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The person in the mirror: using the enfacement illusion to investigate the experiential structure of self-identification

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Abstract

How do we acquire a mental representation of our own face? Recently, synchronous, but not asynchronous, interpersonal multisensory stimulation (IMS) between one's own and another person's face was used to evoke changes in self-identification (*enfacement* illusion). We investigated the conscious experience of these changes with principal component analyses (PCA) that revealed that while the conscious experience during synchronous IMS focused on resemblance and similarity with the other's face, during asynchronous IMS it focused on multisensory stimulation. Analyses on the identified common factor structure revealed significant quantitative differences between synchronous and asynchronous IMS on self-identification and perceived similarity with the other's face. Experiment 2 revealed that participants with lower interoceptive sensitivity experienced stronger enfacement illusion. Overall, self-identification and body-ownership rely on similar basic mechanisms of multisensory integration, but the effects of multisensory input on their experience are qualitatively different, possibly underlying the face's unique role as a marker of selfhood.

Keywords

self-face representation; multisensory integration; mirror-recognition; self-identity; enfacement illusion

1. Introduction

Nothing provides so strong a sense of self as seeing one's own face reflected in a mirror. The familiarity and ease of everyday self-recognition masks the sophistication of this ability, and how rare it is in the animal kingdom. The face is the most distinctive feature of our physical appearance, and one of the key ways by which we become known as individuals, both to ourselves and to others. Traditionally, the ability to recognize oneself in a mirror is taken as evidence of a basic form of self awareness in non-human primates (de Waal, Dindo, Freeman & Hall, 2005; Gallup, 1970) and human infants (Bertenthal & Fischer, 1978). This ability for self-recognition is claimed to be especially fundamental to the awareness of being a self among others like us (Zahavi & Roepstorff, 2011), upon which more complex forms of self-identity are built, such as a diachronic sense of self (Povinelli & Simon, 1998).

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At the ontogenetic level, the formation of a mental representation of what we look like poses two challenges. The first challenge relates to how a mental representation of facial appearance is acquired in the first place. Given that the infant cannot have a priori knowledge of her appearance, the infant encountering a mirror for the first time must succeed in matching her sensorimotor experience with the observed sensorimotor behavior of the object seen inside the mirror. This matching between felt and observed sensorimotor signals will lead to the formation of a mental representation of visual appearance (i.e., *"that is my body reflected in the mirror; therefore that is what I look like"*). This process of self-identification allows successful performance in the classic 'rouge' task of mirror self-recognition, in which infants are exposed to their mirror reflection and their response to a spot of rouge covertly applied to their nose is registered (e.g., they might respond by touching their own nose; see Lewis & Brooks-Gunn, 1979). Second, as our physical appearance changes over time, the mental representation of what we look like should possess sufficient plasticity to ensure both the assimilation of changes and a sense of continuity over time. It is therefore important to distinguish between three key processes: (1) *self-identification*, which allows for the construction and acquisition of a mental representation of appearance; (2) *self-recognition*, which allows for the maintenance of a stored mental representation; and (3) *self-updating*, which allows for assimilation of physical changes that will eventually be reflected in the mental representation.

While the question of maintenance of a self-face representation has been addressed in several studies with adults (see Devue & Brédart (2011) for a review), the neurocognitive mechanisms that allow us to acquire, maintain and update a mental representation of our own face remain incompletely understood. Typically, in self-recognition studies, participants are asked to judge the identity of a static visual stimulus, often a morphed face that contains different percentages of self and other. This process requires a comparison between the static viewed picture and a stored visual representation of one's own face. However, at the ontogenetic level, the initial acquisition of a mental self-face representation cannot be explained by this process of comparing an external stimulus to a mental representation because a mental representation of what we look like does not exist a priori. Instead, it is the infants' ability to integrate online sensorimotor signals with visual feedback during mirror exposure that allows them to realize that the face with the rouge spot that they see in the mirror is their own. Thus, the mental representation of what we look like is given to us by the continuous integration and match of what we feel on our face with what we see on the reflected face. Accumulative multisensory experiences during mirror exposure may allow for the update of the mental representation of our own face as we age, although the continuity and plasticity of self-face representations as we age are issues that remain to be explored. How is a mental representation of one's own face acquired, maintained and updated over time?

Recent studies (Sforza, Bufalari, Haggard & Aglioti, 2010; Tajadura-Jiménez, Grehl & Tsakiris, 2012; Tsakiris, 2008) have capitalized on the known role of multisensory integration for body-awareness (for a review see Tsakiris, 2010) to investigate the effect of on-line multisensory stimulation on self-face representations. Seeing another person's face being touched at the same time as one's face, evokes a change in the mental representation of one's face, which can be measured by performance on a self-face recognition task. Synchronous, but not asynchronous, visuo-tactile stimulation between the two faces changes the categorical boundary between self and other, by shifting it towards the other's face, so that a higher percentage of the other face is assimilated in the mental representation of one's face. This "enfacement illusion" has been shown to be dependent on empathic traits, such as the ability to adopt the point of view of others and to share their emotions (Sforza, et al., 2010), as well as to influence social cognition processes, such as those involved in inference and conformity tasks (Paladino, Mazzurega, Pavani & Schubert, 2011).

While these studies present converging evidence in favor of the effect of multisensory stimulation on self-face representations, a systematic investigation of the experience of identifying oneself with a face is still lacking. The aforementioned studies have shed some light on this question by suggesting that I identify with the face I see, not only because it matches a stored visual representation of my face, but also because I see the face being touched when I feel touch myself. Still, we know little about how one consciously perceives these different aspects of identifying with one's face in the mirror.

1.1 Present study

We consider the enfacement illusion to be a model instance of self-identification, in an analogous way to the phenomenology of embodiment in illusions of body-ownership, such as the Rubber Hand Illusion (RHI; Botvinick & Cohen, 1998). Understanding the experience of self-identification as studied in the enfacement illusion can shed light on the processes by which we come to *acquire* and *update* a mental representation of our physical appearance.

Thus, our first aim was to apply a rigorous psychometric method to decompose the conscious bodily experience of self-identification during enfacement into theoretically useful and distinct subcomponents. The experimental manipulation of the temporal correlation of visuo-tactile stimulation allows for controlled investigation of the phenomenology of self-identification. In Experiment 1, we adopted the psychometric approach of Longo and colleagues (Longo, Schüür, Kammers, Tsakiris & Haggard, 2008) that has been previously used to characterize the alteration of the conscious bodily experience as a function of the pattern of multisensory stimulation in the rubber hand illusion. Our aim was to investigate the changes in the experience of self-identification caused by multisensory stimulation, in order to understand the psychological construct of a mental representation of one's face and to motivate future research on the malleability of self-representations.

We also aimed to investigate the effect of individual differences such as age on the strength of the enfacement illusion. The mental representations of one's face are acquired and updated through accumulative multisensory experiences during mirror exposure. Therefore, it might be hypothesized that the plasticity of self-face representations might depend on the number of mirror experiences and/or on the frequency of body changes experienced by a person, which are age-related. The little evidence on the rate of changes in facial appearance suggests that larger changes occur during adolescence and into early adulthood, and then again in later adulthood (after 40 years old; see Bishara, 2000; Farkas, Eiben, Sivkov, Tompson, Katic & Forrest, 2004). Larger changes in the facial appearance may require a higher degree of plasticity in the mental representation of one's face that would allow the assimilation of these changes. Even though no studies have reported the effect of age on illusions of body-ownership, we believe that the plasticity of the mental body representations in response to body changes, a process we call self-updating, is key in the formation of a mental body-representation, together with, but distinct to, self-identification and self-recognition processes, as introduced above. We therefore aimed at further investigating age-related effects on the enfacement illusion.

Our last aim was to use the findings from the principal component analyses (PCA) and confirmatory factor analyses (CFA) performed in Experiment 1 to study how the magnitude of the malleability of self-identification during exteroceptive stimulation correlates with the interoceptive sensitivity of the body. Recent studies have shown that multisensory integration and resulting effects on the experience of the body depend on (Kammers, Rose & Haggard, 2011) and affect (Moseley, Olthof, Venema, Don, Wijers, et al., 2008) the physiological condition of the body and, further, that they depend on one's sensitivity to the physiological condition of one's body (Tsakiris, Tajadura-Jiménez & Costantini, 2011).

Interoceptive sensitivity (i.e., the sensitivity to the physiological state of one's body) is usually assessed by quantifying performance in a heartbeat perception task (Schandry, 1981). Interestingly, the malleability of body-representations following multisensory stimulation during the RHI has been shown to correlate negatively with interoceptive sensitivity: people with low interoceptive sensitivity experienced a stronger RHI suggesting that sensitivity of individuals to their internal state is linked to the strength of their self-representation (Tsakiris, et al., 2011). Therefore, Experiment 2 investigated how the strength of enfacement, which reflects the malleability of the self as perceived *from the outside*, is linked to the perception of and sensitivity to the self *from within*, as measured by the degree of interoceptive sensitivity. We predicted that people with low interoceptive sensitivity will experience a stronger enfacement illusion than people with high interoceptive sensitivity, showing the modulatory effect of interoceptive sensitivity on the malleability of the self-face representation.

2. Experiment 1: The phenomenology of self-identification

2.1 Material and methods

2.1.1 Participants—Two hundred and fifty six volunteers (140 female; $M_{age} \pm SD = 25.6 \pm 5$; range: 17-38) gave their informed consent to participate. For the 3 participants under 18 years old, parental consent was obtained. Participants were visitors of the "Who am I?" gallery, at the London Science Museum, as part of the museum's Live Science program. The study was approved by the Departmental Ethics Committee, Psychology Department, Royal Holloway, University of London.

2.1.2 Apparatus and materials—A 60 s "induction movie" displayed the face of an unfamiliar individual of the same gender as the participant being touched on the right cheek with a cotton-bud. Touches occurred with a frequency of approximately 0.5 Hz and covered a distance of approximately 2 cm from the zygomatic bone downwards. For each gender, two different movies displaying an unknown individual were produced. The individuals displayed were approximately 23 years old (age range: 20-25).

The movies were presented in full screen mode with a 20″ LCD-screen positioned 50 cm away from participants. A keyboard and Presentation® software were used to control stimuli delivery and collect participants' responses.

2.1.3 Procedure—While participants watched at the other's face being touched in the induction movie, the experimenter touched the participants' own face with an identical cotton bud on the specular congruent location either synchronously or asynchronously with a lag of approximately 1 s. One synchronous and one asynchronous trial were presented, with order randomized, to each participant. The pair of movies presented to the participants was matched with their gender (this resulted in N=114, 61 female, exposed first to the synchronous condition and in N=142, 79 female, exposed first to the asynchronous condition). Which individual was displayed in the synchronous and which in the asynchronous condition was randomized across participants.

The subjective experience of participants during each visuo-tactile condition was assessed with a questionnaire containing eighteen statements, presented in random order. Participants rated their level of agreement with the statements using a 7-item Likert scale. A response of 7 indicated that they "strongly agreed", 1 that they "strongly disagreed" and 4 that they "neither agreed nor disagreed" with the statement. The statements were based on previous studies of multisensory-induced bodily illusions (e.g., Longo, et al., 2008; Sforza, et al., 2010; Tajadura-Jiménez, et al., 2012) and on qualitative pilot research with four participants who were asked to freely describe their experiences during the illusion. The statements were designed to cover a wide range of possible experiences participants may have when exposed to synchronous and asynchronous visuo-tactile stimulation on their own face and the face of someone else that they are looking at.

2.2 Results

The mean and standard deviation for the answers to each of the statements for both synchronous and asynchronous conditions are shown in Table 1.

2.2.1 Dimensions underlying the introspective reports—The dimensions underlying the experience of enfacement were investigated with PCA with varimax orthogonal rotation. Separate PCAs were conducted for the synchronous and asynchronous conditions. The Kayser-Meyer-Olkin measure verified the sampling adequacy for the analyses (KMO = .921 for the synchronous condition and KMO = .891 for the asynchronous condition; all KMO values for individual items were > .712, which is well above the acceptable limit of .5; see Field, 2011). Bartlett's test of sphericity indicated that correlations between items were sufficiently large for PCA (for synchronous condition $\chi^2(153) = 2496.3$; $p < .001$; for asynchronous condition $\chi^2(153) = 1917.5$; $p < .001$).

In the synchronous condition, analyses of eigenvalues and the scree plot led to the extraction of three components which together accounted for 59.4% of the variance in the data (see Table 2). We considered the items that loaded strongly (>.05; cf. Longo, et al., 2008) in each component. The first principal component "Syn-C1" accounted for a large proportion of this variance (44.6%), and included statements relating to feelings that the other person's face resembled or actually was one's own face, that one's own face resembled the other person's face, that the other person's face belonged to oneself, and that one was looking at one's own mirror reflection (statements 3-7, 11-12). The second principal component "Syn-C2" included statements relating to feelings of a causal relationship between the touch of the cotton bud in the movie and on one's own face, of being in control of the other person's face or one's face being out of one's control, of one's face being less vivid than normal and that one was imitating or being imitated by the other person (statements 1-2, 8-10, 15-17). Finally, the third principal component "Syn-C3" included statements that related to the feelings of the other person being attractive and trustworthy (statements 13-14).

In the asynchronous condition, analysis of eigenvalues and the scree plot led to the extraction of five components which together accounted for 64.5% of the variance in the data (see Table 2). The first principal component "Asyn-C1" accounted for a large proportion of the variance (35%), and included statements relating to feelings of a causal relationship between the touch of the cotton bud in the movie and one's own face, of the other person's face being one's own face, of owning and being in control of the other person's face, and of looking at one's own mirror reflection (statements 1-5, 8). The second principal component "Asyn-C2" included four statements that related to the feelings of the other person's face beginning to resemble and being similar to one's own face, as well as feelings of one's face beginning to resemble and being similar to the other person's face (statements 6-7, 11-12). The third principal component "Asyn-C3" included statements that related to feelings of being imitated by the other person, of one's blinks being synchronous with the other person's blinks, and of affiliation with the other person (statements 16-18). The fourth principal component "Asyn-C4" included two statements that related to the feelings of the other person being attractive and trustworthy (statements 13-14). Finally, the fifth principal component "Asyn-C5" included two statements that related to feelings of one's face being out of one's control and the experience of one's face being less vivid than normal (statements 9-10). The presence of this last component only in the asynchronous condition provides further evidence of a substantially different underlying experience in

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synchronous and asynchronous conditions. This is reminiscent of the "*deafference*" component identified following asynchronous stimulation in the RHI (Longo, et al., 2008), which related to the sensations of pins and needles and numbness in the participant's hand, as well as to the experience of their hand being less vivid than normal, during asynchronous stimulation.

Overall, the central dimensions identified by the PCA provide evidence of important differences underlying the subjective experience of participants between the synchronous and the asynchronous conditions. The structure of the component accounting for a large proportion of the variance was not exactly the same in the two conditions. In the synchronous condition, for example, sensorimotor experiences related to touch split to form their own component. Further, the substantial differences between the other components in both conditions, and in particular, the presence of "Asyn-C5" representing the "*loss of one's face*" in the asynchronous condition, provide evidence of qualitative differences underlying the experience of enfacement in the synchronous and asynchronous conditions, which are further discussed in the General Discussion.

2.2.2 Direct comparison between synchronous and asynchronous stimulation — Our results provide evidence of qualitative differences underlying the experience of enfacement in the synchronous and asynchronous conditions. In order to be able to directly compare across synchronous and asynchronous conditions, we, then, searched for the dimensions of experience which were common to both conditions by considering the average experience of both conditions. Importantly, prior to averaging, z-scores were calculated for each questionnaire item and condition to ensure that both conditions contributed equally to the observed variance. Then, the scores for synchronous and asynchronous conditions for each questionnaire item were averaged and entered into a single PCA. Varimax orthogonal rotation was used. The Kayser-Meyer-Olkin measure verified the sampling adequacy for the analyses (KMO = .921; all KMO values for individual items were > .750). Bartlett's test of sphericity indicated that correlations between items were sufficiently large for PCA ($\chi^2(153) = 2709.3$; $p < .001$).

Analyses of eigenvalues and the scree plot led to the extraction of three components which together accounted for 60.3% of the variance in the data (see Table 3). We considered the items that loaded strongly (>.05; cf. Longo, et al., 2008) in each component. The first principal component, which we labeled "*self-identification*", accounted for a large proportion of this variance (45%), and included statements relating to feelings of a causal relationship between the touch of the cotton bud in the movie and on one's own face, feeling that the other person's face resembled or actually was one's own face, that the other person's face belonged to oneself, that one was looking at one's own mirror reflection, that one was in control of the other person's face and that one was imitating or being imitated by the other person (statements 1-6, 8, 15-17). The second principal component, labeled "*similarity*", included statements relating to feelings that the other person's and one's face resembled or were similar to each other or that the experience of one's face was less vivid than normal (statements 6-7, 10-12). Finally, the third principal component, labeled "*affect*", included statements that related to the feelings of the other person being attractive and trustworthy (statements 13-14). It should be noted that the first two components identified (i.e., "*self-identification*" and "*similarity*") match the first two key-processes involved in the formation of a mental representation of "what we look like" described in the introduction (i.e., "*self-identification*" and "*self-recognition*"), while the third factor (i.e., "*affect*"), has also been identified in previous studies on embodiment, such as the changes in body-ownership during the rubber hand illusion (Longo et al., 2008).

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Since the "*self-identification*" component accounted for a large proportion of the variance and was composed for items which suggested diverse, although related, experiences, we conducted an additional PCA, with the items that loaded strongly (>.05) on the "*self-identification*" component. No additional subcomponents were extracted, suggesting that the feelings comprising this component, which were identified in the primary analysis, are tightly interrelated in experience and are not dissociable.

In order to validate the proposed three-factor structure as a model fitting well both conditions, we used structural equation modelling. We fit a model for both conditions combined by using the model identified by the PCA on the mean scores across synchronous and asynchronous conditions to guide the construction of scales. We then used CFA to test whether the overall model provided a good fit for the two conditions combined, and then we tested the model allowing separate estimates for the two conditions separately. Hence, our hypothesized CFA structure comprised three factors: self-identification, similarity and affect. The variables measuring each factor were those identified by the PCA, the reliability of which is influenced by random measurement error. Each of the observed variables was regressed into its respective factor, and the three factors were intercorrelated (see Figure 1).

Structural equation modelling conducted in this model with equality constraints imposed to factor loadings, factor variances, factor covariances and error covariances confirmed that the model provided a reasonable fit with the data. Covarying error terms being part of the same factor and relaxing equality constraints, by keeping only those associated with factor loadings (following the procedure in Byrne, 1994), slightly improved the fits, with the fit indices confirming a good fit (relative χ^2 = 1.67; GFI = .93; NFI = .93; CFI = .97; RMSEA = .036; see Byrne, 1994; Browne & Cudeck, 1993; Kline, 1998; Ullman, 2001). Then, we fit the model separately for the two conditions. CFA evidenced that the model fit equally well in both the synchronous (relative χ^2 = 1.74; GFI = .94; NFI = .94; CFI = .97; RMSEA = .054) and asynchronous (relative χ^2 = 1.78; GFI = .94; NFI = .92; CFI = .96; RMSEA = .054) conditions. This provides confirmation for the three-factor structure to be common to both synchronous and asynchronous conditions[1].

Once we identified the dimensions underlying the introspective experience of enfacement that were common to both synchronous and asynchronous conditions, we calculated for each condition three mean component scores by averaging the scores of the items that loaded in each component. These component scores, then, quantify the experience of the participants for each of the dimensions in the same Likert scale that participants used to give their ratings for each individual statement (summated scales; Hair, Black, Babin, Anderson & Tatham, 2006). They can be used for direct comparison between synchronous and asynchronous conditions since they reflect an experience common to both conditions.

The component scores were submitted in a mixed ANOVA with within-subjects factors condition (synchronous vs. asynchronous) and component ("*self-identification*", "*similarity*" or "*affect*"), and between-subjects factors gender and the order of presentation (i.e., whether the synchronous or the asynchronous condition was first presented). The main effects of

[1]An alternative model to the one proposed here was also considered. This model was based on the structure obtained from the synchronous condition and was comprised of three factors which we named self-identification (statements 3-7, 11-12), sensorimotor experience (statements 1-2, 8-10, 15-17) and affect (statements 13-14, 18). The model was validated with a CFA with equality constraints imposed for the two conditions combined, and also allowing separate estimates for the two conditions separately. This model provided a reasonable fit with the data (for the two conditions combined: relative $\chi 2$ =2.186; GFI = .89; RMSEA = .048; for synchronous condition: relative $\chi 2$ = 2.124; GFI = .909; RMSEA = .066; for asynchronous condition: relative $\chi 2$ = 2.21; GFI = .908; RMSEA = .069), thus providing confirmation that the three-factor structure is, to some extent, common to both synchronous and asynchronous conditions. It is important to note, however, that this approach has the disadvantage that the extracted structure will, by definition, fit better the synchronous than the asynchronous condition, and that the approach adopted in this paper (i.e., the one which considers the means of the two conditions) provides a better fit.

condition ($F(1, 252) = 76.2$, $p < .0001$, $\eta_p^2 = .23$) and component ($F(2, 504) = 193.8$, $p < .0001$, $\eta_p^2 = .43$) were significant, as well as their 2-way interaction ($F(2, 504) = 13.2$, $p < .0001$, $\eta_p^2 = .05$). The significant effect of 'condition' indicates that, overall, participants agreed more with the statements after synchronous ($M \pm SE = 3.54 \pm .07$) than after asynchronous stimulation ($M \pm SE = 2.99 \pm .05$). The significant effect of 'component' indicates that, overall, participants agreed more with the statements comprising the component "*affect*" ($M \pm SE = 4.00 \pm .06$) than with those comprising the components "*self-identification*" ($M \pm SE = 2.64 \pm .06$) and "*similarity*" ($M \pm SE = 3.16 \pm .07$), independent of the pattern of stimulation. The significant interaction (see Figure 2) was driven by a greater difference between the synchronous and asynchronous conditions for the ratings for the statements comprising the component scores "*self-identification*" and "*similarity*" than for those comprising the component score "*affect*". To investigate this interaction, we calculated the difference "synchronous minus asynchronous" for each component score. The resulting values reflect the magnitude of change in the subjective experience between the synchronous and asynchronous stimulation. Paired samples *t*-tests showed that the magnitude of change for "*affect*" ($M \pm SE = .26 \pm .09$) was significantly smaller than the corresponding change for "*self-identification*" ($M \pm SE = .70 \pm .07$; $t(255) = 4.55$, $p < .0001$), and for "*similarity*" ($M \pm SE = .62 \pm .09$; $t(255) = 3.55$, $p < .0001$), whereas for both "*self-identification*" and "*similarity*" the change between conditions was similar ($t(255) = 1.26$, $p > .05$). Therefore, synchronous multisensory stimulation affects the conscious experience of self-identification and similarity between the other person's face and one's own face to a larger extent than it affects the experience of affect.

Although gender did not significantly interact with the main effects or their interaction (all *p*s > .05), the between-subjects effect of gender was significant ($F(1, 252) = 13.94$, $p < .001$, $\eta_p^2 = .05$). Overall, females showed more agreement with the statements ($M \pm SE = 3.46 \pm .07$) than males ($M \pm SE = 3.07 \pm .08$), consistent with previous findings (Page & Green, 2007), including those in studies on the Rubber Hand Illusion (Longo, et al., 2008).

The order of presentation of the two conditions (synchronous and asynchronous) interacted significantly with the effect of condition ($F(1, 252) = 20.16$, $p < .001$, $\eta_p^2 = .07$), but not with the effect of component. In addition, the between-subjects effect of order was significant ($F(1, 252) = 5.11$, $p = .025$, $\eta_p^2 = .02$). Follow-up one-way ANOVAs revealed a significant different effect across components of the asynchronous stimulation for the "*synchronous first*" ($M \pm SE = 2.75 \pm .07$) than for the "*asynchronous first*" ($M \pm SD = 3.27 \pm .08$) group ($t(254) = 4.9$, $p < .001$). However, no different effects after the synchronous stimulation for the "*synchronous first*" ($M \pm SE = 3.58 \pm .09$) than for the "*asynchronous first*" ($M \pm SE = 3.55 \pm .1$) group were observed ($p > .8$). Therefore, the significant interaction was driven by the groups differing in the asynchronous, but not the synchronous condition. Overall, people that were firstly exposed to the asynchronous condition showed higher level of agreement with the statements presented right after the asynchronous IMS than people that were firstly exposed to the synchronous condition. Still, the main effects of condition, component and their interaction hold significant for the full set of participants, and also, when analyzing separately for the two groups of participants, "synchronous first" and "asynchronous first" (all *p*s < .001).

2.2.3 Individual differences: Age—A further analysis investigated the relation between age and the subjective experience of the enfacement illusion. First, we calculated the strength of the components of "*self-identification*", "*similarity*" and "*affect*" by subtracting the scores obtained in the asynchronous conditions from those obtained in the synchronous conditions. Then, we ran linear regressions for each component to investigate whether age was a significant predictor of the change in the experience between conditions.

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The linear regression analyses between the difference synchronous vs. asynchronous and age revealed (see Figure 3) that lower age predicted larger differences between synchronous and asynchronous stimulation for the components of "*self-identification*" and "*similarity*" (for "*self-identification*" $R^2 = .017$, $\beta = -.132$, $F(1,255) = 4.48$, $p = .035$; for "*similarity*" $R^2 = .023$, $\beta = -.150$, $F(1,255) = 5.88$, $p = .016$). As for the other component, "*affect*", age was not a significant predictor of the change between synchronous and asynchronous stimulation ($p > .4$).

Overall, the pattern of participants' responses suggests a significantly different conscious experience of identification with the other face and of perceived similarity between the other person's and one's own face during synchronous and asynchronous visuo-tactile stimulation. The different statements loading on the component explaining most of the variance in each condition suggest that while during synchronous stimulation the conscious experience is that of visual similarity, during asynchronous stimulation the conflict between seen and felt sensations gains importance. Further, differences in the conscious experience due to individual factors such as age were identified. Our results suggest that age predicted the level of agreement with the statements comprising the components "*self-identification*" and "*similarity*", with younger participants showing a higher level of agreement in the synchronous, as compared to the asynchronous, condition than older participants. Experiment 2 further investigated individual factors by looking at differences in interoceptive sensitivity in the effect of visuo-tactile stimulation on the representations of self-face.

3. Experiment 2: Interoceptive sensitivity and the enfacement illusion

3.1 Material and methods

3.1.1 Participants—Fifty six volunteers (43 female; $M_{age} \pm SD = 21.18 \pm 3.3$; range: 17-42) gave their informed consent to participate. Participants were students or staff members of Royal Holloway, University of London, except for one participant who was a high school visitor and for whom parental consent to participate in the study was obtained. The study was approved by the Departmental Ethics Committees.

3.1.2 Apparatus and materials—A similar apparatus as in Experiment 1 was used, and similar "induction movies", with the only exception that the movies lasted for 2 minutes. For each gender, two different movies, each showing a different model, were produced; each movie was presented in either the synchronous or asynchronous condition. The order of synchronous and asynchronous conditions and the assignment of movies to conditions were counterbalanced across participants. The individuals displayed were approximately 19 years old.

Heart rate was monitored with a piezo-electric pulse transducer attached to the participant's left index finger (PowerLab 26T, AD Instruments, UK). Heart signals were sampled at a rate of 1 kHz and amplified.

3.1.3 Procedure—Participants took part individually in the experiment. First, participants' heartbeat perception was measured by using the Mental Tracking Method (Schandry, 1981), a method that has been widely used as a way to assess interoceptive sensitivity. While monitoring participants' heartbeat, and in four trials of different length (25 s, 35 s, 45 s and 100 s), participants were asked to concentrate and silently count their own heart beats. Participants were not allowed to take their own pulse, did not receive any feedback on their performance and were not informed of the length of the trial. An audiovisual cue marked the start and the stop of the trial.

Then, participants were exposed to two "induction movies", while the experimenter touched their face in synchrony or asynchrony with the seen touch. The subjective experience of participants during each visuo-tactile condition was assessed with the same questionnaire used in Experiment 1. In this occasion, participants rated their level of agreement with the statements using a visual analog scale (VAS) ranging from "strongly agree" to "strongly disagree", with the middle point marked as "neither agree nor disagree".

3.2 Results

In order to investigate how interoceptive sensitivity interacts with the pattern of visuo-tactile stimulation, first, for both synchronous and asynchronous conditions, we constructed comparable component scores to those identified in Experiment 1: "*self-identification*", "*similarity*" and "*affect*". Each component was calculated by averaging the ratings of participants for all the statements that comprise the component (average of statements 1-6, 8, 15-17 for "*self-identification*", average of statements 6-7, 10-12 for "*similarity*" and average of statements 13-14 for "*affect*"). The ratings were translated into a scale ranging from 1 ("strongly disagree") to 7 ("strongly agree").

Interoceptive sensitivity (IS) was calculated as the mean score of the four heartbeat detection trials, according to the following formula (Schandry, 1981): ¼ Σ (1 − (|*recorded_heartbeats* − *counted_heartbeats*|/*recorded_heartbeats*))

According to this formula, the IS score can range between 0 and 1, with higher scores indicating higher accuracy of the participants in counting their heartbeats (i.e., higher IS). We calculated the participants' median score of IS, and used this value (Median ± SD = .72 ± .18) to split participants into two groups of high IS (HIGH group, mean IS score ± SD = .86 ± .08; N = 28) and low IS (LOW group, mean IS score ± SD = .57 ± .12; N = 28; see Tsakiris, et al., 2011).

Then, the components scores "*self-identification*", "*similarity*" and "*affect*" for the synchronous and asynchronous conditions, were submitted in a 2×3 ANOVA with within-subjects factors condition (synchronous vs. asynchronous) and component ("*self-identification*", "*similarity*" or "*affect*"), and with IS as a between-subjects factor. Results showed that the main effects of condition (F(1, 54) = 50.04, p < .0001, η_p^2 = .48) and component (F(2, 108) = 22.3, p < .0001, η_p^2 = .29) were significant, as well as the 2-way interaction (F(2, 108) = 9.15, p < .0001, η_p^2 = .14). As in Experiment 1, the significant interaction was driven by a greater difference between the synchronous and asynchronous conditions for the ratings for the statements comprising the component scores "*self-identification*" (mean difference ± SE = 1.03 ± .14; t(55) = 7.5, p < .0001) and "*similarity*" (mean difference ± SE =.85 ± .15; t(55) = 5.5, p < .0001) than for those comprising the component score "*affect*" (mean difference ± SE = .35 ± .14; t(55) = 2.5, p = .014). Follow-up paired samples t-tests between the calculated difference "synchronous minus asynchronous" for all component scores revealed a significant difference between the score "*affect*" and the scores "*self-identification*" (t(55) = 3.8, p < .0001) and "*similarity*" (t(49) = 2.7, p = .009). These findings replicate the main results of Experiment 1.

Furthermore, the interaction of condition with the IS group was significant (F(1, 54) = 4.11, p < .05, η_p^2 = .07), because as shown in Figure 4, participants with low IS gave overall higher ratings to all three components following synchronous stimulation (M ± SE = 4.19 ± .14) than participants with high IS (M ± SE = 3.81 ± .14), while for both groups ratings following asynchronous stimulation were comparable (for low IS, M ± SE = 3.23 ± .16; for high IS, M ± SE = 3.28 ± .16).

The significant interaction between the pattern of stimulation (synchronous vs. asynchronous) and IS group suggests that participants with low IS experienced a stronger experience of identification and similarity with the other's face, as well as a stronger affective experience towards the other's face, after synchronous stimulation than those with high IS. These findings suggest that IS modulates the conscious experience of self and other's face during the enfacement illusion, analogous to previous findings on the relation between interoception and changes in body-ownership following multisensory stimulation (Tsakiris, et al., 2011).

4. General Discussion

The current study represents a systematic attempt to characterize the different aspects of the experience of identifying with a face. The enfacement illusion can be considered a model instance of the effect of multisensory input for the formation of a mental representation of one's face. A structured psychometric approach served to reveal the underlying structure of the subjective experience of the illusion. Specifically, we identified three major components that emerged during synchronous visual and tactile stimulation, and five major components that emerged when vision and touch were not synchronous. Unlike the structure of the experience in the RHI that seemed to be comparable across synchronous and asynchronous stimulation (Longo, et al., 2008), the pattern of stimulation on the face resulted in qualitative differences. When we investigated the common factor structure across stimulation conditions, three major components were identified which we interpreted as "*self-identification", "similarity*" and "*affect*". The rating scores for these three components were significantly different between stimulation conditions. In the same data set, we investigated the effect of individual differences such as gender and age. In terms of age, we found that it was a significant negative predictor of the change in the "*self-identification*" and "*similarity*" components. Finally, we investigated the relation between interoception and conscious experience as a way of understanding how the malleability of self-face representations following multisensory stimulation might also be modulated by interoceptive sensitivity. Consistent with previous findings for other bodily illusions (Tsakiris, et al., 2011), participants with low interoceptive sensitivity showed a stronger enfacement illusion following synchronous stimulation than participants with high interoceptive sensitivity. The present study complements previous research on the behavioral effects of multisensory stimulation on self-face representations (Paladino, et al., 2011; Sforza, et al., 2010; Tajadura-Jiménez, et al., 2012; Tsakiris, 2008), by identifying the key experiential components that are affected by interpersonal multisensory stimulation. Our key findings are discussed in the following sections.

4.1 Differences in the experience of the other's face during synchronous and asynchronous IMS

Following a similar psychometric approach to a bodily illusion (RHI, Longo, et al., 2008) comparable to the enfacement illusion paradigm used here, we analysed separately the subjective ratings given after synchronous and asynchronous multisensory stimulation. In the RHI, the differences between synchronous and asynchronous stimulation were mostly quantitative in nature, rather than qualitative, because the factor structure was almost identical for both stimulation conditions. For the RHI, the key difference was that significant higher ratings were given in the synchronous than the asynchronous condition for highly similar structures across conditions. Unlike the structure of the conscious experience during the RHI, the two PCAs on the enfacement illusion paradigm showed important qualitative differences.

The first component identified in the two PCAs, which accounted for considerably more variance than any of the other components, reflected a substantially different experience of

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the other's face during synchronous than during asynchronous stroking. During the synchronous condition this component related to items reflecting an overall visual identification with the other person's face, including physical similarity between both faces, and did not reflect a particular focus on the multisensory stimulation itself. However, during the asynchronous condition participants strongly focused both on the multisensory stimulation and the feelings of "mirror experience", without really evaluating other aspects related to the physical similarity between the faces. Synchrony seems to bring forward the experience of resemblance and similarity, that is the *effect* of the enfacement illusion, and attenuate the focus on the multisensory input, that is the *cause* of the enfacement illusion. Instead, asynchrony seems to disrupt the self-identification process and bring forward the focus on the touch and the feeling of control and imitation of the other's face. The fact that the component that explains most of the variance in the synchronous condition consists of items that relate to identification, and that this is clearly distinct from the component that refers to the sensorimotor experience of the face, indicates that the detection of synchrony of multisensory input and the strong association established between felt and seen touch automatically suggests visual similarity, shifting conscious experience towards visual similarity rather than tactile sensation. The emergence of two different components for the experience of identifying with the other person's face and the sensorimotor experience of one's face during synchronous visuo-tactile stimulation indicates that, although identification with the other person's face resulted from the multisensory stimulation (as our results evidenced), the conscious experience of self-identification did not regard this stimulation and other motor aspects of the experience as part of the process of self-identification, but rather seemed to put more weight on the visual aspect of the experience.

4.2 Common experience of the other's face during synchronous and asynchronous IMS

Having noted these important qualitative differences in the subjective experience across the two conditions, we then investigated their quantitative differences by focusing on the common factor structure as given by the PCA on the mean ratings across the two conditions. The analysis investigating the dimensions underlying the experience of enfacement which were common to both conditions, served to identify the following three components: *self-identification*, that reflected the extent to which participants felt that the seen face was theirs, *similarity*, that reflected the extent to which participants perceived the seen face as similar, and *affect* that reflected the extent to which the seen face was judged as attractive and trustworthy. This common structure, which was validated by CFA, allowed us to directly compare the magnitude of the experience as reflected in the subjective ratings across the two conditions. While synchronous stimulation resulted in overall higher ratings than asynchronous stimulation, the difference between the two types of stimulation was larger for the first two components than for the third one. The component "*self-identification*" in the current study is reminiscent of the "*embodiment of the rubber hand*" component identified for the RHI (Longo, et al., 2008), which derived from the potentially dissociable subcomponents of ownership, location and agency. In the current study, no further subcomponents for "*self-identification*" were established. This might reflect the differences in the importance of hand and face-representations for self-identity.

The emergence of a separate "*affect*" component provides evidence that feelings of affect towards "the person in the mirror" can be dissociated from feelings of self-identification, sensorimotor or similarity experiences associated with embodiment of the other person's face. It should be noted that previous research on the RHI identified also a component labeled as "*affect*" (Longo, et al., 2008), which mainly related to the pleasantness of felt touch and thus carries an emotional constituent, as does the "*affect*" factor in this study. Furthermore, the observed distinction between the feelings of self-identification and similarity between faces and the feelings of affect towards the "person in the mirror" might be used to refine models of abnormal body-awareness where body-image dissatisfaction and body-image distortions are linked to objectification of one's body and a separation between the subjectivity and physicality of one's body (Legrand, 2010). The observation that interpersonal multisensory stimulation selectively modulates the conscious experiences of self-identification and perceived similarity between faces more than the experience of affect suggests dissociation between the process of identification and the affective relationship with the identified object.

While effects of multisensory integration on self-face representations are often discussed in analogy to its effects on body-representations (see RHI; Longo, et al., 2008; Sforza, et al., 2010; Tajadura-Jiménez, et al., 2012; Tsakiris, 2008), the current use of a psychometric approach highlights important differences between the experiences of self-identification and body-ownership. Previous research on the experience of embodiment during the RHI has identified a fairly similar structure for the experience of embodiment during both conditions of synchronous and asynchronous stimulation of the rubber hand and one's own hand, with the conditions differing in the extent to which components of the structure were present or absent (see Longo, et al., 2008). However, the underlying introspective experience during the synchronous and asynchronous conditions of the enfacement seems to be substantially different, as evidenced by the current results. A different number of components, three for the synchronous and five for the asynchronous condition, emerged. Moreover, the factor explaining most of the variance in both conditions differed in the type of conscious experience that it described, a focus on resemblance and similarity with the other's face following synchronous stimulation and a focus on the feeling of control and imitation of the other's face following asynchronous stimulation. Finally, a distinct component referring to the "*loss of one's face*", emerged only for the asynchronous condition.

Importantly, although most of the mean responses to the questionnaire items in the present study showed 'disagreement' with the statements following both synchronous and asynchronous IMS, the integration of synchronous vision and touch between one's own face and that of another unfamiliar person evoked significant changes in the experience of self-identification, suggesting that participants showed less disagreement following synchronous IMS for these statements (e.g., "looking at one's mirror reflection, rather than at someone else"). Overall, this pattern is consistent with the reported changes in subjective experience in other studies on the influence of multisensory stimulation in face recognition (Paladino, et al., 2010; Sforza, et al., 2010). It should be noted that in our study the mean value for the critical statement 3 ("I felt like the other's face was my face") is numerically higher than the one reported in a previous study using the same question (Sforza, et al., 2010). The pattern of results is also consistent with that reported for other bodily illusions that use multisensory stimulation (Longo, et al., 2008; Longo, Schüür, Kammers, Tsakiris & Haggard, 2009), although it seems that other bodily illusions (e.g. RHI) produce stronger phenomenological effects, as reported by participants.

4.3 Individual differences in age

Our results revealed that lower age predicted larger changes in the experience of identification and of perceived similarity between another person's and one's own face. Younger participants expressed more agreement with the statements comprising the factors "*self-identification*" and "*similarity*" in the synchronous, as compared to the asynchronous, condition. This finding seems to suggest that, for the age range examined, the plasticity of self-face representations reduces with age, a finding which might be explained in terms of the increasing number of mirror experiences accumulated with age and also in terms of a greater need to adapt self-face representations to the larger body changes during certain age periods. Larger body changes occur during adolescence and into early adulthood and then again in later adulthood (i.e., after 40 years old; see Bishara, 2000; Farkas, et al., 2004). The

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age of the sample we report ranges from 17 to 38 years old. Therefore, the younger participants in our sample would be experiencing larger changes in their facial appearance, requiring a higher degree of plasticity in the mental representation of their face that would allow the assimilation of these changes. In line with this observation, the youngest members of the group experienced the strongest enfacement illusion, which may reflect the greater degree of plasticity of self-face representations.

This adaptation may help to ensure that a continuous sense of self is kept even though one's body changes. Similarly, as the number of accumulated mirror experiences increases and the rate of change in one's physical appearance changes with age, the mental representation of one's face becomes less malleable and more stable. The significant correlation found between age and the malleability of the mental representation of one's face evidences the self-updating of mental body-representations, thus strengthening the theoretical framework of mental body-representation that we propose, in which *self-identification, self-recognition*, and *self-updating* are identified as three distinct key processes.

4.4 Interoceptive sensitivity and the strength of self-representations

Finally, Experiment 2 revealed that interoceptive sensitivity (IS) modulated the strength of the experience of enfacement. People with low IS seemed to experience in the enfacement illusion a stronger sense of identification with the other face, of perceived similarity between the other and self-face and of affect towards the other person, than people with high IS, thus showing a link between the plasticity of self-face representations and IS. Importantly, given the significant interaction between stimulation pattern (synchronous vs. asynchronous) and IS group (low vs. high), it seems unlikely that the two groups generally interpreted or used the Likert scale in different ways. Instead, across components, participants with low IS gave higher ratings after synchronous stimulation compared to those with high IS, whereas for the asynchronous condition we did not find such differences. A significant negative correlation between IS and the strength of bodily illusions has been previously reported for the RHI, suggesting that IS is linked to the malleability of body-ownership (Tsakiris, et al., 2011). Low accuracy in heartbeat perception correlated with an increase in sense of ownership during the RHI as measured introspectively, behaviorally, and physiologically (Tsakiris, et al., 2011), and was related to an increase in self-face identification, perceived similarity between faces and affect towards the other face, in the enfacement illusion, as measured introspectively in the present study. Recent studies have provided evidence for both a top-down effect of changes in the experience of body-ownership on homeostatic regulation of the body (Moseley, et al., 2008), as well as a bottom-up modulation of the peripheral physiological state of the body (Kammers, et al., 2011) and the sensitivity to it (Tsakiris, et al., 2011), on the malleability of body-ownership. This suggests a relation between the conscious experience of the self and the physiological regulation of the body, in addition to the well-documented role of multisensory input on the conscious experience of the self. The present study provides further evidence in support of the hypothesis that the sensitivity to the body *from within* is linked to the malleability of self-representations, in the domain of self-face representations, as well as in the domain of body-representations. This extension from body-ownership to self-identification supports that argument that interoceptive sensitivity is linked to the strength of self-representation in general.

5. Conclusions

Overall, the present results corroborate the hypothesis that different representations of the bodily self, such as body-ownership and self-identification, rely on similar basic mechanisms of multisensory integration (Blanke & Metzinger, 2009; Tsakiris, 2010). However, the structure of the experience of body-ownership and self-face identification might be different. In the RHI, experience centers on the change of the representation of one's own body from an embodied first-person perspective. The experimental paradigm of enfacement addresses the question of self-identification, whereby a visual representation of appearance is assimilated in a mental representation of identity. This process requires the integration of both first and third person perspectives, since the subject identifies itself with a visual object, i.e., a face, on the basis of current multisensory input. As argued at the beginning of this paper, unlike the experience of one's body from an embodied 1st person perspective, the experience of self-identification with the body reflected in the mirror requires matching one's sensorimotor experience (1st person perspective) with the observed sensorimotor behavior of the object seen in the mirror (3rd person perspective). The formation of a mental representation of one's visual appearance then follows from this matching between felt and observed sensorimotor signals. Our results highlight the differences between bodily illusions that affect the 1st person embodied perspective, such as the RHI, and those that affect identification, such as the experimental induction of out-of-body experience (Lenggenhager, Tadi, Metzinger & Blanke, 2007) and the body-swap illusion (Ehrsson, 2007; Petkova & Ehrsson, 2008). The latter require the integration of the "subjectively felt" and "objectively seen" self that will result in the formation of a mental representation of one's physical appearance. In that way, the "I" comes to be identified with "me", allowing this "me" to be represented as an object for the others, but also for one's own self, and allowing me to recognize myself as the person in the mirror.

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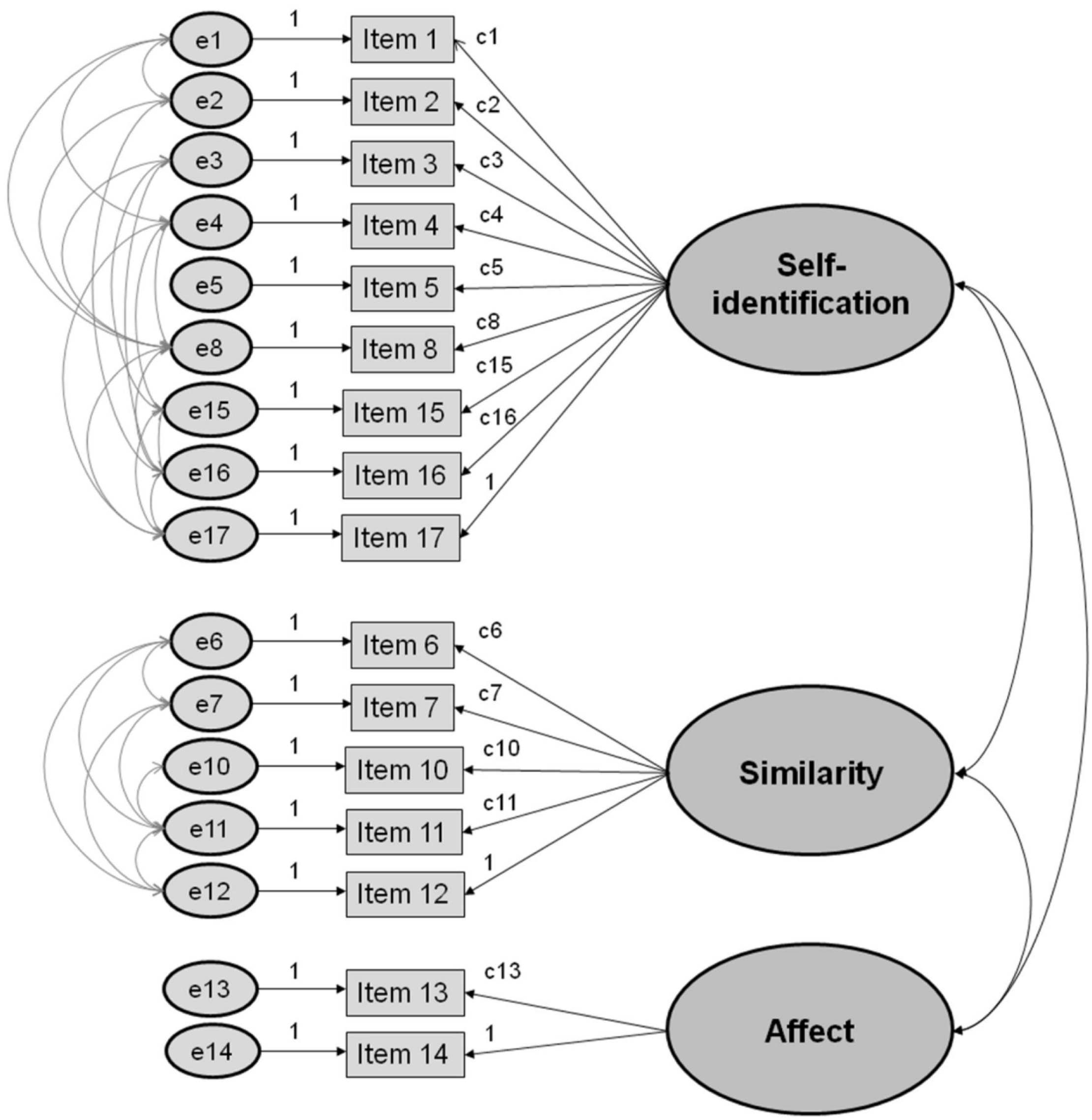

Figure 1.
Three-factor model of factorial structure for the introspective experience of enfacement. The variables measuring each factor (items 1-17) were those identified by the PCA, the reliability of which is influenced by random measurement error (e1-e17). Each of the observed variables was regressed into its respective factor, and the three factors were intercorrelated. Error terms being part of the same factor were covaried and equality constraints were imposed to factor loadings (c1-c16).

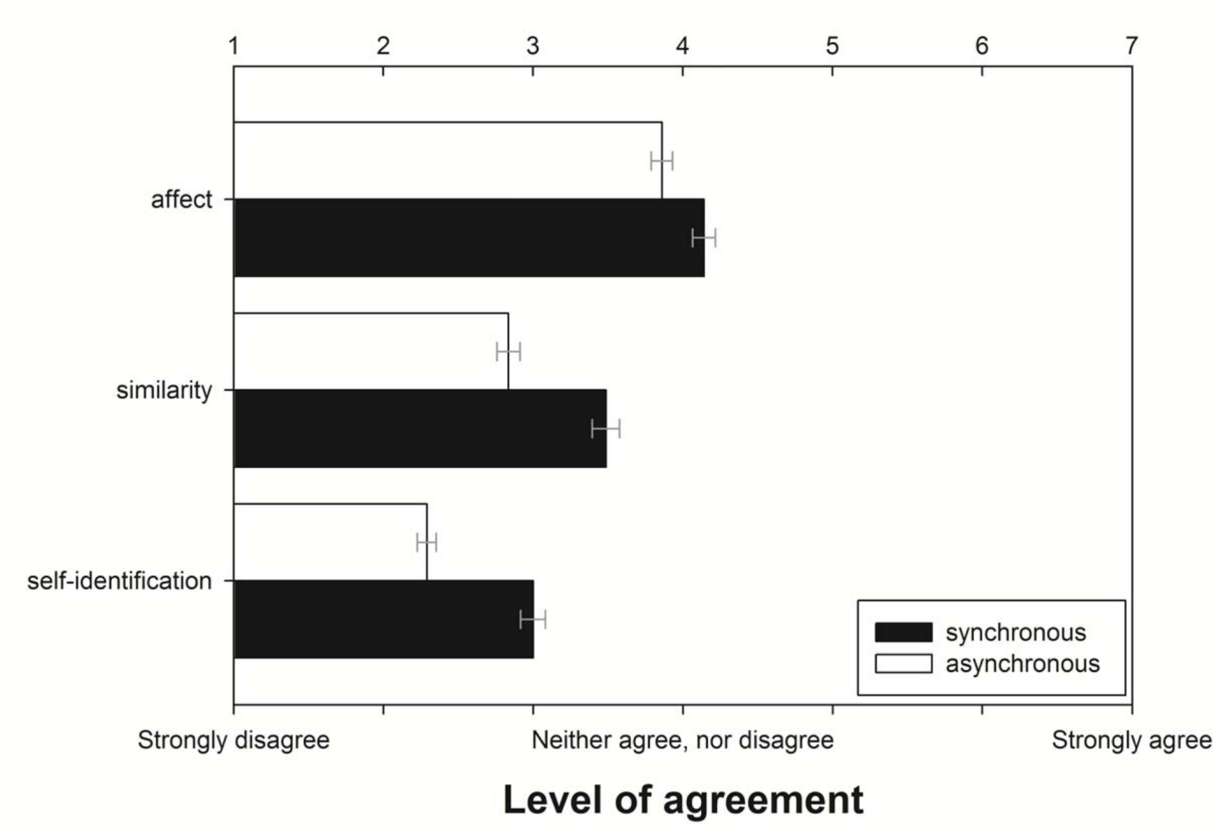

Figure 2.
Mean component scores (± *SE*) for both synchronous and asynchronous conditions in Experiment 1.

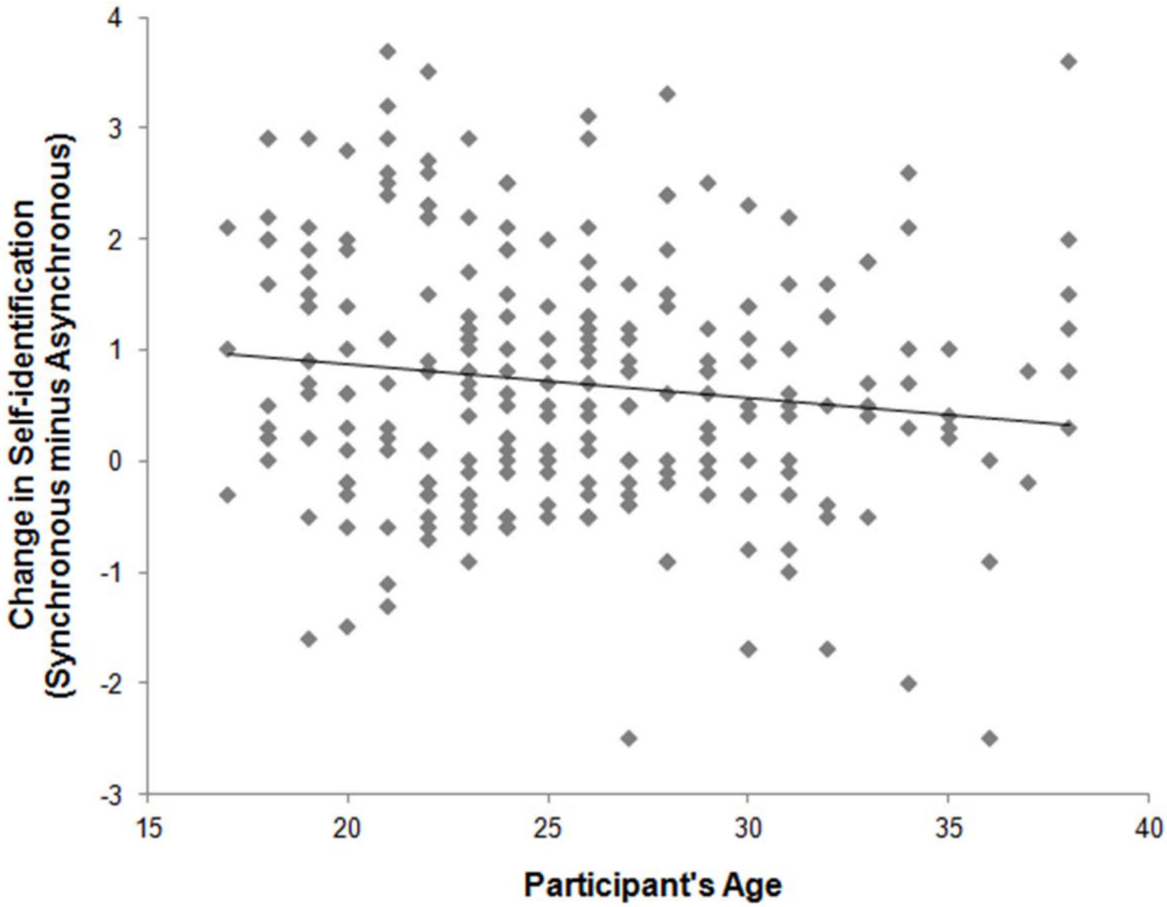

Figure 3.

Negative correlation between participants' age and the change in subjective ratings (i.e., difference between synchronous and asynchronous stimulation) for the component score "self-identification" in Experiment 1.

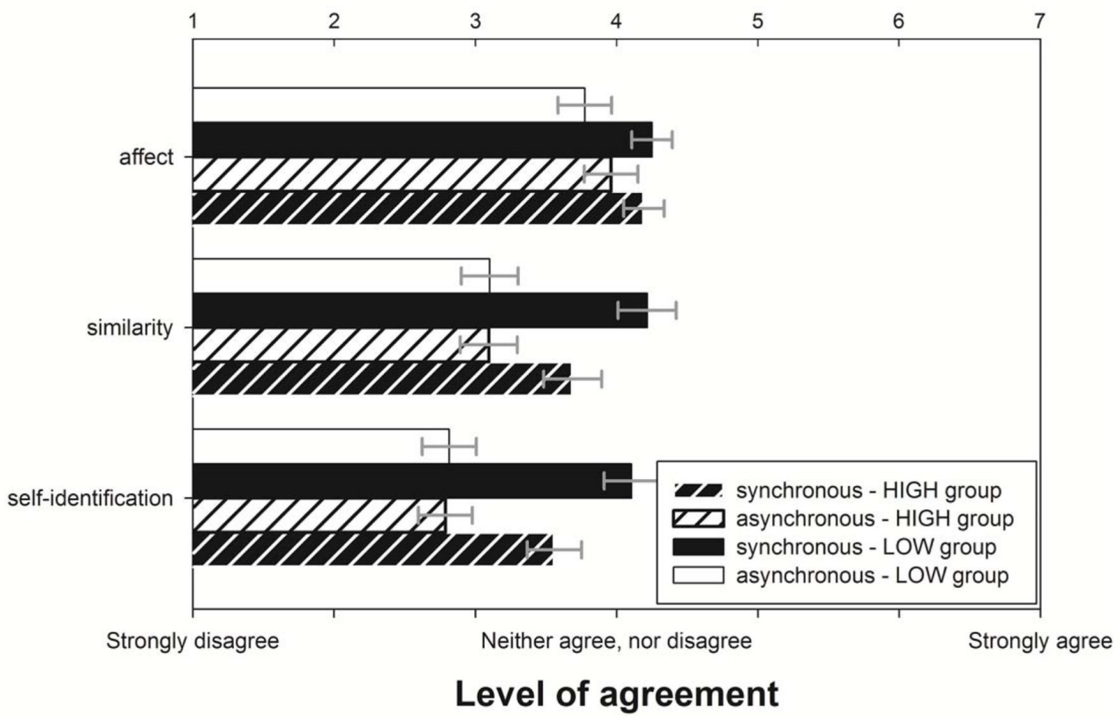

Figure 4.
Mean component scores (± *SE*) for both synchronous and asynchronous conditions and for each interoceptive sensitivity group (HIGH and LOW groups) in Experiment 2.

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Table 1

Mean responses (± *SD*) to the statements for synchronous and asynchronous conditions. The level of agreement with the statements was rated using a 7-item Likert scale. A response of 7 indicated "strongly agreed", 1 "strongly disagreed" and 4 "neither agreed nor disagreed" with the statement.

Item	During the visuo-tactile stimulation…	Synchronous	Asynchronous	*t*	*P*
1	"The touch I felt was caused by the cotton bud touching the other's face"	2.73 *(1.8)*	2.11 *(1.6)*	4.94	.000
2	"The touch I saw on the other's face was caused by the cotton bud touching my own face"	2.99 *(2)*	2.07 *(15)*	8.13	.000
3	"I felt like the other's face was my face"	2.97 *(1.9)*	2.02 *(1.4)*	8.18	.000
4	"It seemed like the other's face belonged to me"	2.72 *(1.7)*	1.96 *(1.4)*	7.12	.000
5	"It seemed like I was looking at my own mirror reflection"	2.97 *(1.8)*	2.13 *(1.5)*	7.09	.000
6	"It seemed like the other's face began to resemble my own face"	3.35 *(1.9)*	2.63 *(1.6)*	5.73	.000
7	"It seemed like my own face began to resemble the other person's face"	3.25 *(1.9)*	2.54 *(1.6)*	5.65	.000
8	"It seemed like I was in control of the other's face"	2.68 *(1.8)*	2.05 *(1.3)*	5.72	.000
9	"It seemed like my own face was out of my control"	2.85 *(1.7)*	2.58 *(1.7)*	2.43	.016
10	"It seemed like the experience of my face was less vivid than normal"	3.55 *(1.7)*	3.29 *(1.7)*	2.08	.039
11	"It seemed like the face of the person in the video was similar to mine"	3.62 *(1.8)*	2.95 *(1.7)*	5.77	.000
12	"It seemed like my face was similar to the face of the person in the video"	3.71 *(1.8)*	2.97 *(1.7)*	5.97	.000
13	"It seemed like the person in the video was attractive"	3.89 *(1.5)*	3.63 *(1.5)*	2.35	.019
14	"It seemed like the person in the video was trustworthy"	4.46 *(1.5)*	4.20 *(1.4)*	2.62	.009
15	"I felt that I was imitating the other person"	3.60 *(2)*	3.02 *(1.9)*	3.93	.000
16	"I felt that other person was imitating me"	2.84 *(1.7)*	2.39 *(1.7)*	3.23	.001
17	"I felt that I blinked when the other person blinked"	3.40 *(2.1)*	2.81 *(1.9)*	3.56	.000
18	"I felt affiliated with the person in the video"	3.91 *(1.8)*	3.32 *(1.8)*	4.15	.000

Table 2

Summary of factor loadings resulting from the principal component analyses with Varimax Rotation ran separately for the synchronous and asynchronous conditions.

Item	During the visuo-tactile stimulation…	Synchronous				Asynchronous					
		Syn-C1	**Syn-C2**	**Syn-C3**	**Commu-nalities**	**Asyn-C1**	**Asyn-C2**	**Asyn-C3**	**Asyn-C4**	**Asyn-C5**	**Commu-nalities**
1	"The touch I felt was caused by the cotton bud touching the other's face"	.311	**.552**	.079	.408	**.714**	−.010	.018	.136	.102	.539
2	"The touch I saw on the other's face was caused by the cotton bud touching my own face"	.249	**.648**	−.076	.487	**.599**	.138	.067	−.321	.191	.522
3	"I felt like the other's face was my face"	**.733**	.400	.059	.700	**.670**	.425	.123	−.042	.138	.666
4	"It seemed like the other's face belonged to me"	**.741**	.405	.113	.726	**.711**	.449	.141	.043	.067	.734
5	"It seemed like I was looking at my own mirror reflection"	**.742**	.347	.167	.699	**.695**	.432	.165	.000	−.076	.703
6	"It seemed like the other's face began to resemble my own face"	**.807**	.263	.121	.734	.486	**.600**	.186	.052	.190	.669
7	"It seemed like my own face began to resemble the other person's face"	**.715**	.403	.135	.692	.414	**.686**	.109	.074	.187	.694
8	"It seemed like I was in control of the other's face"	.475	**.644**	.066	.645	**.754**	.157	.140	−.008	−.051	.616
9	"It seemed like my own face was out of my control"	.205	**.691**	.204	.562	.484	.016	−.005	.219	**.548**	.583
10	"It seemed like the experience of my face was less vivid than normal"	.204	**.552**	−.124	.362	−.032	.249	.030	−.112	**.794**	.707
11	"It seemed like the face of the person in the video was similar to mine"	**.791**	.135	.345	.763	.230	**.830**	.098	.203	.125	.807
12	"It seemed like my face was similar to the face of the person in the video"	**.753**	.198	.335	.718	.163	**.831**	.096	.227	.111	.789
13	"It seemed like the person in the video was attractive"	.193	−.050	**.727**	.569	−.027	.158	−.049	**.764**	.062	.615
14	"It seemed like the person in the video was trustworthy"	.141	.070	**.758**	.599	−.051	.433	−.010	**.570**	−.250	.578
15	"I felt that I was imitating the other person"	.169	**.616**	.436	.598	.359	.133	.267	.470	.387	.589
16	"I felt that other person was imitating me"	.261	**.514**	.136	.351	.227	.129	**.593**	−.164	.087	.454
17	"I felt that I blinked when the other person blinked"	.135	**.550**	.455	.528	.202	−.099	**.783**	.124	−.003	.679
18	"I felt affiliated with the person in the video“	.456	.353	.475	.558	−108	.345	**.731**	.016	−.010	.666
Eigenvalues		8.023	1.482	1.194		6.306	1.869	1.374	1.055	1.004	
% Variance Explained		44.572	8.232	6.631		35.035	10.385	7.631	5.863	5.580	

Note. Factor loadings stronger than 0.5 are in boldface.

Table 3

Summary of component loadings resulting from the principal component analysis with Varimax Rotation ran on the mean values for the synchronous and asynchronous conditions.

Item	During the visuo-tactile stimulation…	Self-identification	Similarity	Affect	Communal ities
1	"The touch I felt was caused by the cotton bud touching the other's face"	**.683**	.200	−.056	.509
2	"The touch I saw on the other's face was caused by the cotton bud touching my own face"	**.729**	.230	−.208	.628
3	"I felt like the other's face was my face"	**.657**	.481	.163	.690
4	"It seemed like the other's face belonged to me"	**.704**	.447	.246	.755
5	"It seemed like I was looking at my own mirror reflection"	**.701**	.375	.250	.695
6	"It seemed like the other's face began to resemble my own face"	**.508**	**.621**	.239	.700
7	"It seemed like my own face began to resemble the other person's face"	.491	**.663**	.232	.735
8	"It seemed like I was in control of the other's face"	**.792**	.290	.039	.713
9	"It seemed like my own face was out of my control"	.440	.494	−.016	.438
10	"It seemed like the experience of my face was less vivid than normal"	.131	**.698**	−.299	.594
11	"It seemed like the face of the person in the video was similar to mine"	.290	**.688**	.482	.790
12	"It seemed like my face was similar to the face of the person in the video"	.236	**.709**	.478	.788
13	"It seemed like the person in the video was attractive"	.115	−.041	**.735**	.555
14	"It seemed like the person in the video was trustworthy"	.002	.161	**.685**	.495
15	"I felt that I was imitating the other person"	**.516**	.315	.301	.456
16	"I felt that other person was imitating me"	**.666**	.092	.186	.487
17	"I felt that I blinked when the other person blinked"	**.557**	.061	.246	.374
18	"I felt affiliated with the person in the video"	.223	.466	.428	.449
Eigenvalues		8.107	1.708	1.037	
% Variance Explained		45.041	9.487	5.762	

Note. Factor loadings stronger than 0.5 are in boldface.