



# The ‘not-so-strange’ body in the mirror: A principal components analysis of direct and mirror self-observation

Paul M. Jenkinson<sup>a,\*</sup>, Catherine Preston<sup>b</sup>

<sup>a</sup> School of Life and Medical Sciences, University of Hertfordshire, UK

<sup>b</sup> Department of Psychology, University of York, UK

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## ABSTRACT

In this study we adopted a psychometric approach to examine how the body is subjectively experienced in a mirror. One hundred and twenty-four healthy participants viewed their body for five minutes directly or via a mirror, and then completed a 20-item questionnaire designed to capture subjective experiences of the body. PCA revealed a two-component structure for both direct and mirror conditions, comprising *body evaluations (and alienation)* and *unusual feelings and perceptions*. The relationship between these components and pre-existing tendencies for appearance anxiety, body dysmorphic-type beliefs, dissociative symptomatology, self-objectification and delusion ideation further supported the similarity between direct and mirror conditions; however, the occurrence of strange experiences like those reported to occur during prolonged face viewing was not confirmed. These results suggest that, despite obvious differences in visual feedback, observing the body via a mirror (as an outside observer) is subjectively equivalent to observing the body directly (from our own viewpoint).

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## 1. Introduction

Mirrors allow us to view the physical appearance of our own face and body from an observer (third person) perspective. Moreover, self-recognition in a mirror is considered a measure of self-awareness (but see Rochat & Zahavi, 2011, for a critical discussion), with only humans and a few other animals possessing this capacity (Amsterdam, 1972; Gordon, 1970; Plotnik, de Waal, & Reiss, 2006; Reiss & Marino, 2001). However, a human's relationship with mirrors and reflections goes beyond simple self-recognition, as we frequently use mirrors to perform complex actions (e.g. driving), as well as for self-grooming and checking our physical appearance. Interestingly, mirrors have such a strong association with viewing the self that we naturally assume individuals are using mirrors for self-observation even when the laws of physics make this impossible, known as the Venus effect (Bertamini, Latto, & Spooner, 2003; Bertamini, Lawson, Jones, & Winters, 2010).

What is more, deficits in self or body perception often involve a preoccupation with viewing the body that can be seen in their atypical interactions with mirrors; for example, individuals suffering from eating disorders, who are thought to have an abnormal experience of their body, often exhibit frequent body checking that involves mirrors, or conversely mirror avoidance (Shafran, Fairburn, Robinson, & Lask, 2004). Sufferers of body dysmorphic disorder can spend hours in front of a mirror or other reflective surface (Veale & Riley, 2001), and deficits in self processing following neurological damage can result in a failure to recognise one's own reflection (Phillips, 1996). Mirrors can also alleviate pathological symptoms involving the

\* Corresponding author at: School of Life and Medical Sciences, University of Hertfordshire, College Lane, Hatfield AL10 9AB, UK.

E-mail address: [p.jenkinson@herts.ac.uk](mailto:p.jenkinson@herts.ac.uk) (P.M. Jenkinson).

self/body experience; for example, patients with somatoparaphrenia who deny ownership of their limbs following brain injury have been found to have ownership temporarily reinstated when viewing their disowned limb via a mirror (Fotopoulou et al., 2011; Jenkinson, Haggard, Ferreira, & Fotopoulou, 2013). Moreover, certain types of “mirror therapy” can reduce negative feelings towards the body in eating disorder patients (Jansen et al., 2015), and can change the body experience and alleviate pain in amputee and neurological patients (Rosén & Lundborg, 2005).

Outside the clinic, recent experimental studies have suggested that even healthy individuals can encounter strange experiences when looking in a mirror. During the “strange face illusion” it has been reported that participants who view their face in a mirror at low illumination for several minutes describe experiences that their reflection changes and distorts; for example, appearing deformed, like another person, or like another being/animal (Caputo, 2010, 2013a; Caputo et al., 2012; see also Schwarz & Fjeld, 1968 for an earlier investigation of the phenomenon). It is surprising that healthy participants can experience strong visual illusions after only a few minutes of normal mirror viewing, given that this is an everyday activity. Thus, it is possible that demand characteristics play a role in these reported strange face illusions, particularly as the illusion is yet to stand up to full scientific rigor, with the few experiments so far reporting the phenomenon having a small sample size and not being fully controlled (Caputo, 2010, 2013a). Less surprising, however, is the finding that these strange illusory experiences are found to be stronger in individuals suffering from schizophrenia (Caputo et al., 2012) and it is thought that they are related to experiences of body dysmorphia and difficulty with self/other distinctions. Indeed, schizophrenia as well as schizotypal traits are thought to be related to deficits in self-face recognition (Irani et al., 2006; Platek & Gallup, 2002) and body/action perception (Louzolo, Kalckert, & Petrovic, 2015; Thakkar, Nichols, McIntosh, & Park, 2011), which seems compatible with the experiences of strange face illusions. For many conditions in which self and body perception is impaired these experiences focus predominantly on the body rather than the face, yet, to date, whether perceptual illusions can occur when viewing our body rather than our face in the mirror has not been investigated. Moreover, investigating the body also allows for more rigorous experimental control; you can view your own body both directly and via a mirror, whereas viewing your own face is only possible via a mirror, or other reflective surface. Therefore, with face illusions it is difficult to determine whether any reported illusory experiences reveal something special about seeing ourselves in a mirror, or are simply due to viewing our own face.

It is widely thought that faces are special and not just another part of the body, both in terms of behavioural and neural processing (Kanwisher, McDermott, & Chun, 1997; McKone, Kanwisher, & Duchaine, 2007; Schwarzlose, 2005). However, some suggest that our specialism for processing faces is purely due to familiarity and expertise (Diamond & Carey, 1986; Gauthier, Skudlarski, Gore, & Anderson, 2000; Gauthier, Tarr, Anderson, Skudlarski, & Gore, 1999). In addition, mirror self-recognition studies in infants find no difference in accuracy of self-recognition for the face and other body parts (Nielsen et al., 2016). Furthermore, multisensory perceptual illusions originally applied to body parts (Botvinick & Cohen, 1998) or whole bodies (Maselli & Slater, 2013; Petkova & Ehrsson, 2008; Preston & Ehrsson, 2014), have now also been adapted, at least to some degree, to the face (Tajadura-Jiménez, Longo, Coleman, & Tsakiris, 2012; Tajadura-Jiménez, Lorusso, & Tsakiris, 2013; Tsakiris, 2008). These illusions use principles of multisensory integration to create an illusory experience of embodiment/ownership over a different body/body part or someone else's face.

A notable difference between these multisensory face and body illusions is that the subjective illusion strength appears to be greatly reduced for the face compared to the body or body parts (e.g. compare Botvinick & Cohen, 1998; Tajadura-Jiménez et al., 2012). For illusions involving the body, participants tend to explicitly agree that they feel like the new body/limb belongs to them, whereas they deny ownership in control conditions. This effect occurs even with a body/body part that is noticeably different from their own in terms of, for example, size, race and even gender (Farmer, Tajadura-Jiménez, & Tsakiris, 2012; Kiltani, Normand, Sanchez-Vives, & Slater, 2012; Normand, Giannopoulos, Spanlang, & Slater, 2011; Preston & Ehrsson, 2014; Preston & Newport, 2012; van der Hoort, Guterstam, & Ehrsson, 2011). For the face illusions, however, although they result in an increase in judgements of ownership compared to control conditions, participants' responses generally reflect uncertainty or a neutral response, rather than strong affirmation of the illusion (Ma, Sellaro, Lippelt, & Hommel, 2016; Tajadura-Jiménez et al., 2012). Synchronous touch of the own and someone else's face seems to blur distinctions between self and other representations. Thus, this “enfacement effect” appears to shift the boundaries of self-recognition as opposed to replacing the actual representation with that of another, as may happen in the rubber hand and other multisensory body (non-face) illusions. This may suggest that our subjective perceptual representation of our own face is relatively rigid, whereas our perceptual experience of the body is more flexible, and as such, may be more prone to perceptual distortions during mirror gazing.

However, studies investigating the effect of mirror viewing on these multisensory body illusions find equivalent results in the mirror compared with direct view (Bertamini, Berselli, Bode, Lawson, & Wong, 2011; Jenkinson & Preston, 2015; Preston, Kuper-Smith, & Ehrsson, 2015) and as such, have suggested that mirror view is no different from a direct ‘first person’ perspective (Preston et al., 2015). This line of argument may therefore suggest that viewing the body in a mirror is essentially the same as viewing the body directly (at least in an explicit or subjective sense), and so be less prone to visual illusions arising simply from prolonged self-observation in a mirror. Viewing our face, on the other hand, cannot be done directly and as such is a relatively more unusual (albeit still frequent) behaviour, in which case we might expect that illusions experienced whilst viewing our face in the mirror may not be present to the same extent for the body.

The aim of this study was to explore the structure of experience during self-observation of the body in a mirror, using a psychometric approach. We were particularly interested in exploring whether seeing the body in a mirror would result in a subjective experience that was equivalent to seeing the body directly (see Bertamini et al., 2011; Jenkinson & Preston, 2015;

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