The Incongruent Self

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“It's a bizarre and rare disorder, but its consequences can be horrific. One man ... dumped his lower leg in dry ice for several hours until doctors were forced to amputate. Others have resorted to wood chippers and gunshots to do away with healthy limbs they never wanted.”

Callaway, Ewen (2009) New Scientist,
Joint Representations

Body Schema
- Proprioceptive
- Sensory-Motor
- Movement & Posture
- Unconscious

Body Image
- Visual
- Perceptions
- Beliefs
- Attitudes
- Conscious
topographical

1. Not proportional
2. Not continuous

Walter Penfield
Canadian

hand
face
thigh
motor
sensory
homunculus
LATERALIZATION

contra lateral

ipsi lateral

right MOTOR SENSORY

left
Integration in Right-Parietal Lobe
Right Parietal Lobe Damage

Loss of awareness of his/her own body and limbs and their positioning in space
Denial of deficit
Disruption of experience
**Supernumerary**
- Phantom limb

**Disownership**
- Somatoparaphrenia
- BIID

**Positive and Negative Effects**
Bilateral Representation?

the hypothesis that the right parietal lobe contains a representation of both the left AND right body
Somatoparaphrenia

- Refusal to believe that their limb belongs to them
- Dis-ownership of body on contralateral side of lesion
'Look at it!' he cried, with revulsion on his face. 'Have you ever seen such a creepy, horrible thing? I thought a cadaver was just dead. But this is uncanny! And somehow - it’s ghastly - it seems stuck to me!'

He seized it with both hands, with extraordinary violence, and tried to tear it off his body, and, failing, punched it in an access of rage.

'Easy!' I said. 'Be calm! Take it easy! I wouldn’t punch that leg like that.'

'And why not?' he asked, irritably, belligerently.

'Because it’s your leg,' I answered. 'Don’t you know your own leg?'

He gazed at me with a look compounded of stupefaction, incredulity, terror and amusement, not unmixed with a jocular sort of suspicion, 'Ah Doc!' he said. 'You’re fooling me! You’re in cahoots with that nurse - you shouldn’t kid patients like this!'

'I’m not kidding,' I said. 'That’s your own leg.' He saw from my face that I was perfectly serious - and a look of utter terror came over him. 'You say it’s my leg, Doc? Wouldn’t you say that a man should know his own leg?'
Somatoparaphrenia: a body delusion. 
A review of the neuropsychological literature

Giuseppe Vallar · Roberta Ronchi

Received: 30 May 2008 / Accepted: 27 August 2008 / Published online: 24 September 2008
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Abstract A review of published brain-damaged patients showing delusional beliefs concerning the contralesional side of the body (somatoparaphrenia) is presented. Somatoparaphrenia has been reported, with a few exceptions, in right-brain-damaged patients, with motor and somatosensory deficits, and the syndrome of unilateral spatial neglect. Somatoparaphrenia, most often characterized by a delusion of disownership of left-sided body parts, may however occur without associated anosognosia for motor deficits, and personal neglect. Also somatosensory deficits may not be a core pathological mechanism of somatoparaphrenia, and visual field disorders may be absent. Deficits of proprioception, however, may play a relevant role. Somatoparaphrenia is often brought about by extensive right-sided lesions, but patients with posterior (parietal-temporal), and insular damage are on record, as well as a few patients with subcortical lesions. Possible pathological factors include a

Between the end of May and the beginning of June 1669, “generosus dominus” Johannes Jakobus Schenck de Stauffenberg, who was going to leave for the fortress of Horn, suddenly fell down, hit by left hemiplegia and aphonia. Once revived, he spoke again, and his only complaint was that he referred that he had lost his left arm, and, when a servant came close to him, he grabbed firmly his (i.e., the servant’s) arm, and stated that it was his own arm, and, in order to prevent that it were taken away from him, he held it tight. (Case 169 Hemiplegia; Wepfer 1727)

Introduction

In 1942, the neurologist Josef Gerstmann (see a biographical note in Triarhou 2008) reported the cases of two right-
Hemispatial Neglect

Left side of sensory space becomes non-existent

Allocentric

Egocentric
allocentric

object-to-object

egocentric

self-to-object
https://youtu.be/ymKvS0XsM4w?t=16
Anosognosia

Unawareness of deficit
denial of deficit
confabulation

E: How is your left arm?
P: Very well.
E: In what sense?
P: Ninety-five per cent.
E: Does it move?
P: It moves depending on the teacher.
E: Could you clap your hands?
P: [raises her right arm]: Where has it gone? I must go and look for it [presumably referring to her left hand]. It must come back by itself.
E: Where is the left hand?
P: I do not know. I think that it has gone for a walk.
E: Has it gone by itself, detached from your body?
P: Yes.
E: At this very moment is your left hand away from you?
P: Yes.
E: Try and look towards the left. [P looks to her left and sees her left hand.]
E: Is your left hand away?
P: Now it has come back.
E: Does it move now?
P: It is too far away to give an answer.
Confabulation

Information at damage site not transferred via corpus callosum

Left brain is clueless to the defect
Joseph Jules François Félix Babinski

French Neurologist

Coined the term in 1914

Greek: "nosos" disease and "gnosis" knowledge
Apotemnophila or BIID
(Body Integrity Identity Disorder)

overwhelming desire to amputate one or more healthy limbs

majority of cases it is the left limb
“Your body is not just a vehicle for your brain to cruise around in. The relationship is perfectly reciprocal: Your body and your brain exist for each other. ... Meaning is rooted in agency (the ability to act and choose), and agency depends on embodiment.”

Sandra Blakeslee and Matthew Blakeslee – The Body Has a Mind of It’s Own
MOVEMENT-PRODUCED STIMULATION IN THE DEVELOPMENT OF VISUALLY GUIDED BEHAVIOR

Journal of Comparative and Physiological Psychology 1963, Vol. 56, No. 5, 872-876
The human brain holds and continuously updates an internal map of the body. Using tendon vibration distort volunteers’ brains rapidly adjusted the processing of touch information to match information from proprioception—the position to the limbs relative to the body.
Blindfolded subjects held their left index finger with their right arm.

Vibration was applied to the right arm on the biceps tendon.

... a subjective elongation of the left index finger.

The triceps vibration induced a subjective flexion of the right arm and, consequently, a subjective shrinking of the left index.
The case of Tom and Philip...
Phantom Limb – From “
https://www.youtube.com/watch?v=1mHIv5ToMTM

From NOVA's "Secrets of the Mind"
There is a secondary somatosensory cortex (region S2) (Brodmann Areas 40 and 43)

Area is responsive to light touch, pain, visceral sensation and tactile attention. Very large receptive areas.
Insula and Amygdala

Both are involved in the mediation of emotion and emotional states

Profile of the Anterior Insula
The anterior insula is implicated in reactions of disgust and has been shown to support general bodily awareness. The region senses our visceral states, which form the basis of gut feelings that inform decision making. Previous research has also shown that neural activation in the anterior insula is important for assessing risks, responding to breaches in trust, representing expected financial risks and predicting the safety of choice outcomes, according to the PNAS paper. —M.W.M.
intraparietal sulcus (IPS)

- perceptual-motor coordination (for directing eye movements and reaching) and visual attention
- processing symbolic numerical information
- visuospatial working memory
- interpreting the intent of others
GSR and its Mediators

electrical conductance of skin
sympathetic nervous system
insula mediates
amygdala influences
Apotemnophilia, a disorder that blurs the distinction between neurology and psychiatry, is characterized by the intense and longstanding desire for amputation of a specific limb. Here we present evidence from two individuals suggestive that this condition, long thought to be entirely psychological in origin, actually has a neurological basis. We found heightened skin conductance response to pinprick below the desired line of amputation. We propose apotemnophilia arises from congenital dysfunction of the right superior parietal lobule and its connection with the insula.
B.C. was a 63-year-old right-handed man who reported that since the age of 4 years he had desired bilateral lower limb amputations. Specifically, he indicated that he wanted his right leg to be amputated four inches below his hip joint and his left leg to be amputated two inches below the knee, and he stated that these parts felt as if they were ‘just not’ his. He attributed his feelings about his legs to ‘a possessive mother’, ‘an abusive boss’ and a desire to ‘fit in’. He noted that recently the left-side desire had become particularly strong, while conversely his desire for a right-sided amputation had decreased. He contacted us a year later to report that the desire for an amputation on his right side had almost completely disappeared. Several months after this, he had an **elective left below-knee amputation** and subsequently stated that he no longer had any desire for a right leg amputation. 

B.C. 63 y/o man – desires both legs amputated; left leg below the knee; right leg below the thigh.
Changes in skin conductance recording in response to pinprick above and below desired levels of amputation in the legs. B.C. wanted both legs amputated. Individuals with apotemnophilia show significant increases SCR below the level of amputation.
Body map integration failure

“They can feel the body being touched, but it does not integrate into their sense of body image…They know the limb is part of their body, but it's 'more' than it should be. It should be gone.”

Paul McGeoch, UCSD
A.O. was a 29-year-old right-handed man who desired a right mid-tibial amputation. He recalled that a ‘strong desire’ for the amputation of his right leg around the middle of his tibia started around the age of 12 years and had been constant since then. He denied a sexual motivation, but stated that rather the presence of his right leg made him feel ‘over-complete’ and that he simply wanted it ‘gone’. He had cut off the distal phalanx of his right middle finger after reading on the internet that this might alleviate his desire for amputation of his leg. He had no a priori desire to amputate this phalanx and its removal did not have an impact on the strength of his desire for his leg to be amputated. He readily acknowledged that his feelings about his leg were not normal. On neurological examination, he reported that pinprick was, possibly, slightly duller in a stocking distribution from the mid-level of his right tibia down. He also commented that at other times the same area felt ‘more sensitive’ than the other side. A month after visiting us, he irrevocably damaged his right leg with dry ice, thus necessitating a right below-knee amputation.

Magnetoencephalography

* MEG

* measures changes in magnetic fields that are correlated to neuronal firing.
Where is the brain malfunction?

Right superior parietal lobule (rSPL)
Linked to people’s representation of their own body

Tap foot to see which areas of the brain are responsive.
Use MEG to visualize neuronal activity.

Touch the normal limb ➔ right parietal lobe showed activity;

Touch the limb they want amputated ➔ no right parietal lobe activity.
Site of desired amputation and right SPL activation detected by MEG in response to tapping of the feet.

Data from:
Apotemnophilia – the Neurological Basis of a ‘Psychological’ Disorder.
McGeoch, Paul, Brang, David, Song, Tao, Lee, Roland, Huang, Mingxiong, and Ramachandran, Vilayanur.

Available from Nature Precedings (2009)
http://hdl.handle.net/10101/npre.2009.2954.1

sPL Activation in BIID Case

Control

Patient

Paul D. McGeoch, David Brang, Tao Song, Roland R. Lee, Mingxiong Huang, V. S. Ramachandran
Body Integrity Identity Disorder (BIID)—Is the Amputation of Healthy Limbs Ethically Justified?

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The term body integrity identity disorder (BIID) describes the extremely rare phenomenon of persons who desire the amputation of one or more healthy limbs or who desire a paralysis. Some of these persons mutilate themselves; others ask surgeons for an amputation or for the transection of their spinal cord. Psychologists and physicians explain this phenomenon in quite different ways; but a successful psychotherapeutic or pharmaceutical therapy is not known. Lobbies of persons suffering from BIID explain the desire for amputation in analogy to the desire of transsexuals for surgical sex reassignment. Medical ethicists discuss the controversy about elective amputations of healthy limbs: on the one hand the principle of autonomy is used to deduce the right for body modifications; on the other hand the autonomy of BIID patients is doubted. Neurological results suggest that BIID is a brain disorder producing a disruption of the body image, for which parallels for stroke patients are known. If BIID were a neuropsychological disturbance, which includes missing insight into the illness and a specific lack of autonomy, then amputations would be contraindicated and must be evaluated as bodily injuries of mentally disordered patients. Instead of only curing the symptom, a causal therapy should be developed to integrate the alien limb into the body image.

Keywords: autonomy, body scheme disturbance, body integrity identity disorder, elective amputations
Desire for amputation of a limb: paraphilia, psychosis, or a new type of identity disorder

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Method. Structured interviews were conducted by telephone of 52 subjects (mean age: 48.6, range 23–77 years; 47 male, 4 female, 1 intersexed) self-identified as having had a desire to have an amputation.

Results. Seventeen per cent ($n = 9$) had an arm or leg amputated with two-thirds using methods that put the subject at risk of death and one-third enlisting a surgeon to amputate their healthy limb. The most common reported reason for wanting an amputation was the subject’s feeling that it would correct a mismatch between the person’s anatomy and sense of his or her ‘true’ self (identity). None were delusional. For all but one subject age at onset was during childhood or early adolescence. For those who had psychotherapy or medication there was no change in the intensity of the desire for amputation. The six subjects who had an amputation at their desired site reported that following the amputation they felt better than they ever had and no longer had a desire for an amputation.

Conclusions. These preliminary results suggest the existence of an extremely unusual clinically distinct condition characterized by a lifelong desire to have an amputation of a particular limb. The condition is associated with serious negative consequences: amputation attempts, impairment and marked distress. Reflecting similarities between Gender Identity Disorder and this condition, the author suggests that it may be conceptualized as an unusual dysfunction in the development one’s fundamental sense of anatomical (body) identity.
Anatomical Identity Crisis

Amputation to establish their “true identity”

“I felt like I was in the wrong body—that I am only complete with both my arm and leg off on the right side”

Is BIID similar to gender identity disorder?

First, M. B. Psychological Medicine, 2004, 34, 1-10
Does psychotherapy work?

Treatment efficacy
A majority of the subjects (65%, n = 34) had been in psychotherapy at some time in their lives but remarkably, almost half (n = 16) never told their therapists about their desire for amputation, fearing that the therapist would consider this evidence of severe mental illness. For none of the subjects did psychotherapy reduce the intensity of the desire for amputation. Forty per cent (n = 21) of the subjects
What about SSRIs?

had taken psychotropic medication at some point in their lives (usually for depression), with 16 out of 21 a selective serotonin re-uptake inhibitor (SSRI) or clomipramine (although most were unable to recall prescribed doses). None of these subjects reported any appreciable effect from the medication on the desire for amputation (although mood often improved).

First, M. B. Psychological Medicine, 2004, 34, 1–10
Are we really sure
– which came first?

Desire could change circuitry

Circuitry could create desire.
Anorexia Nervosa

misperception of true body size

extreme control of food intake
In an experiment, blindfolded healthy women and patients with anorexia nervosa felt designs in sunken relief (top) and then drew them on paper (tables). The patients had difficulty making accurate drawings, suggesting a deficit in the operation of sense of touch. Brain activity measurements taken while the patients felt the reliefs showed less activity in the right parietal cortex (at right). The author hypothesizes that flaws in tactile capabilities and in the integrative function of the parietal cortex could contribute to faulty body image in anorexics.

Grunwald, M
Scientific American Mind 2004
Regional cerebral blood flow changes in early-onset anorexia nervosa before and after weight gain

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Received 16 February 2009; received in revised form 17 September 2009; accepted 27 September 2009
The role of the right parietal lobe in anorexia nervosa.

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Abstract

BACKGROUND: Patients with anorexia nervosa (AN) overestimate their size despite being severely underweight. Whether this misperception echoes an underlying emotional disturbance or also reflects a genuine body-representation deficit is debatable. Current measures inquire directly about subjective perception of body image, thus distinguishing poorly between top-down effects of emotions/attitudes towards the body and disturbances due to proprioceptive disorders/distorted body schema. Disorders of body representation also emerge following damage to the right parietal lobe. The possibility that parietal dysfunction might contribute to AN is suspected, based on the demonstrated association of spatial impairments, comparable to those found after parietal lesion, with this syndrome.

METHOD: We used a behavioral task to compare body knowledge in severe anorexics (n=8), healthy volunteers (n=11) and stroke patients with focal damage to the left/right parietal lobe (n=4). We applied a psychophysical procedure based on the perception, in the dark, of an approaching visual stimulus that was turned off before reaching the observer. Participants had to predict whether the stimulus would have hit/missed their body, had it continued its linear motion.

RESULTS: Healthy volunteers and left parietal patients estimated body boundaries very close to the real ones. Conversely, anorexics and right parietal patients underestimated eccentricity of their left body boundary.

CONCLUSIONS: These findings are in line with the role the parietal cortex plays in developing and maintaining body representation, and support the possibility for a neuropsychological component in the pathogenesis of anorexia, offering alternative approaches to treatment of the disorder.
Overestimated Boundaries

both right parietal lesion patients and anorexia patients overestimated their body boundary
Diminished size–weight illusion in anorexia nervosa: evidence for visuo-proprioceptive integration deficit

Laura K. Case · Rachel C. Wilson · Vilayanur S. Ramachandran
New insights into symptoms and neurocircuit function of anorexia nervosa

Walter H. Kaye*, Julie L. Fudge† and Martin Paulus§

Abstract | Individuals with anorexia nervosa have a relentless preoccupation with dieting and weight loss that results in severe emaciation and sometimes death. It is controversial whether such symptoms are secondary to psychosocial influences, are a consequence of obsessions and anxiety or reflect a primary disturbance of brain appetitive circuits. New brain imaging technology provides insights into ventral and dorsal neural circuit dysfunction — perhaps related to altered serotonin and dopamine metabolism — that contributes to the puzzling symptoms found in people with eating disorders. For example, altered insula activity could explain interoceptive dysfunction, and altered striatal activity might shed light on altered reward modulation in people with anorexia nervosa.
Box 1 | **DSM-IV, diagnostic criteria for anorexia nervosa**¹

- Refusal to maintain body weight at or above a minimally normal weight for age and height (for example, weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body weight less than 85% of that expected.)

- Intense fear of gaining weight or becoming fat, even though underweight.

- Disturbance in the way in which one’s body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.

- In postmenarcheal females, amenorrhea (that is, the absence of at least three consecutive menstrual cycles).

- There are two types of anorexia nervosa: 1. Restricting type, in which the person has not regularly engaged in binge-eating or purging behaviour; 2. Binge-eating/purging type, in which the person has regularly engaged in binge-eating or purging behaviour (that is, self-induced vomiting or the misuse of laxatives, diuretics or enemas).
Body Dysmorphic Disorder

perceived flaw

obsession to the point of inability to function properly in the world
Body dysmorphic disorder (BDD) is an intriguing and relatively common somatoform disorder that has been described around the world for more than a century (Phillips 1991). BDD often causes severe distress and notably impaired functioning, and it can lead to suicide. However, this disorder is typically underrecognized in clinical settings.

BDD is defined in DSM-IV as a preoccupation with an imagined defect in appearance; if a slight physical anomaly is present, the person’s concern is markedly excessive (American Psychiatric Association 1994). The preoccupation causes clinically significant distress or impairment in social, occupational, or other important areas of functioning, and it cannot be better accounted for by another mental disorder, such as anorexia nervosa. Although BDD is classified as a somatoform disorder, its delusional variant is classified as a psychotic disorder (a type of delusional disorder, somatic type).
Patients with BDD typically think about their perceived flaws for 3–8 hours a day (Phillips 1996a). As Ladee (1966, p. 324) wrote: “The preoccupation is so exclusively centered on one aspect of the bodily appearance, which is experienced as deformed, repulsive, unacceptable, or ridiculous, that the whole of one’s existence is dominated by this preoccupation and nothing else has any significance any more.” The thoughts are usually difficult to resist or control and are very distressing, as noted by Morselli (1891), who pointed out that “the dysmorphophobia patient is really miserable.” Such patients have low self-esteem (Rosen and Ramirez 1998) and are rejection sensitive (Phillips et al. 1996a).
**Gender Similarities and Differences**

Two studies that examined gender-related aspects of BDD found that the clinical features of the disorder appear to be similar in men and women. One of these studies ($N = 188$) found, however, that women were more likely than men to focus on their hips and weight, camouflage with makeup and pick their skin, and have comorbid bulimia nervosa (Phillips and Diaz 1997). In addition, the study found that men were more likely to be unmarried; be preoccupied with body build, genitals, and hair thinning; use a hat for camouflage; and have alcohol abuse or dependence. In the other study ($N = 58$), women were more likely to focus on their breasts and legs, check mirrors and camouflage, and have bulimia, panic disorder, and generalized anxiety disorder; men were more likely to focus on their genitals, height, and excessive body hair, and have bipolar disorder (Perugi et al. 1997a).
Cross-Cultural Aspects

Case reports and series from around the world suggest that the clinical features of BDD are similar across cultures, with culture producing nuances on a basically invariant, or universal, expression of BDD (Phillips 1996a).

*Koro*, a culture-related syndrome that may be related to BDD, occurs primarily in Southeast Asia. It is characterized by a preoccupation that the penis (labia, nipples, or breasts in women) is shrinking or retracting and will disappear into the abdomen, resulting in death (Chowdhury 1996). Although *koro* has similarities to BDD, it differs from BDD by its usually brief duration, different associated features (e.g., fear of death), response to reassurance, and occasional occurrence as an epidemic.
Summary

- The function of the right parietal lobe in body image disorders
- The possible correlation of other disorders with right parietal damage cases
- What can happen when these areas are damaged by head trauma or stroke
- Brain lesion studies provide evidence of brain regions that help mediate body representations
The Future of these Studies

The better we understand these disorders, the better we can provide treatment for those afflicted

Look at attention confounds

Create studies with more controls

Treatments exist for the reintegration of body image in anorexic patients

Create more behavioral tasks
Review Anatomy:

- motor cortex
- somatosensory cortex
- sup. parietal lobule
- auditory cortex
- visual cortex