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From Dreams to (Virtual) Reality: Exploring Behavioural Embodiment in Out-Of-Body Experients

CRAIG D. MURRAY AND JEZZ FOX[1]

ABSTRACT: Recent research has indicated that the body experience of people who report a prior out-of-body experience (OBErs) is qualitatively different on a number of body-image variables to that of non-experients (non-OBErs). The present study examined OBErs and non-OBErs Behavioural Embodiment during immersion in a Virtual Reality system. It was hypothesised that OBErs would, compared with non-OBErs, exhibit a disembodied behavioural interaction with the Virtual Environment (VE), characterised by the proportion of time spent navigating the environment from an elevated position and the number of collisions with virtual objects. It was also hypothesised that OBErs would score higher on measures of absorption, dissociation and somatoform dissociation. There were no significant differences between OBErs (*n* = 16) and non-OBErs (*n* = 28) on Behavioural Embodiment (i.e., the proportion of time spent navigating the environment from an elevated position and the number of collisions with virtual objects), although there was a positive correlation with number of OBEs and proportion of trial time spent navigating the environment from an elevated position. OBErs were found to score significantly higher than the non-OBErs on measures of absorption, dissociation and somatoform dissociation.

INTRODUCTION

A key topic in the parapsychological literature has been the phenomenon of the Out-of-Body Experience (OBE), in which the person who has an OBE

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has an experience in which their self or consciousness and their body are spatially separated (Alvarado, 1992). Psychological theories of the out-of-body experience (OBE) have proposed that changes in body-image precipitate its occurrence. For instance, Palmer (1978) presented a psychological theory of the OBE in which he argued that a reduction of proprioceptive information from the body resulted in changes to the 'body-concept', which (in some instances) in turn 'triggered' the OBE. Drawing on Freudian theory, Palmer (1978) argued that the person's change in body-concept threatened their self-concept or sense of individual identity, which triggers unconscious processes in an attempt to re-establish the person's sense of individual identity.

Blackmore (1984) advanced a cognitive explanation of the OBE in which she argued that one of the key functions of the brain is the construction of models of the self within the environment. These may be short-term models (such as those created through perception) or long-term models (such as those formed through memory) and each may influence the other. For most people at most times the model which will be taken for 'reality' will be taken to be that which is most complex, stable and coherent. This model would usually be that generated in most part through sensory input. However, at times, sensory input may be reduced, as in sensory isolation experiments, resulting in impoverished sensory models. This may result in an over-reliance on information from memory in order to achieve stability. Therefore, for an OBE to occur, at least two things are needed: the failure of the somatosensory input-controlled model, and the substitution of an imagery-based one built up from memory.

More recently Irwin (2000) examined the experience of somatic symptoms by OBErs in a study in which he administered the Somatoform Dissociation Questionnaire (SDQ; Nijenhuis, Spinhoven, van Dyke, van der Hart, & Vanderlinden, 1996) to his student sample (made up of 113 psychology students, with an OBE incidence rate of 38.9%). Somatoform dissociation refers to body experiences in which there can be 'deficit symptoms' such as numbness in a part of the body, or 'positive symptoms' in which psychosomatic pain or tics are experienced. Irwin found that scores on the SDQ were the only predictor variable (from a logistic regression analysis which included participants' data for dissociative experiences, absorption, gender and age) able to discriminate independently between people with and without a prior OBE, as well as the only independent variable which contributed significantly in predicting OBE frequency.

Building upon Irwin's (2000) work, Murray and Fox (2004, 2005a) argued that the body experiences of OBErs could be expected to be different to that of non-OBErs. Rather than the OBE occurring as the result of a

discrete change in the sensorial body-image, Murray and Fox argued that it was the exacerbation of pre-existing body-image differences that precipitated the OBE. It was further argued that differences in 'body-image' could be assessed on a number of dimensions. In addition to the sensorially obtained body-image advanced by Palmer and Blackmore, Murray and Fox suggested that perceptual, affective, and social dimensions of body-image would be fruitful avenues for OBE research.

In order to test this theory Murray and Fox (2004) conducted a web-based questionnaire on 'Body experience', which included Palmer's (1979) item for identifying OBErs. Those respondents reporting a previous OBE were found to score significantly higher on measures of somatoform dissociation (the somatic expression of mental dissociation processes), self-consciousness (e.g., introspective behaviour, a tendency to picture one's physical appearance and presentation, and a concern over the appraisal of oneself by others), body dissatisfaction (making negative evaluations of one's body), and lower on a measure of confidence in their physical self-presentation (e.g., how agile or graceful one appears to others) than respondents without a previous OBE. There were no significant differences between these groups with regards to physical self-efficacy or perceived physical ability, objectified body consciousness, or social physique anxiety.

Murray and Fox (2005a) have gone on to examine the effect of immersion in a virtual reality system on the experience of the perceptual body. Such systems use three-dimensional computer graphics technology to generate artificial environments that afford real-time interaction and exploration. These are intended to give the user an impression of being present ('telepresence') or immersed in a computer-generated world. A sense of immersion is promoted through the use of head mounted displays (HMDs). These present stereo images and sound to create a perceptually encompassing computer environment. Following previous studies in which it has been found that when immersed in virtual reality a high proportion of subjects immersed report lower levels of body awareness (Cioffi, 1993; Murray & Gordon, 2001; Riva, 1998), Murray and Fox (2005a) found OBErs reported lower levels of perceptual body awareness than non-OBErs.

Therefore there is increasing evidence that not only do OBEers and non-OBErs have different perceptual experiences of their bodies (Irwin, 2000), but that OBErs are more prone to a procedure designed to undermine the perceptual boundaries of their bodies (Murray & Fox, 2005a). In addition, other dimensions of body experience or body-image seem to be affected, including the degree to which the person feels satisfied with their bodies and their degree of confidence in physical self-presentation (Murray & Fox, 2004, 2005a).

In the present paper we wish to suggest another dimension of body-image that we believe may be useful in the study of OBEs and which we term 'behavioural embodiment'. We suggest that under conditions where persons are not required to behave in an embodied manner (that is, in a manner which is constrained by normal embodied capacities), some persons will be more likely to continue to do so, and some persons less likely to do so. Some evidence is available to support this hypothesis. For instance, both Blackmore (1987) and Irwin (1986) have found that OBErs more frequently dream using disembodied perspectives than do non-OBErs. The dream can be considered one circumstance or condition in which persons are not required to behave in an embodied manner, given that the dream is an imaginal rather than a 'real' experience. However, in the 'real', physical world, if one were to try and behave in this manner then the physical impossibility of some feats achieved in dreams (e.g., rising off the floor and flying), or the real consequence of some actions performed in dreams (e.g., jumping off a building and attempting to fly), would quickly be realised.

In this paper we want to consider another circumstance where people are not necessarily required to behave in an embodied manner, a circumstance, which is available when awake. We refer specifically to some desktop and immersive Virtual Reality (VR) systems described earlier in which persons explore virtual environments. Murray, Bowers, West, Pettifer and Gibson (2000) found that when placed in a virtual city, some persons continued to act in an embodied manner, such as 'walking' on paved areas rather than roads, staying at ground level, travelling around buildings, etc. In contrast, others exploited the lack of physical laws in such an environment, 'flying' in the air to obtain a bird's-eye-view of the environment, and travelling through buildings and other objects. Despite these latter 'transgressions', Murray et al. (2000) argued that, for the most part, virtual environments modelled on physical features of the real-world (such as buildings and roads) draw upon people's everyday understandings and expectations, therefore presenting users with affordances while by-and-large obscuring other possibilities.

Such computer-generated environments in the present context offer the possibility to explore the behavioural embodiment of people who do and do not report a previous OBE. Based upon our general hypothesis that OBErs have a more distanced relationship between their bodies and selves, we hypothesise that this group would exhibit more of the latter kind of behaviours described above ('flying' in the air to obtain a bird's-eye-view of the environment, and travelling through buildings and other objects.), in contrast to non-OBErs, who we hypothesise exhibit more of the former type

of behaviours ('walking' on paved areas rather than roads, staying at ground level, and travelling around buildings).

METHOD

Participants

Participants were asked to take part in a study of 'body experience', which involved using a VR system. Three recruitment methods were used: poster advertisements on the authors' University campus; email advertisement to students and staff; and web advertisement of the pages of the University virtual magazine. A total of 44 participants (30 females, 14 males) took part in the study. Of these, 16 respondents reported a previous OBE (10 females, 6 males, with a mean age of 33 years, *SD* = 10 years, range = 27). The number of prior OBEs reported was between 1 and 12, with a mean of 3.9). The non-OBE sample consisted of 28 participants (20 females, 8 males, with a mean age of 36, *SD* = 9 years, range = 36).

Materials

A Virtual Research V6 head-mounted display (HMD) was used to immerse participants in the virtual environment. The VE was run on a custom-built PC, and a 3D mouse was used to navigate it. The Cityscape virtual environment (see Murray et al., 2000) is comprised of over 300 buildings and over 1000 sections of street. The central region of the city is composed of larger office type buildings, whereas there are smaller buildings and more grass areas towards the outskirts. All streets and avenues are titled on signs visible to participants, which require comparable proximity in the real world to be readable to users. Each participant's exploration of the VE was recorded by a digital video camera for later analysis of their behavioural embodiment.

Measures

Behavioural Embodiment: Two aspects of 'Behavioural Embodiment' were considered. For the first, the proportion of time that each participant spent at an elevated level in the virtual environment was calculated as a proportion (%) of the total time spent immersed. The possible range of scores was therefore 0-100. For the second, the number of collisions that participants had with virtual objects (e.g., buildings, trees, lamp-posts) during the trial period was tallied.

The Somatoform Dissociation Questionnaire (SDQ-20): The SDQ-20 is a 20-item instrument designed to measure 'somatoform dissociation' or the degree to which the person experiences negative (e.g., losses of perceptions and control over functions) or positive (e.g., localised pain) perceptual or somatic symptoms indicative of dissociative disorder (Nijenhuis et al., 1996). Responses are made to 20 statements (e.g., "It sometimes happens that it is as if my body, or part of it, has disappeared") on a 5-point Likert scale from 'not applicable' (1) to 'highly applicable' (5) with the possible range of possible scores being 20-100. This scale is employed in the present study as an indication of respondents' perceptual body-image. Based upon prior research (Irwin, 2000; Murray & Fox, 2004, 2005b) it was hypothesised that respondents with a prior OBE score significantly higher on this scale than respondents without a prior OBE. In the present study Cronbach's alpha = .83, indicating appropriate internal consistency for the scale.

Tellegen Absorption Scale (TAS): The TAS is a 34-item measure of absorption, defined by Tellegen and Atkinson (1974) as "openness to absorbing or self-altering experiences" (p. 268). Respondents indicate whether each item is 'True' or 'False' in regards to their own experience, and the total score is the number of items to which they respond 'True'. This gives a possible range of scores from 0-34. Based upon prior research (e.g., Glickson, 1990) it was hypothesised that OBErs score higher on this measure than non-OBErs. In the present study Cronbach's alpha = .85.

Dissociation Experiences Questionnaire (DEQ): The DEQ (Bernstein & Putnam, 1986) is a 28-item measure of dissociation. The DEQ contains a variety of dissociative experiences, many of which are normal experiences. Respondents circle the percentage of time that they have the particular experience described, in each item, on a scale from 0% to 100%, at 10% intervals. The overall DEQ score is obtained by adding up the 28 item scores and dividing by 28, which produces an overall score ranging from 0 to 100. Based upon prior research (e.g., Richards, 1991) it was hypothesised that OBErs score higher on this measure than non-OBErs. In the present study Cronbach's alpha = .90.

Item for Assessing the Occurrence of Out-Of-Body Experiences: In order to ascertain whether participants had experienced an out-of-body experience, respondents were provided with the following statement from Palmer (1979) and asked to indicate 'yes' or 'no': "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')." [2]

Procedure

Participants completed the DEQ and TAS prior to the VR trial, which took approximately 15 minutes. Following this, participants donned a head-mounted display (HMD) and received instructions on how to use a 3D mouse to navigate the virtual environment. The VE was a colour cityscape environment comprised of buildings, roads, paved and grassy areas. Participants were asked to locate an object within the environment (a representation of an Easter Island head statue). After 15 minutes the trial was stopped.

RESULTS

Respondents' mean scores for each measure are shown in Table 1 along with the results of the ANOVA tests. Significant differences were found between OBE and non-OBE participants on measures of Somatoform Dissociation (F (1, 42) = 23.83, p < .001, partial eta-squared = .362), Absorption (F (1, 42) = 8.91, p = .005, partial eta-squared = .112) and Dissociation (F (1, 42) = 5.29, p = .026, partial eta-squared = .175).[3] However, no significant differences were found between these groups on measures of Behavioural Embodiment.

Because the mean score obtained by these groups for the amount of time spent in the air during the trial differed so markedly, a two-tailed Spearman's correlation was computed for the whole sample on 'time spent in the air' and the number of prior OBEs reported by participants. This correlation was not found to be significant. The same analysis was conducted for participants reporting an OBE only, and was found to be significant, $r(14) = .52$, $p = .041$, two-tailed.

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[2] One of our reviewers criticised the use of a single question to divide the sample into two groups—OBErs and non-OBErs. The first author's response was that Palmer's item "was used precisely for the wide acceptance of this item in discriminating between OBErs and non-OBErs in a reliable manner—see Blackmore, S. J. (1982). Have you ever had an OBE?: The wording of the question. *Journal of the Society for Psychical Research*, *51*, 292-302." (Ed.).

[3] Two-tailed Spearman correlations were performed on the SDQ, DEQ and TAS: the SDQ-20 was found to significantly correlate with the DEQ, $r = .55$, $p < .01$; the DEQ also significantly correlated with the TAS, $r = .35$, $p = .02$. There correlation between the SDQ and the TAS was not significant, $r = .22$, $p = .15$.

Table 1
Mean Scores and ANOVA Significance Test for Study Measures

Measure	OBE Group (n = 16)	Non-OBE Group (n = 28)	F*	p	*partial eta squared*
Behavioural Embodiment:					
Time in the air	45.19 (SD = 32.41)	32.93 (SD = 32.04)	1.48	.231	.034
Number of collisions	1.81 (SD = 2.07)	3.14 (SD = 5.06)	1.00	.323	.023
Somatoform Dissociation	35.94 (SD = 9.42)	25.39 (SD = 5.96)	23.83	< .001	.362
Absorption	24.62 (SD = 5.49)	19.18 (SD = 6.00)	8.91	.005	.112
Dissociation	77.40 (SD = 37.2)	54.60 (SD = 28.20)	5.29	.026	.175

* df = (1, 42)

Discussion

The present study did not find any significant differences between OBE and non-OBE participants on two measures of Behavioural Embodiment while immersed in a virtual reality system. However, as the number of previous OBEs participants reported increased, so did the amount of time they spent navigating the virtual environment in the air, $r(14) = .52$, $p = .041$. As predicted, OBE participants scored significantly higher than non-OBE participants on measures of Somatoform Dissociation ($p < .001$), Absorption ($p = .005$) and Dissociation ($p = .026$).

The finding that the more frequently a person has had an OBE is positively correlated with the amount of time they spend navigating an immersive virtual environment at an elevated level may suggest that examining the frequency (and perhaps a related issue of how recently) a person has an OBE in relation to behavioural embodiment, may be a useful avenue for future research. However, the hypothesis in the present study—that OBErs differ from non-OBErs in terms of behavioural embodiment—was not supported, whereas differences were found between OBErs and non-OBErs on measures of Somatoform Dissociation, Absorption and Dissociation.

One indication of Behavioural Embodiment in the present research was the frequency with which participants collide with objects in the virtual environment. This measure proved problematic: we observed that while participants often made a number of collisions during the trial period, some

of these appeared intentional while others appeared to be accidental. For instance, the reduced peripheral vision, which accompanies the use of head-mounted displays, means that if a participant travels sideways they may not be aware of objects in their path. We had no way in which to distinguish between accidental and intentional collisions, and so using the total number of collisions for each participant was a blunt instrument in this respect.

In conclusion, the present study did not find support for differences in Behavioural Embodiment between OBErs and non-OBErs in an immersive virtual reality experiment.

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Division of Psychology
School of Psychological Sciences
The University of Manchester
Manchester M13 9PL
UK

Email: *craig.murray-2@manchester.ac.uk*