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The incidence and determinants of visual phenomenology during out-of-body experiences

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ABSTRACT

The visual content of out-of-body experiences (OBEs) has received little attention but a number of theories of OBEs include implicit predictions regarding the determinants of this phenomenological feature. Hypnagogic imagery and unusual sleep experiences, weak synaesthesia and preference for employing object and spatial visual imagic cognitive styles were psychometrically measured along with the incidence of self-reported OBEs and the absence or presence of visual content therein, in a sample of individuals drawn from the general population. Seventy percent of individuals who had experienced an OBE reported that the experience included some form of visual content. These individuals exhibited greater scores on the measures of preference for object visual imagic cognition and weak synaesthesia than those who reported an absence of visual content during their OBE. Subsequent analysis revealed that the measure of weak synaesthesia was the stronger discriminator of the two cohorts. The results are discussed within the context of the synaesthetic model of visual phenomenology during OBEs (Brugger, 2000; Irwin, 2000). This account proposes that visual content appears during these experiences through a process of cognitive dedifferentiation in which visual hallucinations are derived from available non-visual sensory cues and that such dedifferentiation is made possible through an underlying characteristic hyperconnectivity of cortical structures regulating vestibular and visual representations of the body and those responsible for the rotation of environmental objects. Predictions derived from this account and suggestions for future research are proffered.

1. Introduction

The out-of-body experience (OBE) refers to the experience of perceiving one's phenomenal centre of consciousness to be in a spatially remote location from one's physical body (Blanke et al., 2004; Brugger, 2002; Irwin, 2004). Psychological research has provided evidence for the position that the OBE constitutes a disruption in the processing of one's body image (Irwin, 2000; Murray and Fox, 2005a; Terhune, 2006). This disruption has been localized to the angular gyrus along the temporo-parietal junction (TPJ) (Blanke et al., 2002), as has the related activity of mental own-body transformation (Blanke et al., 2005). More recently (Easton et al., 2009, this issue), the reporting of OBEs has been linked with impaired connectivity of fronto-parietal attentional networks and the interaction between cannabis consumption and pre-existent damage to the spinal cord (Overney et al., 2009, this issue). These findings suggest that OBEs result from deficient

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integration of body schema, vestibular information, and spatial localization of the self (Mohr and Blanke, 2005).

There remain multiple individual differences in the phenomenology of OBEs that have yet to be adequately addressed (see Blanke and Mohr, 2005), among them is the absence or presence of visual content during such experiences. The presence of visual content is frequently taken to be a core phenomenological property of OBEs. Blanke and Mohr (2005), for instance, include three features in their definition of OBEs: disembodiment (the feeling of being detached or independent of one's physical body), perspective (possession of a distanced visuospatial perspective that is different from the one associated with the physical body), and autoscopy (the visual perception of one's own body). However, a number of authors have noted that whilst most OBEs involve reports of visual content, there are cases that meet all other conventional criteria for an OBE, yet lack this phenomenological feature (Green, 1968; Irwin, 2004; see also Brugger, 2006).

There has been a dearth of OBE studies concerned with visual phenomenology, presumably because of the apparent rarity of non-visual OBEs. Despite this, multiple theories of, or conjectures regarding, OBEs have implicitly included predictions regarding the determinants of this feature. These predictions can be subsumed under two models that are here referred to as the *hypnagogic* (McCreery, 1997; Palmer, 1978) and the *synaesthetic* models (Brugger, 2000; Irwin, 2000). A third, the *cognitive style* model, is advanced below.

The hypnagogic model (McCreery, 1997; Palmer, 1978) proposes that visual content during an OBE results from the intrusion of visual hypnagogic imagery. This account is consistent with associations between dissociative tendencies and anomalous sleep experiences such as hypnagogic hallucinations (Watson, 2001) and OBEs and lack of sleep (Ohayon, 2000), the latter of which is conducive to microsleeps (Hemmeter et al., 1998). It also fares well with respect to the comparable incidence of hypnagogic imagery (Ohayon et al., 1996) and OBEs (Alvarado, 2000). Associations between hypnagogic imagery and OBEs have been inconsistent (Sherwood, 2002) though this may be because the presence of visual content during the latter is infrequently included as a variable.

According to the synaesthetic model (Brugger, 2000; Irwin, 2000) the visual content of an OBE stems from cross-modal processing wherein non-visual (e.g., somatic) sensations are dedifferentiated into visual hallucinations of one's body and/or environment. In support of this, Brugger (2000) notes a case of a patient who had cortical blindness but reported visual perceptions that were dependent upon the presence of non-visual cues (Goldenberg et al., 1995). The experience of visual content during an OBE may occur because of functional connectivity between cortical structures responsible for integrating multimodal information that is rooted in a pre-existing tendency for such hyperconnectivity and manifested in weak synaesthetic experiences. In line with the aforementioned research linking the TPJ to the occurrence of OBEs, it is noteworthy that the parietal region is involved in the integration of multisensory information and has been implicated in various neuroimaging studies of synaesthesia (Muggleton et al., 2007).

The cognitive style model conjectures that the visual phenomenology of an OBE is a function of an individual's habitual preference for processing visual information and utilizing visual imagery during cognition (Richardson, 1977; see also Amorim, 2003). In support of this model, Terhune and Smith (2006) observed that individuals experiencing visual hallucinations during an experimental task scored higher on an index of visual cognitive style than non-hallucinators. Conversely, Blackmore (1982) and Irwin (1980) found no relationship between scores on similar measures and the reporting of OBEs. Heterogeneity in the incidence of visual content during OBEs may explain these and other inconsistencies in the relationship between OBEs and visual imagery (Alvarado, 2000). It is also important to distinguish between object and spatial visual imagery (Farah et al., 1988; Levine et al., 1985), the former referring to representations of individual objects and the latter referring to abstract representations of spatial relations amongst objects, and the corresponding preferences for employing these distinct imagery styles (Kozhevnikov et al., 2005). The unique visuospatial perspectives often experienced during OBEs presumably rely upon mental transformations (Blanke et al., 2005) and thus may depend upon spatial imagery preferences (Blackmore, 1987). Alternatively, visual content of one's physical body and other environmental objects during an OBE may rely upon preferences for object visual imagery.

The intentions of the present research were twofold. First, this study sought to document the incidence of visual content during OBEs in a sample drawn from the general population. Second, the predictive utility of the three (non-competing) deterministic models of the visual phenomenology of OBEs was tested, with the corresponding expectations that individuals reporting visual OBEs would exhibit greater scores on indices of hypnagogic imagery, weak synaesthesia, and preference for a visual cognitive style, than those reporting non-visual OBEs.

2. Materials and methods

2.1. *Participants*

Participants were recruited through postings on general public pages of WWW sites for a study on 'unusual experiences'. All provided informed consent to participate and were petitioned to answer each item honestly and in accordance with their lived experience. Four hundred and twenty participants provided suitable data. Respondents ranged in age from 18 to 76 years ($M \pm SD = 32.05 \pm 11.45$), were predominantly (81%) female, and resided in the United States (93%), Canada (6%), and other countries (<1%). Following a page inquiring about demographic variables, participants completed the following indices in counter-balanced order.

2.2. *Materials*

2.2.1. *Hypnagogia*

The Iowa Sleep Experiences Survey (ISES; Watson, 2001) is an 18-item scale with two factors: 'General Sleep Experiences' (GES; 15 items) and 'Lucid Dreaming' (3 items). Individuals respond to statements with a number indicating the frequency ($1 =$ never to $7 =$ several times a week) with which they have had the respective experience. Both the ISES–GES and an ISES item measuring hypnagogic imagery (''I experience intense, dreamlike images *as I begin to fall asleep*'') were used in the analyses. The ISES–GES has been found to be reliable (Watson, 2001) and had suitable internal consistency in the present sample (Cronbach's $\alpha = .86$).

2.2.2. *Synaesthesia*

A seven-item true/false synaesthesia scale adapted from the Tellegen Absorption Scale (TAS; Tellegen and Atkinson, 1974; see also Jamieson, 2005) measures synaesthetic experiences (e.g., ''Textures – such as wool, sand, wood – sometimes remind me of colors or music.''). The scale yielded a Cronbach's α of .62 in the present sample. Thalbourne et al. (2001) suggest that this measure may index weak synaesthesia (Martino and Marks, 2001) and it is interpreted accordingly in the present analyses.

2.2.3. *OBEs*

The experience of an OBE was measured with Palmer's (1979) criterion: ''Have you ever had an experience in which you felt that 'you' were 'outside of' or 'away from' your physical body; that is, the feeling that your consciousness, mind or centre of awareness was at a different place than your physical body? (If in doubt, please answer 'no').'' Participants responded to this question using a four-point response format: 'no', 'yes – during the experience I had no visual experiences', 'yes – during the experience I had visual experiences', or 'yes – I am unsure if I had visual experiences during the experience'. Participants were informed that visual experiences may include the ''sight of your body, the room in which your physical body was located, or some other type of visual imagery or scene.'' Those endorsing the second response option were requested to describe the context and content of their experience. This criterion doesn't exclude OBEs occurring during dreams; however, the results remained unchanged when individuals who reported that their OBE occurred during a dream were excluded from the analyses.

2.2.4. *Visual cognitive style*

Three visual cognitive style measures were used. The first, the visual scale of the Style of Processing scale (SOP; Childers et al., 1995; Heckler et al., 1993; see also Ong and Milech, 2001, 2004), has 10 items anchored on 5-point response formats. The other two scales were drawn from the Object-Spatial Imagers Questionnaire (OSIQ; Blajenkova et al., 2006), a 30-item scale with a 5-point response format, and measure preference for object and spatial visual imagery, respectively. The three scales had sufficient internal consistency (Cronbach's α's: SOP visual = .87, OSIQ object = .86; OSIQ spatial = .85).

2.3. *Sample characteristics and statistical analyses*

Of the 420 respondents, 157 (37%) reported prior OBEs. Thirty-eight (of 157, 24%) were unable to report on the absence or presence of visual content during their experience and were excluded from the analyses. Eighty-one (68%) of the remaining respondents reported visual content during their OBE, whereas 38 (32%) did not. The two groups did not differ from one another in age (M years $\pm$ SD) or sex distributions (visual OBE group: 34.51 ± 11.00, 64 [79%] female; non-visual OBE group: 31.71 ± 13.75, 29 [76%] female), nor from those not reporting OBEs ($N = 263$; 31.71 ± 11.35, 215 [82%] female), all p's $> .10$. In the total sample, age correlated negatively with ISES–GES, ISES hypnagogic, OSIQ object, and TAS synaesthesia scores, and sex (1 = female, 2 = male) correlated negatively with OSIQ object and positively with OSIQ spatial scores, all r(pb)'s $> |.11|$, all p's $< .02$.

Partial correlations controlling for age and sex were used to assess the relationships among the predictor variables and a multivariate analysis of covariance (MANCOVA) controlling for age and sex contrasted the three groups on the different measures. The data met the assumptions of distribution normality and homogeneity of variance across groups. A two-block binary logistic regression analysis was used to discriminate individuals reporting non-visual and visual OBEs. Age and sex were included in the first block as 'nuisance' variables and significant dependent measures from the MANCOVA entered the model in the second block using the backwards entry method; this allowed for redundant predictor variables to be excluded while controlling for the influence of age and sex. Wald statistics and odds ratios (ORs) with 95% confidence intervals (CIs) are presented for individual predictors. A series of exploratory univariate analyses of covariance (ANCOVAs) controlling for age and sex were used to contrast respondents who did not report OBEs with those reporting non-visual and visual OBEs on the predictor measures. All analyses were two-tailed and used conventional significance values ($\alpha = .05$) except the exploratory ANCOVAs which were Bonferroni corrected for multiple analyses ($\alpha = .004$).

3. Results

Table 1 presents partial correlations among the six measures. All of the correlations, except those involving OSIQ spatial scores, are significant, indicating substantial shared variance among the variables.

Table 1 – Partial correlation matrix for the research measures controlling for age and sex ($N = 382$)

	ISES hypnagogic	OSIQ object	OSIQ spatial	SOP visual	TAS synaesthesia
ISES GES	.66*	.38*	.00	.33*	.34*
ISES hypnagogic		.28*	.07	.21*	.26*
OSIQ object			.00	.63*	.41*
OSIQ spatial				.00	.06
SOP visual					.36*

*$p < .001$.

Table 2 – Descriptive statistics [M and (SD)] for the research measures as a function of group (non-OBE [N = 263], non-visual OBE [N = 38], and visual OBE [N = 81])

	Non-OBE	OBE		Total
		Non-visual	Visual	
ISES GES	3.05 (.90)	3.42 (.82)	3.68 (.86)	3.22 (.92)
ISES hypnagogic	3.52 (2.13)	4.16 (2.28)	4.48 (2.21)	3.79 (2.20)
OSIQ object	3.44 (.69)	3.55 (.60)	3.81 (.67)	3.53 (.69)
OSIQ spatial	2.63 (.69)	2.52 (.73)	2.61 (.78)	2.62 (.71)
SOP visual	37.84 (7.32)	39.26 (6.97)	40.48 (6.94)	38.54 (7.27)
TAS synaesthesia	4.14 (1.76)	4.39 (1.55)	4.99 (1.54)	4.34 (1.72)

The overall model for the MANCOVA examining the effect of group (no OBE, non-visual OBE, and visual OBE) on the six measures was significant, $F[12,746] = 4.28$, $p < .001$, $\eta_p^2 = .06$. Main effects (all df's = 2, 377) of group were found for ISES–GES ($F = 21.04$, $p < .001$, $\eta_p^2 = .10$), ISES hypnagogic ($F = 8.25$, $p < .001$, $\eta_p^2 = .04$), OSIQ object ($F = 10.84$, $p < .001$, $\eta_p^2 = .05$), SOP visual ($F = 4.88$, $p = .008$, $\eta p2 = .03$), and TAS synaesthesia scores ($F = 9.16$, $p < .001$, $\eta_p^2 = .05$), but not for OSIQ spatial scores, $F = .81$, $p = .45$, $\eta_p^2 = .00$. See Table 2 for descriptive statistics.

One set of simple planned contrasts of individuals reporting non-visual and visual OBEs was performed for each main effect. These contrasts allowed for the crucial tests of the different predictive models of the occurrence of visual content during OBEs. In support of the cognitive style and synaesthetic models, respondents reporting visual OBEs scored significantly higher on the OSIQ object scale ($p = .045$) and the TAS synaesthesia scale, $p = .044$. The two groups did not differ on any of the other measures: ISES–GES ($p = .058$), ISES hypnagogic ($p = .32$), and SOP visual, $p = .33$.

OSIQ object and TAS synaesthesia scale scores were entered into the second block of the binary logistic regression analysis on OBE group (non-visual and visual). The first block was non-significant (χ^2 [2, $N = 119$] = 1.78, $p = .41$, Nagelkerke $R^2 = .02$) and neither age (Wald = 1.58, OR = 1.02, CIs: .99, 1.06, $p = .21$) nor sex (Wald = .31, OR = .77, CIs: .30, 1.97, $p = .58$) was an independent predictor of OBE group. The second block retained only TAS synaesthesia scores and was significant, χ^2 (1, $N = 119$) = 5.16, $p = .023$, Nagelkerke $R^2 = .08$; Wald = 4.92, OR = 1.36, CIs: 1.04, 1.78. The model correctly predicted the membership of 11% (4 of 38) of respondents reporting non-visual OBEs and 94% (76 of 81) of those reporting visual OBEs, with overall prediction being 67%. This analysis indicates that OSIQ object scale scores did not contribute substantial variance to the presence of OBE visual content independently of TAS synaesthesia scores.

The two OBE groups were next independently contrasted with the cohort of respondents who did not report OBEs. Respondents reporting visual OBEs, relative to non-experients (all df's = 1, 340), yielded higher ISES–GES ($F = 38.66$, $p < .001$, $\eta_p^2 = .10$), ISES hypnagogic ($F = 14.76$, $p < .001$, $\eta_p^2 = .04$), OSIQ object ($F = 20.67$, $p < .001$, $\eta_p^2 = .06$), SOP visual scores ($F = 9.00$, $p = .003$, $\eta_p^2 = .03$), and TAS synaesthesia scores ($F = 17.76$, $p < .001$, $\eta_p^2 = .05$), but the two groups did not differ on the OSIQ spatial scale, $F = .05$, $p = .83$, $\eta_p^2 = .00$. In contrast, respondents reporting non-visual OBEs and no OBEs did not significantly differ on any of the measures (all df's = 1, 297), ISES hypnagogic ($F = 3.10$, $p = .079$, $\eta_p^2 = .01$), OSIQ object ($F = 1.27$, $p = .26$, $\eta_p^2 = .00$), OSIQ spatial ($F = 1.72$, $p = .19$, $\eta_p^2 = .01$), SOP visual ($F = 1.24$, $p = .27$, $\eta_p^2 = .00$), and TAS synaesthesia ($F = .68$, $p = .41$, $\eta_p^2 = .00$), though respondents reporting non-visual OBEs scored suggestively higher on the ISES–GES than those who didn't report OBEs, $F = 5.89$, $p = .016$, $\eta_p^2 = .02$. This may indicate that the former are more dissociative or schizotypal than the latter (Watson, 2001).

4. Discussion

Visual content is often regarded as a core phenomenological property of OBEs. This study found that approximately 70% of individuals who experienced OBEs reported that the experience possessed visual imagic or perceptual features. The inclusion of a response option by which participants could express that they were unsure as to the presence of these features suggests that they were confident in their responses. The discrepancy between this finding and the extant literature may lie in the fact that visual content has been neglected as a property of OBEs that varies with individual differences.

In support of the synaesthetic model (Brugger, 2000; Irwin, 2000), the index of weak synaesthesia was the only retained predictor in a regression model that significantly discriminated individuals reporting non-visual and visual OBEs. Whilst the sensitivity of the model is strong, its specificity is poor, a divergence that can be attributed in part to the unequal sample sizes of the two groups. One measure of object visual cognitive style was excluded from this model and another did not differ between the two OBE groups. Further, a measure of spatial visual cognitive style was unrelated to the presence of visual content during OBEs, suggesting that the latter depends on mental transformations (Blanke et al., 2005) that differ from the imagery style indexed by this measure (Blajenkova et al., 2006). The support for the hypnagogic model too was unimpressive. Individuals reporting visual and non-visual OBEs did not differ on the measure of visual hypnagogic imagery, though the former exhibited suggestively greater scores on the general scale of unusual sleep experiences. Although the hypnagogic and cognitive style models are worthy of further study, given the equivocal support they received the remainder of this discussion attends to the synaesthetic model.

These results suggest that the experience of visual content during OBEs is rooted in a general capacity for cross-modal binding (e.g., of bodily and visual perceptions) and the corresponding experience of stimulus-congruent multimodal perceptions (e.g., experiencing cold whilst looking at a painting of a snowstorm) (Ott, 2007). The synaesthetic binding of vestibular and visual representations of one's body may result in part from associative learning (Marks, 2000), as appears to be the case with grapheme-color associations in non-synaesthetes (Simner et al., 2005). This learned binding may be developed and maintained through an attentional bias towards one's body image. For instance, individuals reporting OBEs have greater self-consciousness, body dissatisfaction, and social physique anxiety than non-experients (Murray and Fox, 2005a, 2005b; see also Mohr and Blanke, 2005). Visual images of oneself from a spectator perspective are common during anxiety-provoking situations (Hackmann et al., 1998; Spurr and Stopa, 2003). Individuals high in somatoform dissociation, who report an inflated number of OBEs (Irwin, 2000), also exhibit heightened body-focused attention when exposed to body-specific threatening stimuli (Brown et al., 2007), conditions which arguably parallel those in which OBEs frequently occur (e.g., sleep paralysis; Cheyne, et al., 1999; Cheyne and Girard, 2009, this issue; see also Irwin, 2004).

Vestibular hallucinations (e.g., floating) and the own-body mental transformations often experienced during visual OBEs have been localized to the right TPJ (Blanke et al., 2002, 2005). The application of electrical currents to this region lower in strength than those required for visual OBE induction induced vestibular hallucinations, but not autoscopy or other visual hallucinations (Blanke et al., 2002). The non-visual OBEs reported in the present study may refer to spontaneous instances of such vestibular hallucinations or what Cheyne and Girard (2009, this issue) refer to as 'out-of-body feelings' (OBFs). Cheyne and Girard (2009, this issue) present evidence for a model of OBEs during sleep paralysis in which OBFs partially mediate the relationship between illusory movement experiences and visual OBEs. The present results suggest that weak synaesthesia may moderate the relationship between OBFs and visual OBEs. Mohr and Blanke (2005) emphasize the importance of establishing specific definitional criteria with regard to the phenomenology, and corresponding measurement of, OBEs. Future research thus needs to consider whether the non-visual experiences documented in this study are better understood as a variant of OBEs or a conceptually distinct manifestation of depersonalization or somatoform dissociation (see also Devinsky et al., 1989).

Notably, the TPJ does not appear to be implicated in the mental transformation of objects (Blanke et al., 2005) and only own-body visual hallucinations were reported during stimulation of the angular gyrus (Blanke et al., 2002). The binding of vestibular and visual representations of the body alone cannot account for other frequent content features of visual OBEs such as inanimate objects and other persons in one's environment. Brugger (2000) argues that such visual content, especially perceptions that *deviate* from visual representations recruited from short term memory (e.g., another person moving around the room), result from the incorporation of non-visual cues to visually represent and spatially localize objects. Kosslyn et al. (1996) proposed that the angular gyrus is involved in the implementation of an associative memory system through which the spatial relations of objects are integrated with other multimodal information (see also Blanke et al., 2004, 2005). In addition to possessing cross-connections between TPJ subregions modulating vestibular and visual representations of the body, those experiencing visual content during OBEs may possess a generalized cortical hyperconnectivity including cross-connections between the TPJ and the inferior and superior parietal lobes, which regulate the visual representation and transformation of environmental objects (Jordan et al., 2001; Kosslyn et al., 1996). Concurrent visual representations may be triggered when neural signals associated with the inducer (non-visual sensation) reach a threshold and provoke activity in the inferior and superior parietal lobes. Such activation may be facilitated by disinhibition of feedback signals triggered by neural signals associated with the original inducing stimulus that propagate down pathways that generate representations of environmental objects (see Grossenbacher and Lovelace, 2001). This speculation is consistent with disinhibition in schizotypal cognition and its links with OBEs and inflated reporting of distortions in body image and visual hallucinations, especially under conditions of restricted environmental stimulation (McCreery and Claridge, 1996a, 2002; see also Arzy et al., 2007; Mohr and Blanke, 2005).

A number of predictions can be derived from the foregoing speculations. First, individuals reporting visual OBEs are expected to perform better on cross-modal binding tasks, such as that of Martino and Marks (1999). Tasks that specifically target somatosensory, tactile, or vestibular-visual binding (see Brown et al., 2007; Ramachandran and Rogers-Ramachandran, 1996; for historical observations, see Wade, 2009, this issue) will undoubtedly facilitate more powerful tests of the synaesthetic model. Whether body image anxiety or vividness of visual content during OBEs correlate with such cross-modal binding are also questions worth pursuing. The extent to which the occurrence of visual content during OBEs is facilitated by a generalized loosening of associative processing warrants attention (see Ramachandran and Hubbard, 2001). Individuals reporting visual OBEs are expected to experience a greater influx of visual representations of the body under conditions of altered kinaesthetic, somatic, and vestibular feedback (e.g., Norlander et al., 2000–2001; see also McCreery and Claridge, 1996a; Wackermann et al., 2008). OBEs with visual content may be more likely to exhibit spatial biases in the visual representation of one's body (see Girard et al., 2007) than those that lack visual content. Further, visual OBEs should involve veridical visual content of *changes* in the environment only when non-visual cues pertaining to such occurrences are presented (Brugger, 2000; Goldenberg et al., 1995). Along similar lines, non-visual sensory stimuli may be associated with particular visual phenomenological features of an OBE. For instance, whereas somatic, tactile and vestibular information may contribute to the visual representation of one's physical body (Blanke et al., 2004; Irwin, 2000), exogenous cues such as auditory stimuli may be utilized in the representation of environmental objects and other persons (Brugger, 2000; Goldenberg et al., 1995). In this respect, the visual complexity of an OBE may be a function of the number and vividness of non-visual sensory inputs concurrently available to a percipient. If such is the case, this may mean that the visual phenomenology of an OBE can be systematically altered by manipulating non-visual sensory stimuli. Whether the synaesthetic dedifferentiation giving rise to the visual phenomenology of OBEs is projective or associative (Dixon et al., 2004), that is, whether the visual content is perceptual or imagic, respectively, may be worth considering as well. Finally, individuals reporting visual OBEs, relative to non-visual OBEs, are expected to exhibit greater gamma-band coherence, reflecting increased functional connectivity (Miltner et al., 1999), between electrodes over the TPJ and adjacent inferior and superior parietal regions during OBEs involving own-body and environmental transformations (see also McCreery and Claridge, 1996b). Adequate testing of many of these predictions requires the development of an experimental analogue of OBEs, thus it is to this task that researchers should most exhaustively direct their efforts (for a promising paradigm, see Blanke et al., 2005).

In summary, this study found that approximately 70% of individuals reporting OBEs experienced visual content during the experience and that these individuals were best discriminated from those who did not report visual content by a measure of weak synaesthesia. It is argued that individuals reporting visual OBEs exhibit hyperconnectivity of cortical structures including the TPJ and those responsible for the generation of rotated visual representations of environmental objects. The present findings are limited by their dependence upon self-report instruments and a predominantly female sample. Moreover, web-based samples have previously been found to be unrepresentative of the general population (Skitka and Sargis, 2006). The method of recruitment may have inflated the incidence of OBEs, though there is no compelling reason to believe that it differentially targeted individuals based on OBE visual phenomenology. In addition to providing participants with greater anonymity, the web-based design of this study permitted the recruitment of a large sample of unique individuals and previous research indicates that web and laboratory studies often reach similar conclusions (Birnbaum, 2004). Above all, this study demonstrates that examining specific phenomenological features of OBEs and other anomalous perceptions and modeling their determinants based on prior theory represent a useful research strategy in the study of anomalous experiences.

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