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Note

Reports of intimate touch: Erogenous zones and somatosensory cortical organization

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ABSTRACT

Introduction: Erogenous zones have paradoxical response properties, producing erotic feelings from body surfaces distant from the genitalia. Ramachandran has suggested an intriguing neuroscientific explanation for the distribution of erogenous zones, based on the arrangement of body parts (such as the adjacent positioning of the genitals and the feet) in primary somatosensory cortex (S1). The present study represents the first systematic survey of the magnitude of erotic sensations from various body parts, as well as the first empirical investigation of the S1 theory of erogenous zones, by analysis of whether evaluations of erogenous magnitude from adjacent S1 sites tend to correlate.

Methods: A sample of some 800 participants, primarily from the British Isles and Sub-Saharan Africa, completed a survey of 41 body parts, each rated for erogenous intensity.

Results: Ratings for the feet were surprisingly low. However, there were remarkable levels of correlation between ratings of intensity, regardless of the age, sexual orientation, nationality, race and, more surprisingly, the sex of our participant sample (R^2 values ranging between .90 and .98). Multiple regression and factor analysis investigated whether body parts nearby in S1 were significantly correlated.

Conclusion: The S1 hypothesis appears to lack support, because of the low level of foot ratings, the lack of inter-correlation between ratings for nearby S1 sites, and the previous literature suggesting that cortical stimulation of S1 does not appear to be erotogenic. The consistency across demographic variables is open to multiple interpretations. However, it may be that individual experience or cultural differences (a starting point for some accounts of erogenous zone distribution) are not substantial determining variables. Thus, while S1 does not appear to be the likely site that would support Ramachandran's neural body map proposal, we suggest that the origins of erogenous distribution may derive from a map located *elsewhere* in the brain.

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1. Introduction

Erogenous zones have long been a topic of interest, by virtue of their paradoxical response properties: erotic sensations derived from body surfaces (e.g., neck) which have no special connection to the genitalia. There has been substantial interest in the topic in the popular media (Fulbright, 2007, pp. xvii–xviii; Martin, 2009). However, there appears to have been little *scientific* interest in their paradoxical response properties.

An intriguing neuroscientific explanation for the distribution of erogenous zones was proposed in the 1990s, based on the arrangement of body parts in primary somatosensory cortex (S1). Ramachandran & Blakeslee (1998, pp. 35–36) suggested that activation of body parts *adjacent* to genital zones in S1 may produce *partial* activation of the areas for genital representation – producing low level erotic sensation. Notably, several upper body areas (e.g., neck, ear, etc.) lie adjacent to the breast in (lateral) S1, and Ramachandran argued that lower body parts, especially the feet, lie close to the cortical mapping for the genitals in (medial) S1.

In favour of this argument, there is also evidence that the body part boundaries in S1 can be dynamic and even 'fuzzy', with many reports of plasticity in S1, including changes following practise or sensory restriction (e.g., Buonomano & Merzenich, 1998; Candia, Wienbruch, Elbert, Rockstroh, & Ray, 2003; Donoghue, 1995), or changes as part of the phantom limb phenomenon (Berlucchi & Aglioti, 1997; Elbert et al., 1994; Flor et al., 1998, 2006; Halligan, Zeman, & Berger, 1999; Karl, Birbaumer, Lutzenburger, Cohen, & Flor, 2001). A related observation has been suggested in relation to the feeling or belief that ones' own limb(s) are foreign to the body, sometimes referred to as body integrity identity disorder, foreign limb syndrome, or xenomelia (Hilti et al., 2013, p. 7; McGeoch et al., 2011).

However, these findings also have a controversial element, especially in relation to the mapping of the genitalia onto the cortical homunculus (Blakeslee & Blakeslee, 2008; Bradley, Farrell, & Ojemann, 1998; Georgiadis & Holstege, 2005; Georgiadis et al., 2006; Kell, von Kriegstein, Rösler, Kleinschmidt, & Laufs, 2005; Komisaruk et al., 2011; Michels, Mehnert, Boy, Schurch, & Kollias, 2010; Penfield & Boldrey, 1937; Penfield & Rasmussen, 1950; Schott, 1993). There is a growing understanding of the complexity of primary somatosensory representation of the genitalia in both males (Holstege et al., 2003; Kell et al., 2005) and females (Komisaruk et al., 2011; Michels et al., 2010), together with imaging findings on sexual arousal and orgasm (Georgiadis, Reinders, Paans, Renken, & Kortekaas, 2009; Holstege et al., 2003).

In this context, it seems appropriate to consider whether the various strands of evidence for the S1 theory are robust. There are several such lines of evidence.

1.1. Cortical stimulation

One source of information is whether these proposed S1-generated sensations are genuinely *erotic*. There have long been reports of direct cortical stimulation of S1 (Foerester & Penfield, 1930; Penfield & Boldrey, 1937; Penfield & Jasper, 1954; Penfield & Kristiansen, 1951; Penfield & Rasmussen, 1950). However, these reports do not appear to have an erotic element. Electrical stimulation of S1 appears to produce general sensations of "tingling or numbness" (Penfield & Rasmussen, 1950, p. 26) and this also applies to stimulation of genital S1. For example, Penfield and Rasmussen's (1950) patient reported seizure-related sensation in both the labia and the nipple, deriving from the right post-central gyrus, but reported "nothing in the sensation that resembled sexual excitement" (1950, p. 26). Indeed, even after several decades of cortical stimulation work (with approximately 400 patients) Penfield and Rasmussen reported that "Curiously enough, we have never produced *erotic sensations* of any sort by [electrical] stimulation [of the cortex]" [p. 26 (italics as in the original), also see Penfield & Kristiansen, 1951, or Di Noto, Newman, Wall, & Einstien, 2013, p. 1006 for a modern referencing of this literature]. These reports were derived in a clinical setting, but nonetheless do suggest that primary somatosensory cortex does not appear to be a source of powerful erogenous stimulation.

1.2. Phantom phenomena

There have been a few case reports in the scientific literature which address the S1 theory from the perspective of phantom limb: a phenomenon known to be related to S1 plasticity (Flor et al., 1998; Flor, Nikolajsen, & Jensen, 2006; Kew et al., 1997; Medina & Coslett, 2010; Ramachandran & Hirstein, 1998). Aglioti, Cortese, and Franchini (1994) report that stimulation of the ear-lobe frequently produced sensation in the phantom nipple after mastectomy, with related accounts after orchiectomy reported by Weinstein, Sersen, and Vetter (1968). Notably, while these patients reported phantom breast or testicle sensation, in neither case was the sensation erotic. Again, these data do not support the S1 claim.

1.3. The feet as erogenous zones

In the original S1 account, much was made of the fact that the genitals and feet were adjacent (Ramachandran & Blakeslee, 1998). Notably, there is a literature (e.g., Scorolli, Ghirlanda, Enquist, Zattoni, & Jannini, 2007) demonstrating that the lower limbs are of especial erotic interest. For example, the feet, and items associated with the feet (shoes, stockings etc.), constitute almost *half* of all body part fetishes (47%, Scorolli et al., 2007, p. 435). However, fetishes are *non*-somatic sources of pleasure – a typically visual form of desire derived from objects *external* to the body. Such erotic links are presumably mediated by visual (rather than somatosensory) systems, again running counter to the Ramachandran proposal.

This begs the question of whether there are studies of the distribution of erogenous zones (i.e., based on somatic touch) in the neurologically-normal. However, there is a striking absence of empirical research in this area, and it appears that no systematic survey of the magnitude of preferred erotic sensations from various body parts has *ever* been published. The most thorough investigation of erogenous experience is that of Kinsey, Pomeroy, and Martin (1953a) and Kinsey, Pomeroy, Martin, and Gebhard (1953b), which contains 521