Is that me in the mirror? Depersonalisation modulates tactile mirroring mechanisms

Julia Adler a,*, Nadine Schabinger a, Matthias Michal a, Manfred E. Beutel a, Helge Gillmeister b

a Department of Psychosomatic Medicine and Psychotherapy, University Medical Center of the Johannes Gutenberg - University Mainz, Mainz, Germany
b Department of Psychology, University of Essex, Colchester, UK

1. Introduction

That “the ego is first and foremost a bodily ego” was suggested over a hundred years ago (Freud, 1923, p.26), and is a notion that has been rediscovered and substantiated by neuroscientific research during the last decades (e.g. Blanke et al., 2015; Lenggenhager et al., 2009).

Bodily self-consciousness, that is, the feeling of oneself as a bodily subject (e.g. Legrand, 2006), is described as the basic, pre-reflective representation of body-related information (e.g. Gallagher, 2000; Haggard et al., 2003; Jeannerod, 2007; Legrand, 2006). This pre-reflective sense of bodily self is based on sensory-motor experiences like seeing and feeling your own body move provide the multisensory-motor contingencies that are instrumental in giving rise to the bodily self (e.g. Rochat and Striano, 2000; Zmyj et al., 2011). In line with this, sensitivity to synchrony between seen and felt body-related stimuli (touch on the face) is present from birth (Filippetti et al., 2013, 2015), and sensory-motor contingencies have been shown to modulate cortical processing at 5 months of age (Filippetti et al., 2014).

Our sense of self is thought to develop through sensory-motor contingencies provided, not only by observing one’s own body, but also by mirroring interactions with others. This suggests that there is a strong link between mirroring mechanisms and the bodily self. The present study tested whether this link is expressed at early, implicit stages of the mirroring process or at later, more cognitive stages. We also provide, to the best of our knowledge, the first demonstration of how inter-individual differences in our sense of bodily self may affect mirroring mechanisms. We used somatosensory event-related potentials (SEPs) to investigate the temporal dynamics of mirroring highly self-related information (viewed touch on one’s own face) compared to other-related information (viewed touch on a stranger’s face), in individuals with low and high levels of depersonalisation, a mental condition characterised by feeling detached or estranged from one’s own body. For the low-depersonalisation group, mirroring for self-related events (P45) preceded mirroring for other-related events (N80). At later stages (P200), mirroring was stronger for other-related than self-related events. This shows that early, implicit and later, more cognitive processes play different relative roles in mirroring self- and other-related bodily events. Critically, mirroring differed in the high-depersonalisation group, specifically for self-related events. An absence of early, implicit mirroring for self-related events over P45 suggests that the associated processes may be the neural correlates of the disembodiment experienced in depersonalisation. A lack of differential mirroring for self- and other-related events over P200 may reflect compensatory mechanisms that redress deficiencies in mirroring at earlier stages, which may break down to give rise to symptoms of depersonalisation. Alternatively, or in addition, they may represent an attenuation of processes related to self-other distinction. Our study thus shows that mirroring, especially for events on one’s own face, can be strongly affected by how connected the observer feels to their own bodily self.

* Correspondence to: Department of Psychosomatic Medicine and Psychotherapy, University Medical Center of the Johannes Gutenberg-University Mainz, Untere Zahlbacher Str.8, D-55131 Mainz, Germany
E-mail address: Julia.Adler@uni-mainz.de (J. Adler).
and thus, allow infants to develop a basic sense of themselves as a self-structuring body (Gallese and Sinaglia, 2010) that is the subject of experiences (the sense of “I am a body”; Stern, 1985). This self-structuring body is both capable of affecting others and of being affected by other bodies within a given motor repertoire (“power for action”), which is the basis of all social engagement and communication (Gallese and Sinaglia, 2010). Further, mirroring interactions that are capable of establishing an affective reciprocity between an infant and their primary caregiver are thought to be the basis of the emergent ability to represent one’s own self (and others) as a mental agent (“mentalising”) (e.g. Fonagy et al., 2007; see also Markova and Legerstee (2006) and Stern (1995)). In these ways, it is thought that our social being is based on mirroring – an intuitive bodily resonance with others (Merleau-Ponty, 1962; see Fuchs and Koch (2014) for a recent illustration).

These processes would not be possible without a mechanism that allows sensory-motor resonance with other bodies. Such a mechanism exists in a core network of inferior frontal gyrus, premotor and parietal cortical areas (“mirror neuron system”, MNS), which primes and encodes actions regardless of whether they are performed by oneself or observed on another person (e.g. di Pellegrino et al., 1992; Iacoboni et al., 1999; Molenberghs et al., 2012). Through the mapping of observed actions onto those in one’s own motor repertoire, the MNS supports the internal simulation of others’ sensory-motor experiences and is thus thought to enable an understanding of their intentions (e.g. Gallese and Goldman, 1998). While the involvement of the MNS in higher functions like intention understanding is debated (e.g. Cook et al., 2014; Dinstein et al., 2008), studies over the past two decades have revealed mirror-like cortical activations not only for motor actions (see Avenanti et al. (2013) for a recent review), but also for emotions (see Bastiaansen et al. (2009) for a recent review), and for sensations, like pain and touch (see Bufalari and Ionta (2013) for a recent review). In line with this, a recent meta-analysis has suggested that human mirror functioning can engage a broader network of primary sensory and emotional processing areas in addition to the core MNS (Molenberghs et al., 2012).

As argued above, mirroring plays a crucial role in the development of the bodily self. That is, the basic functional features of the MNS are thought to give rise to different forms of self-consciousness (e.g. sense of agency and body ownership, for which bodily self-consciousness is both a prerequisite and core component; Gallese and Sinaglia, 2010). Furthermore, a close relationship between mirroring mechanisms and our sense of bodily self can also be observed in adults. First, it has been argued that the inferior frontal and parietal areas which comprise the MNS overlap with those involved in self-related processing, such as self-face observation (e.g. Uddin et al., 2005, 2006; for reviews see Molnar-Szakacs and Uddin (2013) and Uddin et al. (2007)).

Second, and more directly relevant for the present study, there is a functional link between mirroring and self-related processing. Behavioural studies have shown that mirroring is stronger the better the perceived match is between oneself and a viewed person (Cardini et al., 2011, 2013; Serino et al., 2008, 2009). Importantly, effects of mirroring are maximally enhanced when observing one’s own face (Cardini et al., 2011, 2013; Serino et al., 2008; see also Keean et al. (2001) and Salomon et al. (2012)), which is a typical approach to investigate the neuronal correlates of self-related processes (see Keean et al. (2000), Platek et al. (2004), Salamon et al. (2012), Sugiera et al. (2000) and Uddin et al. (2005, 2006)). Uddin et al. (2005) surmised that, because we understand others by mapping them onto a representation of ourselves (making them “like me”, Melzoff and Brooks, 2001), one’s own face activates fronto-parietal circuits more than another person’s face because it results in a better match with existing representations.

In sum, while philosophical, developmental and neuroscientific studies have pointed to a strong link between mirroring mechanisms and the bodily self, several questions remain hitherto unanswered. One is whether this link is expressed at early, implicit stages of the mirroring process or at later, more cognitive stages. Another is whether this link differs in observers with an altered sense of bodily self.

It is already known that synchronous visuo-tactile stimulation, which can be described as “mirror like experiences” because seen touches concur with felt touches (e.g. Tajadura-Jiménez et al., 2013), can alter cortical self-representations (e.g. Apps et al., 2013; Tsakiris et al., 2007). This has been shown to increase identification with a stranger or avatar (e.g. Maister et al., 2013; Serino, Sforza et al., 2015; Tsakiris, 2008; Tsakiris and Haggard, 2005), and to cause mirroring effects that are indistinguishable from those for one’s own face (Cardini et al., 2013).

In this study we ask whether individual differences in self-processing are associated with changes in mirroring. Stark alterations can be expected in depersonalisation, a psychological condition characterised by estrangement, detachment or disconnection from one’s own being while reality testing and sense of identity remain otherwise intact (e.g. Simeon, 2004). Depersonalisation can occur in healthy adults following severe stress, traumatic life events, or drug use (e.g. Charbonneau and O’Connor, 1999; Simeon, 2004; Trueeman, 1984), or as a symptom of another mental disorder (e.g. panic disorder, post-traumatic stress disorder; e.g. Simeon, 2004). When depersonalisation symptoms are persistent and debilitating, however, they may indicate the presence of depersonalisation-derealisation disorder. For mild (non-pathological) depersonalisation there is a high life-time prevalence of up to 80%, while the clinical disorder occurs in around 1% of the adult population (e.g. Hunter et al., 2004). The phenomenology of depersonalisation may entail abnormal sensory experiences, autoscopie or candid out-of-body experiences, and emotional blunting. However, one of the core components of depersonalisation is disembodiment - the disrupted relationship with one’s own bodily self (e.g. feeling detached from body parts or the whole body; looking in the mirror and feeling estranged from one’s image; not feeling in control of one’s movements) (e.g. Sierra et al., 2005; Sierra and Berrios, 2000; Sierra and David, 2011; Simeon, 2004), and it is thought that this disembodiment is due to faulty integration of self-perceptions with one’s sense of self (Simeon, 2004).

The experimental literature on self-related processes in depersonalisation is relatively sparse, but one recent fMRI study has observed stronger frontal lobe activity in response to images of one’s own face in contrast to strangers’ faces (Ketay et al., 2014). Ketay et al. argued that these differences may reflect impairments in implicit self-processing, which exist alongside the preserved ability to explicitly recognize oneself, in patients with depersonalisation.

To investigate the stages of processing affected by the link between mirroring and self-related processing, and its alterations in depersonalisation, the present study used electroencephalography (EEG) in a tactile mirroring paradigm. The tactile mirroring paradigm is an effective method to delineate mirroring processes (e.g. Banissy et al., 2009; Bufalari et al., 2007; Cardini et al., 2011; Deschrijver et al., 2015; Serino et al., 2008, 2009; Gillmeister, 2014; Martinez-Jauand et al., 2012). In most variants of this paradigm, observers receive tactile stimuli on their own, hidden body while viewing another person’s body being touched or not touched at the same time. As mirroring entails an internal simulation of the observed event, a match between the representations of the felt and the seen stimulus should be present when viewing touch but not when viewing no touch. Thus, the differences in somatosensory processing between touch-viewed and no-touch-viewed conditions reflect tactile mirroring.
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات