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Felt presence: Paranoid delusion or hallucinatory social imagery? ☆

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Abstract

Cheyne and Girard characterize felt presence (FP) during sleep paralysis attacks as a pre-hallucinatory expression of a threat-activated vigilance system. While their results may be consistent with this interpretation, they are nonetheless correlational and do not address a parsimonious alternative explanation. This alternative stipulates that FP is a purely spatial, hallucinatory form of a common cognitive phenomenon—social imagery—that is often, but not necessarily, linked with threat and fear and that may induce distress among susceptible individuals. The occurrence of both fearful and non-fearful FPs in a multiplicity of situations other than sleep paralysis attacks supports the notion that FPs are hallucinatory variants of social imagery and that they are not necessarily bound to threat-activated vigilance. Evidence linking FPs with anxiety disorders supports the notion that the distress they evoke may be mediated by a more general affective distress personality factor. To illustrate the predominantly spatial character of FP hallucinations, similarities between FP and phantom limbs are summarized and the possibility that these two phenomena are parallel expressions (self- vs. other-presence) of a mirror neuron system is considered.

Keywords: Felt presence; Sleep paralysis; Hallucination; Social imagery; Spatial imagery; Distress; Phantom limb; Mirror neuron system; Body image; Dreaming; Imagery

1. Introduction

Cheyne and Girard (2007) present a thought-provoking study of felt presence (FP) experiences arising in association with sleep paralysis attacks. They interpret their findings to support the notion that FP is a pre-hallucinatory expression of a threat-activated vigilance system (TAVS) that enables the formation of more specific, visual, auditory or tactile, hallucinations. The FP achieves this by binding or conceptually integrating

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sensory content that is consistent with the TAVS/FP threat motif. The authors do not consider FP to be hallucinatory per se, but rather a 'feeling state' that incorporates content into subsequent hallucinations. This notion appears to stem from the common observation that FP experiences, unlike conventional hallucinations, frequently occur without sensory or pseudo-sensory determinants, i.e., they are 'felt' to be present but are neither seen nor heard nor sensed by touch. In supporting this point of view, the authors concur with others (e.g., Jaspers, 1963) who distinguish hallucinations from delusions on the basis of presence or absence of sensory content, but they appear to depart substantially from Cheyne's own previous position that FPs are 'the most elementary form of hallucination' (Cheyne, 2001, p. 3). The position now taken is that the non-sensory character of a FP qualifies it as a delusion, more specifically, as 'a temporary but powerful paranoid delusion of an unspecified threatening external agency' (p. 22).

Cheyne and Girard further propose that the vigilance system producing FP experiences is activated by the seemingly threatening conditions of a sleep paralysis attack: inability to move, helplessness, the supine position and darkness. Activation of the TAVS in this manner is experienced subjectively as a nonspecific sense of a threatening presence. With greater activation of the TAVS, the FP facilitates development of more intense hallucinatory experience by serving as an 'attractor' for more specific sensory information such as visual, auditory, tactile and pain imagery that is consistent with the sense of threat. The presumed order of causal events is displayed in the upper part of Fig. 1. In brief, the threat-activated FP facilitates the binding or conceptual integration of sensory and pseudo-sensory information into a sensorily recognizable hallucination of an external threatening agent.

My assessment of this model is that, while plausible, it is not completely consistent with either the phenomenology of FP experiences or evidence linking FPs to anxious temperament. I suggest an alternative explanation by which the presumed order of causal events hinges upon a different sequence (see lower part of Fig. 1). In this case, the paralysis attack enables activation of hallucinatory social imagery in the form of a FP—similar to what normally occurs during dreaming (see Nielsen & Lara-Carrasco, in press). The FP leads naturally to an emotional reaction that is appropriate to the ongoing context—fear is common but not exclusive—and also to distress in susceptible individuals. The latter are individuals who possess an affect distress personality style (Levin & Nielsen, in press) which may be associated with a variety of anxiety disorders. This alternative explanation implies that the TAVS model errs concerning 2 specific suppositions:

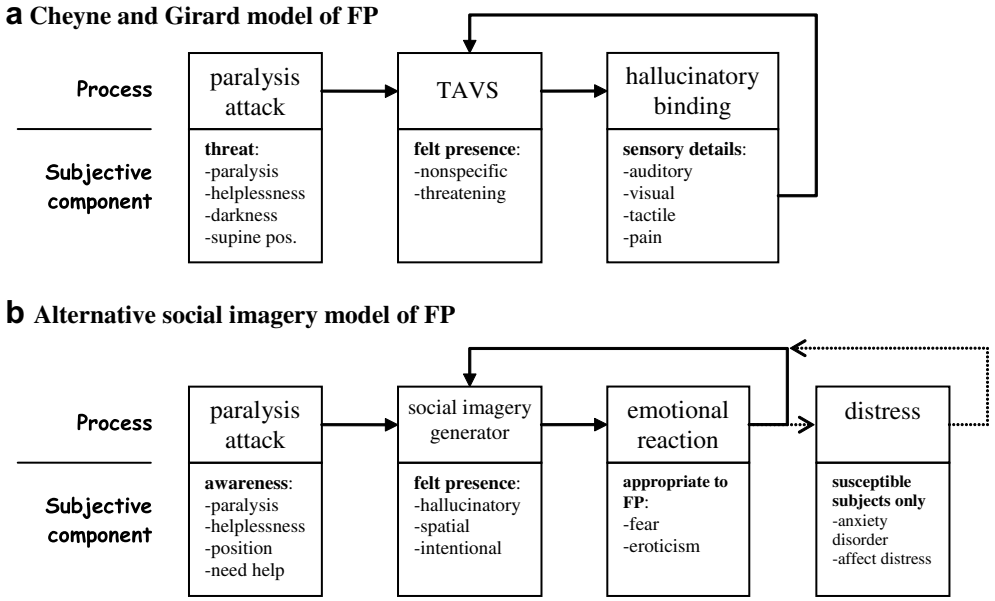

Fig. 1. Schematic representations of two models of felt presence production during sleep paralysis attacks. In model a, felt presence is triggered by threat and contributes to hallucination; in model b, felt presence is hallucinatory content that triggers fear and, in susceptible individuals, affective distress.

(1) *FP is the product of a threat/vigilance system*. Rather, I suggest that FP is a variant of normal social imagery, primed by REM sleep processes in a semi-wakeful state, whose uncanny nature evokes various types of emotional reactions (fear, trepidation, eroticism, curiosity), including distress if the individual is prone to anxiety disorders or affect distress.
(2) *FP is pre-hallucinatory (e.g., a feeling, a conception, a delusion*). Rather, I suggest that FP is a bona fide hallucination of a predominantly spatial nature.

These components of the alternative conceptualization are further detailed below.

2. Felt presence is a variant of normal social imagery

2.1. The felt presence occurs elsewhere than during sleep paralysis

Even though felt presence (FP) experiences are commonly studied as a correlate of sleep paralysis attacks, they also appear in a wide range of other situations and conditions—in both sleeping and waking states (see Table 1). Not all subjective features of these other FP forms are identical to those of sleep paralysis, but they do share multiple essential attributes: (1) their apparent proximity, i.e., they are orientated in space relative to the self, (2) their 'feltness', i.e., their apparent presence is detected often without accompanying visual,

Table 1
Felt presence experiences documented for exceptional conditions other than sleep paralysis attacks

Condition	Name	Authors	Special features
1. Post-partum state	Baby-in-bed (BIB) nightmares	Nielsen and Paquette (2004); Nielsen and Paquette (2007)	Presence of infant is sensed in parental bed Typically accompanied by dream enacting behaviors Sleep disruption, stress of maternal responsibility likely factors
2. Epilepsy	Sensed presence	Cheyne and Girard (2004); Landtblom (2006)	Presence is focus of epileptic aura
3. Brain damage (especially temporoparietal areas)	Feeling of presence	Brugger et al. (1996)	Presence is unilaterally localized in space 61% consistently on right side of body; 39% on left
4. Partial sensory deprivation	Sensed presence	Tiller and Persinger (1994)	Possible interaction with hypnotizability
5. Unusual environments (spirit quests, solitary sailing, polar and mountain exploration, shipwrecks, plane crashes)	Feeling presence of an imaginary companion	Suedfeld and Mocellin (1987); Brugger et al. (1999)	Likely enabling factors: monotony, cold, isolation, danger, near-starvation, physical debility, uncertainty of survival/rescue, exhaustion Presence often encouraging, comforting, offering hope
6. Bereavement	Presence of deceased	Datson and Marwit (1997); Grimby (1993)	Perceivers higher on neuroticism, externalized control, extroversion and prior marital harmony Presence typically comforting or helpful
7. Right brain stimulation with weak, complex, magnetic fields	Evoked sensed presence	St-Pierre and Persinger (2006); Booth et al. (2005)	Possible interactions with temperament and global geomagnetic activity
8. Electrical stimulation of left temporoparietal junction	Illusory shadowy person	Arzy et al. (2006)	Presence was localized behind the subject and shadowed her posture changes and limb movements Was at times unpleasant, but not specifically threatening
9. Prolonged gazing into mirror or other reflective surface (psychomanteum)	Presence of deceased	Moody and Perry (1993)	Experiences are typically positive and therapeutic
10. Spontaneous occurrence, typically among religious persons	Presence of angels	Burnham (1991)	Experiences typically comforting, may occur during wakefulness or sleep

auditory or tactile sensory determinants, and (3) their apparent intentionality, i.e., they seem to have goals or intentions with respect to the self. As shown in Table 1, the conditions under which such FPs occur vary substantially. They are evoked by recent births and deaths, sensory deprivation conditions and brain disorders such as epilepsy and tumors. They arise in a variety of extreme environments, such as polar trekking and mountain climbing above 6000 m. There have also been demonstrations of evoked FPs by electrical stimulation of temporoparietal brain regions (Arzy, Seeck, Ortigue, Spinelli, & Blanke, 2006) and by weak magnetic field stimulation of the same regions (Persinger & Healey, 2002; St-Pierre & Persinger, 2006). However, a failed independent replication attempt with the latter methodology provides evidence that the suggestibility of subjects may be responsible for the magnetic stimulation effect (Granqvist et al., 2005; for a rebuttal see Persinger & Koren, 2005).

Beyond the FPs evoked under extreme and unusual conditions, a variety of FP-like experiences occur during normal life experiences, further bolstering the suggestion that sleep paralysis FPs are variants of a much more generic capacity for generation of realistic social imagery. These experiences largely fall under the heading of animistic experiences (Nielsen, 1991; Sheehan, Papalia-Finlay, & Hooper, 1980). Any experience of the presence of a spiritual entity such as God, an angel or a spiritual guide reflects this capacity, as does the sensed presence of maleficent entities such as aliens, apparitions, ghosts and devils. Numerous other activities involving FP have been articulated (for review see Brugger, Regard, & Landis, 1996) and are beyond the scope of the present paper to detail. But to illustrate the variety of situations, FPs appear to be involved in childhood imaginary companions, personified play and fears of invisible creatures in the dark, in the sexual fantasies and amorous longings of adolescents and adults and in the esoteric practices of channeling, automatic writing and 'crossing-over'. Ultimately, a case may be made that FPs accompany social imagery of all kinds to the extent that such imagery is spatially determined. A mundane example of this can be illustrated to oneself simply by closing one's eyes while in the presence of another person who remains motionless and quiet; the other's presence is still clearly felt, even despite the absence of visual, auditory or tactile signs. FP may thus constitute the spatial skeleton of all imagined entities—a type of orientational scaffold that is pushed into background awareness whenever visual and/or auditory determinants of the imagery become too salient.

In sum, the implication of FP in a variety of exceptional and mundane imaginal experiences attests to the widespread occurrence of the phenomenon and supports the notion that it is a variant of a more general social imagery process. Descriptive studies converge in demonstrating the ubiquity of FP experiences and in establishing some of the conditions under which they occur spontaneously. They also provide clues as to how FPs may be evoked and studied experimentally. Rather than a threat-related pre-hallucinatory feeling, FP is here considered to be a vivid variant of social imagery, which is itself a basic, albeit under-appreciated, dimension of human cognition (see Nielsen & Lara-Carrasco, in press for a more detailed statement of this position).

2.2. Felt presence is distressing to susceptible individuals

While FP during sleep paralysis attacks is associated with fear in many instances, this is by no means the only emotion it can evoke. For example, Cheyne and Girard (Table 1) report that only 37% of subjects report FPs that are felt to be threatening; 56% report that they are friendly, neutral or simply 'watching' them. Furthermore, FPs occurring in conditions other than sleep paralysis attacks are often not fearful in nature; those associated with extreme environments or the deceased, are typically experienced to be helpful, encouraging or comforting (see Table 1, last column). This variability in emotional responses casts doubt on the suggestion that FP is necessarily the subjective expression of threat-activated vigilance. It seems as reasonable to suggest that FPs themselves evoke emotions as do social images in dreams more generally (Foulkes, 1982), and that fear may be the most frequent emotion evoked in this state, as it is during dreaming (Merritt, Stickgold, Pace-Schott, Williams, & Hobson, 1994; Nielsen, Deslauriers, & Baylor, 1991). Moreover, the emotions evoked by FPs are likely affected by both (1) situational factors, such as the context of the ongoing hallucinatory story or whether or not the individual is alone in the house (and can recall this fact) and (2) temperamental factors, especially whether the individual suffers from anxiety or possesses a personality characterized by affective distress (Levin & Nielsen, in press).

There is, in fact, mounting evidence that a distress-prone temperament is associated with frequent experiences of threatening FPs (see review in Solomonova et al., in press). For example, we (Simard & Nielsen, 2005)

found that subjects who had previously experienced sleep paralysis attacks with FP scored higher on a social anxiety measure than did subjects who had attacks without FP or who had experienced neither phenomenon. Results to be presented in a future issue (Solomonova et al., in press) indicate that a new measure of sleep paralysis distress is correlated preferentially with FP frequency, but also with more general measures of affect distress, such as social anxiety and distress due to nightmares. Further, these findings provide evidence that sleep paralysis distress is associated with dysfunctional social imagery, specifically, with social imagery in which the self is overly passive, i.e., the "being observed by others" subscale of the Liebowitz Social Anxiety Scale and a new subscale (the 'Other Experiences Questionnaire' 7-item subscale or OEQ7) measuring passive FP-like experiences during the waking state. Together, such findings suggest not only that a distress-prone temperament may mediate FP emotions but that dysfunction of more general social imagery processes may be implicated in this effect.

3. FP is an hallucination of a spatial nature

Various findings concur that the realism of an FP experience is not necessarily based upon real sensory information of a visual, auditory or tactile nature, nor even upon imagined sensations of these types. Rather, the *spatial* information inherent in a FP appears to constitute its primary phenomenological quality. Elsewhere (Solomonova et al., in press), we refer to this as *hallucinatory content of a purely spatial nature*. I argue here that absence of sensory determinants for an imaginal experience does not necessarily qualify that experience as non-hallucinatory. As Gibson (1966) early clarified, perception is not about sensory attributes, but about the unchanging or invariant information that the senses convey. We perceive people and their communications, not arrays of fluctuating colors or sequences of shifting sounds. In the case of imagined or hallucinated perceptions, which Gibson did not consider in any detail, the same principle holds true, even though purely sensory input sources are minimized. Visual, auditory and tactile sensations are not the phenomenological objects of imagined perception but are merely convenient labels that we apply to categorize them. The FP phenomenon exemplifies this fact. An FP can contain a wealth of hallucinated information—spatial location, orientation, mass, volume, extent, movement, trajectory—all without the need for representation by any of the traditional sensory channels. Such spatial information is, according to Gibson (1966, p. 59), the most basic of all invariant perceptual information available in the environment.[1] Thus, FP is not only hallucinatory, but its content bears the most basic type of perceptual information. This notion accords more closely with Cheyne's (2001) earlier conceptions of FP than with the Girard and Cheyne version in the present issue.

The apparent spatiality of FP experiences is, I suggest, one constant feature of a cognitive system that subserves the task of representing social imagery in memory but that, under the exceptional circumstances of sleep paralysis attacks and others summarized above (Table 1), manifests with only a minimum of 'sensory' (visual, auditory, tactile) attributes and a predominance of spatial attributes. The spatiality attributes are shared with much other imagery (e.g., body image, virtual settings, imagined objects) and may constitute a common 'grammar' by which all imagery is seamlessly integrated during dreaming, hypnagogic hallucination and other imaginative activity. To the extent that images are products of spatial determinants, they may more easily be combined into a continuous coherent narrative—irrespective of the 'sensory' channel that predominates. This attribute of FP spatiality provides an alternative explanation for the findings from Cheyne and Girard's path analyses, i.e., FPs may account for shared variance with sensory hallucinations precisely because the exemplary spatial nature of FPs facilitates their ready integration with other types of spatially-determined imagery.

[1] For Gibson, perception of space is apprehension of the environment's framework, 'a dim, underlying, and ceaseless awareness of what is permanent in the world'. (p. 59). As he never considered imagery, dream or hallucination in any detail, he remained silent on phenomena such as FP, during which this representation of invariant space loses its 'dim' quality and becomes focally salient.

3.1. Felt presence is analogous to the phantom limb phenomenon

To better understand the production of FPs, it may be useful to examine them as analogous to another, more extensively studied, type of spatial hallucination associated with self-, rather than social-imagery: the phantom limb phenomenon. Phantom limbs appear almost universally after amputation of an arm or leg (Ramachandran & Hirstein, 1998; Richardson, Glenn, Nurmikko, & Horgan, 2006; Woodhouse, 2005), but also very often occur following induced nerve block of an intact limb (Melzack & Bromage, 1973) or in cases of congenital limb deficiency (Schultz, Melzack, Israel, & Lacroix, 1997; Weinstein & Sersen, 1961). They are analogous to FPs in several respects. First, both are vivid hallucinatory events (see previous section). Accordingly, they are both representations of absent perceptions; the presence of an absent person in the case of FPs and the presence of an absent limb in the case of phantom limbs. Second, both hallucinations are spatial in nature. Like FPs, phantom limbs are not determined by visual, auditory or tactile perceptions, even though they, like FPs, may often be accompanied by them (e.g., phantom tingling, phantom pain). Like FPs, the structure of phantom limbs may be vague or quite detailed; for example, a phantom may be present but undescribable or may incorporate detailed feelings of the joints and digits (Richardson et al., 2006). Third, in both cases, the representation of spatiality extends to apparent movement through space. FPs may move relative to the paralyzed victim; phantom limbs may move reflexively or in response to motor commands (Mercier, Reilly, Vargas, Aballea, & Sirigu, 2006; Reilly, Mercier, Schieber, & Sirigu, 2006; Richardson et al., 2006).

Fourth, notwithstanding the vivid apparent reality of both FPs and phantom limbs, both types of representation may appear to be incomplete, faulty or bizarre. FPs may consist of known persons with unexpectedly odd characteristics or even of never-before-seen beastly apparitions. Phantom limbs may be distorted relative to the original limb (Halligan, 2002), e.g., twisted, outsized, missing parts, or paralyzed. Or they may assume bizarre, never-before-felt shapes, e.g., hyper-extension of the fingers (Ramachandran & Rogers-Ramachandran, 1996), 'telescoping' (hand receding toward the shoulder) (Weiss & Fishman, 1963) or phantom fingers protruding from the (real) shoulder.

Fifth, FPs and phantom limbs may be similar in how the hallucinatory 'felt' aspect is enhanced or inhibited by other auditory, visual or tactile information. In the case of a phantom limb, visual or tactile information presented concurrently with the phantom can dramatically change the quality of the felt experience. For example, apparent visual 'scratching' of an itchy phantom can alleviate the phantom itch (Jacome, 1978). Or, mirror projections of the intact arm onto the phantom can induce movement sensations in the phantom (Brodie, Whyte, & Niven, 2007; Ramachandran & Rogers-Ramachandran, 1996), can override phantom sensations (Hunter, Katz, & Davis, 2003; Ramachandran & Hirstein, 1998), can alleviate phantom pain (Giraux & Sirigu, 2003) and can stop phantom 'clenching spasms' (Ramachandran, Rogers-Ramachandran, & Cobb, 1995). Such mirror projections can even induce a permanent telescoping of the phantom arm (Ramachandran et al., 1995). In the case of FPs, visual and auditory imagery is also quite readily integrated into the experience. The FP may be glimpsed briefly out to the side, or heard to climb the stairs or to speak into the ear, or felt to climb onto the bed. Cheyne and Girard's findings, in fact, indicate that FP occurrences are relatively strongly correlated with visual, auditory and tactile features. It remains unknown, however, to what extent the FP in its vivid felt form can coexist with such other imagery. Does a salient visual depiction of the felt intruder cause its vivid spatial quality to change or weaken in a manner analogous to the mirror-induced disruptions of phantom limb sensations? It is possible that a relative absence of competing sensory details is a *necessary* condition for the continued awareness of a FP; that when these other details become too salient, the FP loses its sense of spatial uniqueness.

Finally, Melzack (1989) has argued for the existence of a network of brain regions ('neuromatrix') underlying phantom limbs and the body image more generally. This network involves multiple somatosensory projection systems, the limbic system and other regions that 'stamp' all self-relevant incoming information with a 'neurosignature' of the self or body image. More recently, studies of the 'rubber hand' illusion and vibration-induced movement illusions (Naito, Roland, & Ehrsson, 2002) have identified even more specific brain loci of the body image (Ehrsson, Spence, & Passingham, 2004). An analogous neural architecture for FPs remains unknown (although see one suggestion by Persinger (1993)). However, in line with the present comparative analysis, it may be suggested that a similar matrix of brain regions underlies FP experiences. It seems likely that some subset of information processed by the brain is stamped with an analogous signature identifying

it as socially autonomous—a 'neuroautograph' might be an appropriate analogue to Melzack's neurosignature.

3.2. Does felt presence mirror the body image?

Thus far, we have considered FPs and phantom limbs to be analogous, albeit independent, hallucinatory experiences. However, the many points of similarity between the phenomena suggest that it may be worth considering whether the two are also functionally related at some level of nervous system functioning. This possibility is feasible in light of new research pointing to the centrality of *mirror neurons* in behavior and cognitive representation. Mirror neurons were first identified in monkeys (di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Rizzolatti & Craighero, 2004) and later confirmed in humans with a variety of brain imaging techniques (see Gallese, 2003 for review). They are activated both when a specific behavior, such as grasping for food, is *enacted by an individual* and when the same behavior is *perceived to be enacted by someone else*. The implication of this finding for the present discussion is that the meaning of behavior, whether self- or other-initiated, is stored in one and the same neural representation. An emerging consensus is that these common representations parsimoniously explain a variety of phenomena, including imitation, empathy and contagion (e.g., yawning), as well as how humans understand the intentions of others' actions and social behaviors more generally (Fogassi et al., 2005; Iacoboni et al., 2005).

The functioning of mirror neurons in the production of imagery, dreaming and hallucinations remains unknown. However, some evidence links them to the development of phantom limbs, motor imagery and the body image (Astafiev, Stanley, Shulman, & Corbetta, 2004; Brugger et al., 2000; for review see Price, 2006). For example, mirror neurons might explain how individuals born without limbs nonetheless experience phantom limbs; a complete body image representation may be learned, via mirror neurons, simply by observing others move their limbs. In the case of dream imagery, the phenomena of introjection and projective identification have long lacked such a parsimonious neurobiological explanation. The fact that somatosensory forms of stimulation (electrical pulses, pressure) applied during REM sleep and intended to influence the dreamed body image are frequently also projected onto the corresponding body parts of other dreamed characters (Koulack, 1969; Nielsen, 1993), is compatible with the notion that mirror neurons are implicated in representing both self and other character images.

If higher order representations such as body image and dream characters are, at least partially, sustained by the mirror neuron system, then FPs too may be parsimoniously explained as variant representations from the same informational source—a social manifestation of body image perhaps. Body image and FP would, from this perspective, be based upon information encoded in one and the same mirror neuron representations, but would differ in that the former is 'stamped' with a 'neurosignature' and the latter with a 'neuroautograph.' Such an isomorphic relationship could explain unusual features of FP experiences, such as the apparent reciprocity between the dreamer's level of felt terror and the degree of evil attributed to the FP (Cheyne, 2001).

4. Conclusion

FP may be parsimoniously explained as a type of social imagery whose predominant attribute, spatiality, renders it compatible with other spatially-determined imagery. FP imagery may evoke fear during sleep paralysis attacks just as social imagery in general commonly evokes fear during dreaming. Among susceptible individuals, FP may incite considerable distress. Similarities between FP and phantom limbs as well as speculation that these are interrelated phenomena need close experimental scrutiny. There is a particular need for studies of how mirror neurons are implicated in imaginal processes and dreaming. If the mirror neuron system indeed facilitates a variety of functions by virtue of 'motor simulation' (Aziz-Zadeh, Wilson, Rizzolatti, & Iacoboni, 2006; Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005; Gallese, 2006), then a fruitful avenue of research may be to explore how self and other motor imagery is interrelated in dreams and how such imagery is further connected to waking state conceptions and simulations of motor behavior. Other useful research might be to examine dreaming in relation to autoscopia, out-of-body experience, perspective taking, self-other distinctions, and body imagery—all phenomena and processes that have been linked to multisensory integrative regions at the temporo-parietal junction (Blanke & Arzy, 2005; Blanke et al., 2005).

References

Arzy, S., Seeck, M., Ortigue, S., Spinelli, L., & Blanke, O. (2006). Induction of an illusory shadow person. *Nature, 443*, 287.

Astafiev, S. V., Stanley, C. M., Shulman, G. L., & Corbetta, M. (2004). Extrastriate body area in human occipital cortex responds to the performance of motor actions. *Nature Neuroscience, 7*, 542–548.

Aziz-Zadeh, L., Wilson, S. M., Rizzolatti, G., & Iacoboni, M. (2006). Congruent embodied representations for visually presented actions and linguistic phrases describing actions. *Current Biology, 16*, 1818–1823.

Blanke, O., & Arzy, S. (2005). The out-of-body experience: disturbed self-processing at the temporo-parietal junction. *Neuroscientist, 11*, 16–24.

Blanke, O., Mohr, C., Michel, C. M., Pascual-Leone, A., Brugger, P., Seeck, M., et al. (2005). Linking out-of-body experience and self processing to mental own-body imagery at the temporoparietal junction. *Journal of Neuroscience, 25*, 550–557.

Booth, J. N., Koren, S. A., & Persinger, M. A. (2005). Increased feelings of the sensed presence and increased geomagnetic activity at the time of the experience during exposures to transcerebral weak complex magnetic fields. *International Journal of Neuroscience, 115*, 1053–1079.

Brodie, E. E., Whyte, A., & Niven, C. A. (2007). Analgesia through the looking-glass? A randomized controlled trial investigating the effect of viewing a 'virtual' limb upon phantom limb pain, sensation and movement. *European Journal of Pain, 11*, 428–436.

Brugger, P., Kollias, S. K., Muri, G., Crelier, G., Hepp-Reymond, M.-C., & Regard, M. (2000). Beyond remembering: phantom sensations of congenitally absent limbs. *Proceedings of the National Academy of Sciences of the United States of America, 97*, 6167–6172.

Brugger, P., Regard, M., & Landis, T. (1996). Unilaterally felt presences—the neuropsychiatry of ones invisible doppelganger. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 9*, 114–122.

Brugger, P., Regard, M., Landis, T., & Oelz, O. (1999). Hallucinatory experiences in extreme-altitude climbers. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 12*, 67–71.

Burnham, S. (1991). *Angel letters*. New York: Ballantine Books.

Calvo-Merino, B., Glaser, D. E., Grezes, J., Passingham, R. E., & Haggard, P. (2005). Action observation and acquired motor skills: an FMRI study with expert dancers. *Cerebral Cortex, 15*, 1243–1249.

Cheyne, J. A. (2001). The ominous numinous. *Journal of Consciousness Studies, 8*, 133–150.

Cheyne, J. A., & Girard, T. A. (2004). Spatial characteristics of hallucinations associated with sleep paralysis. *Cognitive Neuropsychiatry, 9*, 281–300.

Datson, S. L., & Marwit, S. J. (1997). Personality constructs and perceived presence of deceased loved ones. *Death Studies, 21*, 131–146.

di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., & Rizzolatti, G. (1992). Understanding motor events: a neurophysiological study. *Experimental Brain Research, 91*, 176–180.

Ehrsson, H. H., Spence, C., & Passingham, R. E. (2004). That's my hand! activity in premotor cortex reflects feeling of ownership of a limb. *Science, 305*, 875–877.

Fogassi, L., Ferrari, P. F., Gesierich, B., Rozzi, S., Chersi, F., & Rizzolatti, G. (2005). Parietal lobe: from action organization to intention understanding. *Science, 308*, 662–667.

Foulkes, D. (1982). REM-dream perspectives on the development of affect and cognition. *Psychiatric Journal of the University of Ottawa, 7*, 48–55.

Gallese, V. (2003). The roots of empathy: the shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology, 36*, 171–180.

Gallese, V. (2006). Intentional attunement: a neurophysiological perspective on social cognition and its disruption in autism. *Brain Research, 1079*, 15–24.

Gibson, J. J. (1966). *The senses considered as perceptual systems*. Boston: Houghton Mifflin Company.

Giraux, P., & Sirigu, A. (2003). Illusory movements of the paralyzed limb restore motor cortex activity. *Neuroimage, 20*(Suppl 1), S107–S111.

Granqvist, P., Fredrikson, M., Unge, P., Hagenfeldt, A., Valind, S., Larhammar, D., et al. (2005). Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak complex magnetic fields. *Neuroscience Letters, 379*, 1–6.

Grimby, A. (1993). Bereavement among elderly people: grief reactions, post- bereavement hallucinations and quality of life. *Acta Psychiatrica Scandinavica, 87*, 72–80.

Halligan, P. W. (2002). Phantom limbs: the body in mind. *Cognitive Neuropsychiatry, 7*, 251–269.

Hunter, J. P., Katz, J., & Davis, K. D. (2003). The effect of tactile and visual sensory inputs on phantom limb awareness. *Brain, 126*, 579–589.

Iacoboni, M., Molnar-Szakacs, I., Gallese, V., Buccino, G., Mazziotta, J. C., & Rizzolatti, G. (2005). Grasping the intentions of others with one's own mirror neuron system. *PLoS Biology, 3*, e79.

Jacome, D. (1978). Phantom itching relieved by scratching phantom feet. *Journal of the American Medical Association, 240*, 2432.

Jaspers, K. (1963). *General psychopathology (orig. 1923)*. University of Chicago Press.

Koulack, D. (1969). Effects of somatosensory stimulation on dream content. *Archives of General Psychiatry, 20*, 718–725.

Landtblom, A. M. (2006). The ''sensed presence'': an epileptic aura with religious overtones. *Epilepsy & Behavior, 9*, 186–188.

Levin, R. & Nielsen, T. A. (in press). Disturbing dreams, PTSD and affect distress: a review and neurocognitive model. *Psychological Bulletin*.

Melzack, R. (1989). Phantom limbs, the self and the brain (The D.O. Hebb Memorial Lecture). *Canadian Journal of Psychology, 30*, 1–17.

Melzack, R., & Bromage, P. R. (1973). Experimental phantom limbs. *Experimental Neurology, 39*, 261–269.
Mercier, C., Reilly, K. T., Vargas, C. D., Aballea, A., & Sirigu, A. (2006). Mapping phantom movement representations in the motor cortex of amputees. *Brain, 129*, 2202–2210.
Merritt, J. M., Stickgold, R., Pace-Schott, E., Williams, J., & Hobson, J. A. (1994). Emotion profiles in the dreams of men and women. *Consciousness and Cognition, 3*, 46–60.
Moody, R., & Perry, P. (1993). *Reunions. Visionary encounters with departed loved ones*. New York: Ballantine Books.
Naito, E., Roland, P. E., & Ehrsson, H. H. (2002). I feel my hand moving: a new role of the primary motor cortex in somatic perception of limb movement. *Neuron, 36*, 979–988.
Nielsen, T. A. (1991). Reality dreams and their effects on spiritual belief: a revision of animism theory. In J. Gackenbach & A. A. Sheikh (Eds.), *Dream images: A call to mental arms* (pp. 233–264). Amityville: Baywood Publishing Company, Inc.
Nielsen, T. A. (1993). Changes in the kinesthetic content of dreams following somatosensory stimulation of leg muscles during REM sleep. *Dreaming, 3*, 99–113.
Nielsen, T. A. & Lara-Carrasco, J. (in press). Nightmares, dreaming and emotion regulation: a review. In D. Barrett & P. McNamara (Eds.), Westport, CT: Praeger Greenwood.
Nielsen, T. A. & Paquette, T. (2004). High prevalence of postpartum peril dreams and sleep behaviors. In 17th Congress of the European Sleep Research Society, October 5–9, 2004, Prague, Czech Republic.
Nielsen, T. A. & Paquette, T. (2007). A postpartum dream-enacting parasomnia. Sleep, submitted for publication.
Nielsen, T. A., Deslauriers, D., & Baylor, G. W. (1991). Emotions in dream and waking event reports. *Dreaming, 1*, 287–300.
Persinger, M. A. (1993). Vectorial cerebral hemisphericity as differential sources for the sensed presence, mystical experiences and religious conversions. [Review]. *Perceptual and Motor Skills, 76*, 915–930.
Persinger, M. A., & Healey, F. (2002). Experimental facilitation of the sensed presence: possible intercalation between the hemispheres induced by complex magnetic fields. *Journal of Nervous and Mental Disease, 190*, 533–541.
Persinger, M. A., & Koren, S. A. (2005). A response to Granqvist et al. "Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak magnetic fields". *Neuroscience Letters, 380*, 346–347.
Price, E. H. (2006). A critical review of congenital phantom limb cases and a developmental theory for the basis of body image. *Consciousness and Cognition, 15*, 310–322.
Ramachandran, V. S., & Rogers-Ramachandran, D. (1996). Synaesthesia in phantom limbs induced with mirrors. *Royal Society of London—Series B: Biological Sciences, 263*, 377–386.
Ramachandran, V. S., & Hirstein, W. (1998). The perception of phantom limbs. The D.O. Hebb lecture. *Brain, 121*(Pt 9), 1603–1630.
Ramachandran, V. S., Rogers-Ramachandran, D., & Cobb, S. (1995). Touching the phantom limb. *Journal of Cognitive Neuroscience, 377*, 489–490.
Reilly, K. T., Mercier, C., Schieber, M. H., & Sirigu, A. (2006). Persistent hand motor commands in the amputees' brain. *Brain, 129*, 2211–2223.
Richardson, C., Glenn, S., Nurmikko, T., & Horgan, M. (2006). Incidence of phantom phenomena including phantom limb pain 6 months after major lower limb amputation in patients with peripheral vascular disease. *Clinical Journal of Pain, 22*, 353–358.
Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.
Schultz, G., Melzack, R., Israel, R., & Lacroix, R. (1997). Painful and non-painful phantom limb sensations in people with congenital limb deficiency or early childhood amputation. *Pain Research and Management, 2*, 59, Ref Type: Abstract.
Sheehan, N. W., Papalia-Finlay, D. E., & Hooper, F. H. (1980). The nature of the life concept across the life-span. *International Journal of Aging & Human Development, 12*, 1–13.
Simard, V., & Nielsen, T. A. (2005). Sensed presence as a possible manifestation of social anxiety. *Dreaming, 15*, 245–260.
Solomonova, E., Nielsen, T., Stenstrom, P., Simard, V., Frantova, E., & Donderi, D., (2007). Sensed presence as a correlate of sleep paralysis distress, social anxiety and waking state social imagery. *Consciousness and Cognition*, doi:10.1016/j.concog.2007.04.007.
St-Pierre, L. S., & Persinger, M. A. (2006). Experimental facilitation of the sensed presence is predicted by the specific patterns of the applied magnetic fields, not by suggestibility: re-analyses of 19 experiments. *International Journal of Neuroscience, 116*, 1079–1096.
Suedfeld, P., & Mocellin, J. S. (1987). The "sensed presence" in unusual environments. *Environment & Behavior, 19*, 33–52.
Tiller, S. G., & Persinger, M. A. (1994). Elevated incidence of a sensed presence and sexual arousal during partial sensory deprivation and sensitivity to hypnosis: implications for hemisphericity and gender differences. *Perceptual and Motor Skills, 79*, 1527–1531.
Weinstein, S., & Sersen, E. A. (1961). Phantoms in cases of congenital absence of limbs. *Neurology, II*, 905–911.
Weiss, S. A., & Fishman, S. (1963). Extended and telescoped phantom limbs in unilateral amputees. *Journal of Abnormal and Social Psychology, 66*, 489–497.
Woodhouse, A. (2005). Phantom limb sensation. *Clinical and Experimental Pharmacology Physiology, 32*, 132–134.