. p. 130b–4b.
- [3] Murphy FX. Hesychasm. In: Marthler BL, editor. *The new catholic encyclopedia*. Thonson-Gale; 2002. p. 811a,b.
- [4] Hausherr I. *La méthode d'Oraison hesychaste*. Orientalia Christiana 1929;IX:128–9.
- [5] Hausherr I. *Hésychasme et Prière*. Orientalia Christiana Analecta 1966;176. Roma: Pont institutum orientalium studiorum.
- [6] Maloney GA. Mount athos. In: Marthler BL, editor. *The new catholic encyclopedia*. Thonson-Gale; 2002. p. 31b–2a.
- [7] Herzog M. *Annapurna*. New York: American Book-Stratford Press; 1952. p. 41–55.
- [8] Clarke C. On surviving a bivouac at high altitude. *BMJ* 1976;1:92–3.
- [9] Brugger P, Regard M, Landis T, Oelz O. Hallucinatory experience in extreme-altitude climbers. *Neuropsychi Neuropsych Behav Neur* 1999;12:67–71.
- [10] Firth PG, Bolay H. Transient high altitude neurological dysfunction: an origin in the temporoparietal cortex. *High Alt Med Biol* 2004;5:71–5.
- [11] Habeler P. *The lonely victory*. New York: Simon & Shuster; 1979. p. 166–76.
- [12] Ravenhill TH. Some experiences of mountain sickness in the andes. *Am J Trop Med Hyg* 1913;16:313–20.
- [13] Lukianowicz N. Autoscopy phenomena. *Arch Neurol* 1958;80:199–220.
- [14] Grüsser OJ, Landis T. The splitting of 'I' and 'me': Heautoscopy and related phenomena. In: Grüsser OJ, Landis T, editors. *Visual agnosias and other disturbances of visual perception and cognition*. Amsterdam: MacMillan; 1991. p. 297–303.
- [15] Denning TR, Berrios GE. Autoscopy phenomena. *Br J Psychiatry* 1994;165:808–17.
- [16] Blanke O, Landis T, Spinelli L, Seeck M. Out-of-body experience and autoscopy of neurological origin. *Brain* 2004;127:243–58.
- [17] Schomer DL, O'Connor M, Spiers P, Seeck M, Marcel M, Bear D. Temporolimbic epilepsy and behaviour. In: Mesulam MM, editor. *Principles of behavioral neurology*. Philadelphia: FA Davis Company; 2001. p. 373–405.
- [18] Blanke O, Ortigue S, Coeytaux A, Martory MD, Landis T. Hearing of a presence. *Neurocase* 2003;9:329–39.
- [19] Devinsky O, Feldmann E, Burrows K, Bromfield E. Autoscopy phenomena with seizures. *Arch Neurol* 1989;46:1080–8.
- [20] Blanke O, Arzy S. Out-of body experiences due to disturbed self processing at the right temporo-parietal junction. *Neuroscientist* 2005;11:16–24.

- [21] Guldin WO, Grüsser OJ. Is there a vestibular cortex? *Trends Neurosci* 1998;21:254–9.
- [22] Idel M. *The mystical experience in Abraham Abulafia*. Albany: State University of New York Press; 1988.
- [23] Regard M, Oelz O, Brugger P, Landis T. Persistent cognitive impairment in climbers after repeated exposure to extreme altitude. *Neurology* 1989;39:210–3.
- [24] Garrido E, Castello A, Ventura JL, Capdevila A, Rodriguez FA. Cortical atrophy and other brain magnetic resonance imaging (MRI) changes after extremely high-altitude climbs without oxygen. *Int J Sports Med* 1993;14:232–4.
- [25] Hochachka PW, Clark CM, Matheson GO, Brown WD, Stone CK, Nickles RJ, et al. Effects on regional brain metabolism of high-altitude hypoxia: a study of six US marines. *Am J Physiol* 1999;277:314–9.
- [26] Johnson TS, Rock PB. Acute mountain sickness. *N Engl J Med* 1989;319:841–5.
- [27] Regard M, Landis T, Casey J, Maggiorini M, Bartsch P, Oelz O. Cognitive changes at high altitude in healthy climbers and in climbers developing acute mountain sickness. *Aviat Space Environ Med* 1991;62:291–5.
- [28] Tormes FR, Guedry FE. Disorientation phenomena in naval helicopter pilots. *Aviat Space Environ Med* 1975;46:387–93.
- [29] Benson AJ. Spatial disorientation: common illusions. In: Ernsting J, Nicholson AN, Rainford DJ, editors. *Aviation medicine*. 3rd ed.. Oxford: Butterworth & Heinmann; 1999. p. 437–54.
- [30] Binns J. *Ascetics and ambassadors of Christ: The Monasteries of Palestine*. Oxford: Oxford University Press; 1994.
- [31] Hirschfeld Y. *Longing for the desert*. Tel-Aviv: Yediot Ahronot; 2004.
- [32] Brandt T. *Vertigo: its multisensory syndromes*. 2nd ed. London: Springer Verlag; 2000.
- [33] Moore P. Mystical experience, mystical doctrine, mystical technique. In: Kats ST, editor. *Mysticism and philosophical analysis*. New York: Oxford University Press; 1978. p. 112–4.
- [34] Idel M. *Kabbalah: new perspectives*. New Haven: Yale University Press; 1990.
- [35] Idel M. *Absorbing perfections*. New Haven: Yale University Press; 2002.
- [36] Arzy S, Idel M, Landis T, Blanke O. Speaking with one's self: autoscopic phenomena in the writings of the Ecstatic Kabbalah. *J Cons Studies*, in press.
- [37] Eliade M. *The two and the one*. London: Harvell Press; 1969. p. 19–77.
- [38] James W. *The varieties of religious experience. A study in human nature*. New York: Penguin; 1985.

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