

LAST BUT NOT LEAST

Sexual and food preference in apotemnophilia and anorexia: interactions between ‘beliefs’ and ‘needs’ regulated by two-way connections between body image and limbic structures

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Abstract. Apotemnophilia straddles the boundary between neurology and psychiatry. It is a condition in which individuals experience the strong and specific desire for amputation of a healthy limb. Research suggests this disorder may be of neurological origin, specifically that the body image centers of the brain lack a cortical representation for a particular limb. A curious aspect of this condition is that sufferers often report an attraction to amputees in addition to desiring their own limb be removed. We postulate that sexual ‘aesthetic preference’ for certain body morphology is dictated in all individuals in part by the cortical representation of one’s body image.

Apotemnophilia is a curious and rare disorder in which a completely normal individual has an intense desire to have a limb amputated (Money et al 1977), sometimes describing his/her body (self) as being “overcomplete” and the limb being “intrusive”. Apotemnophilia is often regarded as being a purely psychiatric condition, and it has even been suggested that it arises from a Freudian wish-fulfillment fantasy—the amputation stump thought to resemble a large penis. Others have regarded the condition as an ‘attention getting’ strategy—though this argument is counter to the fact that sufferers hide the condition from others for fear of persecution.

Contrary to the psychiatric etiology, we suggested a neurological basis (Ramachandran and McGeoch 2007) for the condition, based on five criteria. (1) The condition usually begins in early childhood. (2) The sufferer usually has no other psychological issues of any consequence. (3) Sufferers can point to the specific line (eg 2 inches above the knee) along which they desire amputation; ie it is not just a nebulous desire for any amputation (as one might expect from a psychodynamic account) nor can it be a desire to attract attention, for if that were the case the precise level should not matter. (4) In more than two-thirds of cases the left limb is involved—this disproportionate involvement of the left side reminds us of somatoparaphrenia, viz the denial of owning one’s limb made by some patients with left-sided hemiplegia following right parietal lobe strokes (Vallar and Ronchi 2008). The right parietal lobe, especially the superior parietal lobule (SPL), is involved in the construction of a neural representation of the body (Critchley 1953). Body image is constructed by inputs from multiple sensory modalities: vision, proprioception, and re-afferent signals from motor commands, and is constantly updated in response to feedback from the environment or from one’s own body. (5) The skin conductance response (SCR) to touching the affected limb is abnormally high (Brang et al 2008), further suggesting this condition is of neurological origin.

On the basis of these considerations we suggested that there is a genetically ‘hard-wired’ image, possibly a topographically organized representation, of one’s body in the right superior and inferior parietal lobule, encompassing regions of polysensory

temporoparietal-occipital junction. Partial evidence for such a genetic scaffolding comes from previous case reports of patients with congenitally missing arms who report having phantoms (Ramachandran and Hirstein 1998). If a particular body part (eg arm or leg) fails to be represented in this body image, then the result may be a desire to have it removed. Or, there may be a Geschwindian disconnection (or otherwise abnormal connections) between a portion of the body image and limbic structures. Yet, if this were true, why wouldn't the patient remain simply indifferent to the arm's presence? Why the claim that the body is 'overcomplete' or (sometimes) that the limb is mildly aversive? After all, patients with brachial avulsion or arm numbness and paralysis caused by stroke do not desire the arm to be amputated.

The key difference is that in apotemnophilia there is ostensibly normal sensory input from the limb to the primary somatosensory cortex (S1) but no representation of the arm in the polysensory body image representation. This discrepancy may be responsible for creating the feeling of 'overcompleteness' and mild aversiveness of the limb and the accompanying desire for amputation. Conversely, after brachial avulsion or hemiparesis, the input to S1 itself is lost, so there is, if anything, an indifference rather than an 'overpresence' (although at an intellectual/cognitive level the patient knows the arm is paralyzed). This discrepancy between S1 and polymodal body representation in the cortex may also explain the heightened SCR in response to touching the limb and the largely ineffable and verbally non-communicable nature of the experience—"the body is overcomplete; the limb feels overpresent yet it is still part of me and that's why I want to be rid of it."

In somatoparaphrenia, on the other hand, there is input missing to both S1 (as a result of deafferentation) and a piece of somatic representation damaged by stroke, so there is indifference or sometimes an outright denial ("This isn't my arm, Doctor") rather than a desire for amputation. Furthermore, if the stroke causes differential damage to sensory input to S1 and body image (in SPL), there would once again be a discrepancy that leads to feelings of actual aversion ("this arm is a communist") and paranoia rather than mere alienation. This tendency to 'hate' the plegic limb is much more common for the left side and, crucially, not confined to the paralyzed body part (Loetscher et al 2006).

One curious aspect of apotemnophilia that is unexplained by our model is the associated sexual inclinations in some subjects, namely a desire for intimacy with an amputee. These sexual overtones are probably one reason why people have held a Freudian psychosexual view of the disorder. We postulate that sexual 'aesthetic preference' for certain body morphology is dictated in part by the shape of the cortical representation of the body image—and perhaps hardwired—in the right parietal. This offers an alternative explanation of why ostriches prefer ostriches as mates (presumably even when smell cues are eliminated) and pigs prefer porcine shapes to humans (which is not to deny that the preference may partly arise through imprinting on one's parents). In rare instances humans prefer sheep (S M Anstis, personal communication) and women are attracted to Neanderthal morphology, but these may represent atavisms.

We suggest that there is a genetically specified mechanism that creates a cortical template of one's body that acts on limbic connections to determine aesthetic visual preference for one's own body 'type' (hence a donkey is attracted to a donkey-like creature). This argument is especially compelling for an innate body image but it doesn't rule out the possibility of acquired changes in one's body image affecting one's aesthetic preference. It is the transcription of the body representation into limbic circuitry to determine aesthetic choice that needs to be hardwired—in a manner loosely analogous to DNA to RNA transcription. The implications of one brain area having a template that 'transcribes' on to another would be radical. If a person with apotemnophilia has a leg missing in his internal (genetically hardwired) body image, then that would affect

his limbic circuits in a manner that would explain his sexual affinity for amputees. As the desire for amputation typically arises for one or both legs, this argument is even more compelling, as the majority of sufferers are specifically attracted to lower-limb amputees. Consistent with this, it is known that the amygdala (and possibly nucleus accumbens) sends feedback to multiple levels of extrastriate visual processing (setting up biases for certain morphotypes in addition to explaining preferences in ‘art’).

Another body image disturbance is anorexia nervosa. A striking feature of this disorder is that counter-intuitively their appetite is often normal, yet the patients refrain from eating because they perceive themselves to be obese (eg when looking in a mirror). We suggest that the primary disorder is not in hypothalamic appetite centers, but, as in apotemnophilia, in the body image representation constructed in the polysensory SPL; that is, the SPL homunculus itself is obese and distorts the perception of one’s body. The perceived discrepancy between body image (and a failure to construct an allocentric ‘objective’ view of the body) leads to acute discomfort that, in turn, reduces long-term food intake behavior rather than, and irrespective of, current appetite. Such a theory would flatly contradict the standard physiological model of food intake being regulated entirely by appetite and satiety. The organism strives for long-term weight change, which can shift long-term food consumption surreptitiously by ‘re-setting’ one’s appetite ‘thermostat’. Correcting this primary body image disturbance may therefore be the only way to cure the condition—which should be seen as a problem in long-term energy regulation rather than a simple appetite problem. Going back to sexual preference, one might expect the distorted body image in an anorexic to manifest itself—counter-intuitively—as an aesthetic preference toward obese members of the opposite sex.

These seemingly enigmatic syndromes can give us insights not only into the regulation (and dysfunction) of body image and its cortical representation, but body weight and sexual preference as well, and shed light on how the brain translates high-level cortical representation and concomitant cognitive beliefs into low-level, vegetative needs. Indeed the disturbances may provide clues for understanding the very nature of the self and indeed our perceptions of the self and others—which has been called the last great-unsolved problem in science.

References

- Brang D, McGeoch P, Ramachandran V S, 2008 “Apotemnophilia: a neurological disorder” *NeuroReport* **19** 1305–1306
- Critchley M, 1953 *The Parietal Lobes* 1st edition (New York: Hafner Publishing Company) pp 225–255
- Loetscher T, Regard M, Brugger P, 2006 “Misoplegia: a review of the literature and a case without hemiplegia” *Journal of Neurology, Neurosurgery, and Psychiatry* **77** 1099–1100
- Money J, Jobaris R, Furth G, 1977, “Apotemnophilia: two cases of self-demand amputation as a paraphilia” *Journal of Sex Research* **13** 115–125
- Ramachandran V S, Hirstein W, 1998 “The perception of phantom limbs: The D. O. Hebb lecture” *Brain* **121** 1603–1630
- Ramachandran V S, McGeoch P D, 2007 “Can vestibular caloric stimulation be used to treat apotemnophilia?” *Medical Hypotheses* **69** 250–252
- Vallar G, Ronchi R, 2009 “Somatoparaphrenia: a body delusion. A review of the neuropsychological literature” *Experimental Brain Research* **192** 533–551, doi:10.1007/s00221-008-1562-y

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