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Self-Transcendence Correlates with Brain Function Impairment

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Biography

Bernardo Kastrup has a Ph.D. in computer engineering with specializations in artificial intelligence and reconfigurable computing. He has worked as a scientist in some of the world's foremost research laboratories, including the European Organization for Nuclear Research (CERN) and the Philips Research Laboratories (where the "Casimir Effect" of Quantum Field Theory was discovered). Bernardo has authored many scientific papers and philosophy books. His three most recent books are: *More Than Allegory*, *Brief Peeks Beyond* and *Why Materialism Is Baloney*.

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Abstract

A broad pattern of correlations between mechanisms of brain function impairment and self-transcendence is shown. The pattern includes such mechanisms as cerebral hypoxia, physiological stress, transcranial magnetic stimulation, trance-induced physiological effects, the action of psychoactive substances and even physical trauma to the brain. In all these cases, subjects report self-transcending experiences often described as 'mystical' and 'awareness-expanding,' as well as self-transcending skills often described as 'savant.' The idea that these correlations could be rather trivially accounted for on the basis of disruptions to inhibitory neural processes is reviewed and shown to be implausible. Instead, this paper suggests that an as-of-yet unrecognized causal principle underlying the entire pattern might be at work, whose further elucidation through systematic research could hold great promise.

Keywords

Neural Correlates of Consciousness, Self-Transcendence, Mystical Experience, Acquired Savant, Near Death Experience, Cerebral Hypoxia, Psychedelics, Brain Damage

Introduction

In this paper, 'self-transcendence' is defined as the abrupt—thus *not* gradual—broadening of one's sense of self through a step-function enrichment of one's subjective inner life. This can happen, for instance, when one suddenly acquires (a) a feeling that one is no longer confined to the spatio-temporal locus of the physical body; (b) entirely new mental skills that one has never attempted to develop through learning or training; or (c) unfamiliar emotions, insights or inner imagery. This essay attempts to show that there is a consistent pattern of correlations between self-transcendence—so defined—and a broad variety of brain function impairment mechanisms. In other words, several types of brain function *impairment* are consistently accompanied by *richer* inner life. This is counterintuitive and suggests a common underlying causal principle yet to be understood in its full scope.

In the next sections, several mechanisms of brain function impairment and the resulting self-transcendence effects will be reviewed. The goal is to establish a broad pattern by highlighting the similarities of the mechanisms and their effects.

Cerebral Hypoxia

Fainting or near-fainting caused by restrictions of oxygen supply to the brain is known to induce liberating feelings of self-transcendence. For instance, the potentially fatal ‘choking game’ played by teenagers worldwide (Macnab 2009) is an attempt to induce such feelings through partial strangulation (Neal 2008, 310–315). The psychotherapeutic technique of holotropic breathwork (Rhinewine & Williams 2007), as well as more traditional yogic breathing practices, use hyperventilation to achieve similar effects: by increasing blood alkalinity levels, they interfere with normal oxygen uptake in the brain and ultimately lead to what is described as an expansion of ordinary awareness (Taylor 1994). Even straightforward hyperventilation outside a therapeutic context can lead to self-transcending experiences, such as described in this anecdotal—though representative—report:

One of us stood against a tree and breathed deeply for a while and then took a very deep breath. Another pushed down hard on his ribcage ... This rendered the subject immediately unconscious ... When I tried it, I didn’t think it would work, but then suddenly I was in a meadow which glowed in yellow and red, everything was extremely beautiful and funny. This seemed to last for ages. I must say that I have never felt such bliss ever again. (Retz 2007)

Finally, pilots undergoing G-force induced Loss Of Consciousness (G-LOC)—whereby blood is forced out of the brain, causing hypoxia—report “memorable dreams” phenomenologically similar to near-death experiences (Whinnery & Whinnery 1990), which are notoriously self-transcending in character.

Generalized Physiological Stress

Near-Death Experiences (NDEs) are the prime examples of self-transcendence associated with dramatically reduced brain function due to e.g. cardiac arrest (van Lommel 2001). They reportedly entail life-transforming phenomenology—encompassing insights, emotions and rich inner imagery—far surpassing the envelop of ordinary experiences (Kelly et al. 2009, 367–421), despite overwhelming disruption to the brain’s ability to operate. A recent and well-publicized NDE, which occurred while the patient was under close supervision of medical staff, captures this self-transcendent dimension. In the patient’s own words:

I certainly don't feel reduced or smaller in any way. On the contrary, I haven't ever been this huge, this powerful, or this all-encompassing. ... [I] felt greater and more intense and expansive than my physical being. (Moorjani 2012, 69)

In a related manner, traditional initiatory rituals in pre-literate cultures sought to reveal the true nature of self and world through physical ordeals (Eliade 2009). It is reasonable to imagine that these ordeals—such as long sessions in sweat lodges, exposure to the elements, extreme exertion and even poisoning—physically compromised brain function through generalized physiological stress, thereby inducing self-transcending experiences.

Electromagnetic Impairment

The use of transcranial magnetic stimulation can inhibit activity in localized areas of the brain by impairing the associated electromagnetic fields. As reported in a study (Blanke 2002), when neural activity in the angular gyrus of a patient with epilepsy was inhibited in this way, self-transcending out-of-body experiences were induced.

Trance-induced Impairment

During the practice of so-called 'psychography,' an alleged medium enters a trance state and writes down information allegedly originating from a transcendent source beyond the medium's ordinary self. A neuroimaging study (Peres 2012) revealed that experienced mediums displayed marked reduction of activity in key brain regions—such as the frontal lobes and hippocampus—when compared to regular, non-trance writing. Despite this, text written under trance scored consistently higher in a measure of complexity than material produced without trance. As an observant science journalist remarked, more complex writing

typically would require more activity in the frontal and temporal lobes—but that's precisely the opposite of what was observed. To put this another way, the low level of activity in the experienced mediums' frontal lobes should have resulted in vague, unfocused, obtuse garble. Instead, it resulted in more complex writing samples than they were able to produce while not entranced. Why? No one's sure. (DiSalvo 2012)

Chemical Impairment

Psychedelic substances have been known to induce powerful self-transcending experiences (Strassman 2001; Griffiths et al. 2006; Strassman et al. 2008). It had been assumed that they did so by exciting parts of the brain. Yet, recent neuroimaging studies have shown that psychedelics do largely the opposite (Carhart-Harris et al. 2012; Palhano-Fontes et al. 2015; Carhart-Harris et al. 2016). In an article he wrote for *Scientific American Mind*, neuroscientist Christof Koch (2012) expressed his surprise at these results. Carhart-Harris (2012, 2138), for instance, reported “only decreases in cerebral blood flow” under the influence of a psychedelic. Perhaps even more significantly, “the magnitude of this decrease [in brain activity] predicted the intensity of the subjective effects” of the psychedelic (Ibid.). As such, the significant self-transcending experiences that follow psychedelic intake are—counterintuitively—accompanied by reductions of brain activity.

Physical Damage

If the trend above is consistent, we should expect some types of physical brain damage to also correlate with self-transcending experiences. And indeed, this has been reported. In a recent study (Cristofori 2016), CT scans of more than one hundred Vietnam war veterans showed that damage to the frontal and parietal lobes increased the likelihood of self-transcending “mystical experiences.” In a previous study (Urgesi et al. 2010), patients were evaluated before and after brain surgery for the removal of tumors, which caused collateral damage in surrounding tissue. Statistically significant increases in feelings of self-transcendence were reported after the surgery.

The self-transcending character of experiences that accompany certain types of brain injury has been evocatively described by neuroanatomist Jill Bolte Taylor, following a stroke that damaged her brain’s left hemisphere:

my perception of my physical boundaries was no longer limited to where my skin met air. I felt like a genie liberated from its bottle. The energy of my spirit seemed to flow like a great whale gliding through a sea of silent euphoria. (Taylor 2009, 67)

The similarity to Moorjani’s experience quoted earlier (2012, 69) is striking, despite the latter having been caused by generalized physiological stress, not a left-hemisphere stroke.

Not only ‘mystical experiences’ correlate with brain damage, but also the emergence of new mental skills. The literature reports many cases of so-called ‘acquired savant

syndrome,' wherein an accident or disease leading to brain injury gives rise to genius-level abilities (Lythgoe et al. 2005; Treffert 2006; Treffert 2009, 1354; Piore 2013). There are examples of such abilities arising after meningitis, bullet wounds to the head, and even with the progression of dementia (Miller et al. 1998; Miller et al. 2000).

Discussion

As we've seen, there is a broad pattern associating a variety of brain impairment mechanisms with self-transcending experiences. A potential explanation for this is that brain function impairment could disproportionately affect inhibitory neural processes, thereby generating or bringing into awareness other neural processes associated with self-transcending experiences. There are, however, problems with this explanation.

Under the physicalist assumption that experience is constituted or generated by brain activity, an increase in the richness of experience—as often entailed by self-transcendence—must be accompanied by an increase in the metabolism associated with the neural correlates of experience (Kastrup 2016). This is so because (a) there supposedly is nothing to experience but its neural correlates; and (b) richer experience spans a broader information space in awareness that only increased metabolism can create in the physical substrate of the brain. Any other alternative would decouple experience from the workings of the living brain information-wise, contradicting physicalism. As such, it is difficult to see why a reduction of oxygen supply to the brain *as a whole*—as in partial strangulation, hyperventilation, G-LOC, cardiac arrest, etc.—would selectively affect inhibitory neural processes, while maintaining enough oxygen supply to feed an *increase* in the neural correlates of experience.

Alternatively, one could speculate that self-transcending experiences occur only *after* normal brain function resumes, subsequent to e.g. restoration of oxygen supply. This, however, cannot account for several of the cases reviewed above. For instance, during the neuroimaging studies of the psychedelic state (e.g., Carhart-Harris et al. 2012) researchers collected subjective reports of self-transcendence while *concurrently* monitoring the subjects' reduced brain activity levels. The same holds for the neuroimaging study of psychography (Peres 2012). Similarly, in the case of acquired savant (e.g. Treffert 2006; Treffert 2009, 1354) new mental skills are also *concomitant* with the presence of physical damage in the brain. And even in the case of NDEs, there are arguments for why confabulation after resumption of normal brain function cannot account for some of the reported experiences (Kelly et al. 2009, 419–421).

Appeals to impairment of inhibitory processes to explain acquired savant syndrome are particularly difficult to defend. They necessarily entail that the savant skills are pre-developed in the brain but remain inhibited. Brain function impairment occasioned by e.g. trauma then supposedly unlocks these dormant skills by shutting down inhibitory processes. One must wonder, however, how the brain could have developed extraordinary skills, such as e.g. prodigious aptitude for calculations, without any training. And if these skills—many of which are advantageous for survival—were latent in us all, why would the brain have evolved to keep them inhibited in the first place?

It is conceivable that individual cases of self-transcendence could have their own idiosyncratic explanation, unrelated to the other cases, and that the overall pattern suggested in this paper is a red herring. For instance, one could tentatively explain (a) the euphoric effects of hypoxia by speculating that it e.g. somehow triggers the brain's reward system, while accounting for (b) the expansion of one's sense of identity beyond the physical body—as reported by Taylor (2009, 67)—through e.g. damage to the orientation association area of the left brain hemisphere. But given the sometimes-striking similarities in the phenomenology reported across the cases reviewed and the fact that *all* cases—despite their different mechanisms of action—entail impairment of brain function, the question is whether it is plausible that no common causal principle is at work.

The current data is at least suggestive of a single, yet-unrecognized causal principle underlying all cases. More systematic studies of the subjective effects of brain function impairment—leveraging e.g. psychedelic compounds and trans-cranial magnetic stimulation—in specific brain regions could help unveil this principle. Could one e.g. reliably trigger savant skills or mystical experiences by inhibiting neural activity in particular areas under controlled conditions? What would the implications of such a scenario be? Questions such as these hold not only great public interest, but also high significance for both neuroscience and neurophilosophy.

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