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Strange-face illusions during eye-to-eye gazing in dyads: specific effects on derealization, depersonalization and dissociative identity

Giovanni B. Caputo, PhD

DISTUM, University of Urbino, Urbino, Italy

ABSTRACT

Experimentally induced strange-face illusions can be perceived when two individuals look at each other in the eyes under low illumination for about 10 minutes. This task of subject-other eye-to-eye gazing produces the following perceptions by the subject: (i) mild to huge deformations and color/shape changes of face and facial features; (ii) lifeless, unmoving faces and immaterial presences akin to out-of-body experiences; (iii) pseudo-hallucinations, enlightened 'idealized' faces and personalities – rather than the other's actual face. Dissociative phenomena seem to be involved, whereas the effects of non-pathological dissociation on strange-face illusions have not yet been directly investigated. In the present study, dissociative perceptions and strange-face illusions were measured through self-report questionnaires on a large sample (N = 90) of healthy young individuals. Results of correlation and factor analyses suggest that strange-face illusions can involve, respectively: (i) strange-face illusions correlated to derealization; (ii) strange-face illusions correlated to depersonalization; and (iii) strange-face illusions of identity, which are supposedly correlated to identity dissociation. The findings support the separation between detachment and compartmentalization in dissociative processes. Effects of gender show that strange-face illusions are more frequent in men with respect to women if dyads are composed of individuals of different-gender. Furthermore, drawings of strange-faces, which were perceived by portrait artists in place the others' faces, allowed a direct illustration of examples of dissociative identities. Findings are discussed in relation to the three-level model of self-referential processing.

Introduction

The dissociative disorders are regarded as discontinuities "in the normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control, and behaviour" (American Psychiatric Association, 2013; Spiegel et al., 2013). Symptoms of dissociation involve distortions in visual perception, changes of time and space representations,

memory gaps, distortions of one's own body representation, and out-of-body experiences (Bremner et al., 1998; Holmes et al., 2005).

There are two interrelated and yet separable types of dissociation (Chiu et al., 2015; Waller, Putnam, & Carlson, 1996; Waller & Ross, 1997). Pathological dissociation – including distorted perception of bodily sensations and emotions, and autobiographical amnesia – is more restricted in clinical populations. Non-pathological dissociation, which includes absorption and mild gaps in awareness, is also widespread in normal individuals (Ross, Joshi, & Currie, 1990). From a cognitive viewpoint, studies have highlighted that both pathological and non-pathological dissociative experiences entail altered states of consciousness (Brown, 2006; Cardeña & Carlson, 2011; Frewen & Lanius, 2015; Holmes et al., 2005; Putnam, 1997; Steele, Dorahy, Van der Hart, & Nijenhuis, 2009).

The DSM-5 (American Psychiatric Association, 2013) distinguishes three dissociative disorders: depersonalization/derealization, dissociative amnesia, and dissociative identity disorder. Depersonalization describes a subjective experience of 'detachment' from one's body and self, while derealization concerns a subjective experience of 'detachment' from the external world (Holmes et al., 2005). In a state of derealization, patients feel the external world as unfamiliar, unreal, dream-like, or as though they were viewing life from behind a glass (Hunter, Phillips, Chalder, Sierra, & David, 2003; Simeon, 2009). In a state of depersonalization, patients feel a sense of unreality and detachment from themselves, as if their actions, bodies, sensations, feelings, or thoughts do not belong to themselves (American Psychiatric Association, 2013). Depersonalization/derealization have not been distinguished in DSM-5, because there is some evidence that both symptoms can be present in patients (Simeon, 2009; Spiegel et al., 2013). In both depersonalization and derealization, 'detachment' can involve a common neurophysiologic mechanism, which minimizes the impact of potentially debilitating affects in threatening situations (Sierra & Berrios, 1998).

Dissociative amnesia is characterized by an inability to recall autobiographical information after a traumatic event (American Psychiatric Association, 2013). Dissociative amnesia can involve one's entire identity or can concern repetitive memory gaps that turn one's entire past into a puzzle with missing pieces (Dell, 2013). Forgotten memories are still present and can influence behavior (Huntjens, Postma, Peters, Woertman, & van der Hart, 2003), whereas they cannot be organized into a 'cohesive narrative' (Huntjens, Dorahy, & van Wees-Cieraad, 2013).

Dissociative identity disorder refers to the existence of two or more distinct identities and recurrent gaps in autobiographical memory (American Psychiatric Association, 2013). Abrupt transitions between distinct personality states are hallmarks of dissociative identity disorder

(American Psychiatric Association, 2013). Other parallel dissociative disorders are: dissociative fugue, conversion disorder, and somatoform dissociation. Holmes et al. (2005) hypothesized that all these disorders involve 'compartmentalization', which is a deficit in the voluntary control of mental processes and actions. The 'compartmentalized' functions continue to process information normally and are capable of influencing ongoing emotions, cognitions and actions while being inaccessible to voluntary control and conscious awareness (Holmes et al., 2005).

Some authors have conceptualized dissociative experiences as a pathological progression on a continuum stemming from normal integration of consciousness, followed by depersonalization and derealization, through to dissociative amnesia, and finally to dissociative identity disorder (Bernstein, Ellason, Ross, & Vanderlinden, 2001; Bernstein & Putnam, 1986; Bremner et al., 1998; Spiegel, 1997). Adversely, other authors proposed that 'detachment' and 'compartmentalization' are separated disorders that can occur in isolation (Holmes et al., 2005). Indeed, clinical studies based on self-report scales of dissociation found independence between depersonalization/derealization (i.e. 'detachment') and 'compartmentalization' disorders (Baker et al., 2003; Simeon, Knutelska, Nelson, Guralnik, & Schmeidler, 2003). Studies based on factor analysis of self-report scales found independent factors for 'detachment' and 'compartmentalization' (Carlson & Putnam, 1993; Ross, Ellason, & Anderson, 1995; Stockdale, Gridley, Balogh, & Holtgraves, 2002).

In the past, researchers developed experimental techniques for investigating non-pathological dissociation in the laboratory. Experimental tools for producing dissociation were comprised of: dot staring, mirror staring, spiral staring, strobe light, hyperventilation, audio stimulation, and stimulus deprivation (Dorahy, Peck, & Huntjens, 2016; Leonard, Telch, & Harrington, 1999; Lickel, Nelson, Lickel, & Deacon, 2008; Miller, Brown, DiNardo, & Barlow, 1994). Another experimental technique consisted of viewing films made of several clips, which showed car crashes and interpersonal violence, and this induced dissociative amnesia by intrusive memories of film scenes (Brewin, 2014; Holmes, Oakley, Stuart, & Brewin, 2006; James et al., 2016).

A recent experimental tool in producing dissociation is self-face mirror-gazing under low illumination (Caputo, 2010a) and intersubjective eye-to-eye gazing in dyads under low illumination (Caputo, 2013). Both experimental procedures, mirror-gazing and eye-to-eye gazing, consistently produce perception of strange-face illusions in place of the actual face. Observers perceive distortions of their own faces or of the others' face, monsters, unknown individuals, archetypical faces, dead peoples' faces, faces of relatives, and of animals. Strange-face illusions can be evaluated in terms of strength and frequency with psychophysical measurements (Caputo, 2010b, 2013; Caputo et al., 2012; Derome

et al., 2018; Fonseca-Pedrero et al., 2015), through dissociation questionnaires (Brewin, Ma, & Colson, 2013; Brewin & Mersaditabari, 2013), or through self-report with strange-face questionnaires (Caputo, 2015, 2017). In previous studies, strange-face illusions have been variously explained by the effect of general dissociation (Brewin et al., 2013; Brewin & Mersaditabari, 2013), by depersonalization (Derome et al., 2018; Fonseca-Pedrero et al., 2015), or by identity dissociation (Caputo, 2010b). However, it is not clear which components of dissociation are involved in strange-face illusions, since both derealization/depersonalization (i.e. 'detachment') and hallucination-like perceptions (i.e. 'compartmentalization' of pseudo-hallucinations; Brown, 2006) are involved (Caputo, 2015). From the neurophysiologic viewpoint, higher depersonalization of strange-face illusions is produced by lower connectivity of visual areas within the primary visual network, and higher connectivity of brain areas within the default mode network (Derome et al., 2018).

From a theoretical viewpoint, strange-faces are complex illusions (Collerton et al., 2016; Frewen & Lanius, 2015; Hood, 2012), which involve the misrepresentation of the self (and of the other) at different levels of mental processing. According to the model of the self (Northoff et al., 2006; see for similar models Sakson-Obada, Chudzikiewicz, Pankowski, & Jarema, 2018; Stanghellini et al., 2014), three different levels of processing of the self can be distinguished from a mental and neurophysiologic standpoint: firstly, the sensory and spatial-temporal processing mapped on to the subject's body, and defined as the 'bodily-self'; secondly, the pre-reflective ego-referential processing related to the 'minimal-self' and connected to the sense of one's body 'mineness'; thirdly, the 'narrative-self', which is related to autobiographical, emotional, symbolic and social self, which is built by linking together past, present and future events into one identity – in other words, the 'identity-self'. In relationship to strange-face illusions, Derome et al. (2018), on the basis of fMRI findings, posited that the first and second level of the self could be involved during strange-face illusions. However, it is likely that the third level of 'identity-self' would be involved, since observers show natural propensity to describe the 'narrative' identity of the strange-self /other who appear abruptly in front of them. For example, healthy individuals can describe strange-others as ancestors, old persons or children, etc.; schizophrenic patients can describe strange-others as their true animal faces or persecutors. Hence, it can be hypothesized that each of the three levels of discontinuity in the integration of the self – which can be predicted on the basis of the model of self-referential processing (Northoff et al., 2006) – produces both a different type of strange-face illusions and a different type of dissociative state of consciousness. Three 'prototypes' of strange-face illusions could be hypothesized.

A general limitation of previous studies on strange-face illusions (Caputo, 2010a, 2015) is small samples of individuals who were employed (Jenkinson & Preston, 2017). Moreover, in the previous study on dyads (Caputo, 2015) the correlation between strange-face illusions and non-pathological dissociation was not found. The general purpose of the new research reported here was to determine the limitations of the above-mentioned articles by studying strange-face illusions on a large sample of normal individuals. Furthermore, given that dissociation is a multi-facet disorder, it would be important to study the relationship between strange-face illusions and specific aspects of dissociation. The hypothesis of this study is that strange-face illusions may be related to specific facets of dissociation.

As previously discussed, another limitation of former strange-face illusion studies is that the evidence was only indirect because it was based on psychophysical measures, verbal descriptions, dissociation scales, or questionnaires. However, direct evidence of strange-face illusions is still lacking. The specific purpose of the present research was to overtly display strange-face illusions. This was done by employing portrait artists and asking them to draw their perceptions of the other's face at the end of an intersubjective eye-to-eye gazing session. According to the finding that strange-face illusions involve different types of perceptions and different dissociative states of consciousness, different types of strange-face illusions should emerge from different artists.

Methods

The experiment was run in accordance with the Helsinki declaration of human rights. A University-based research ethics committee approved the study.

Participants

Ninety volunteers participated in the research. They were a large sample of healthy young individuals (N = 90; 61 women and 29 men; range 19–36 years; mean age 22 years, st.dev. 2.3). Participants were students and employees from various University and Academy faculties, artists and also unrelated individuals. All participants were Caucasians. Among the participants, there were 15 portrait artists. All participants were naïve observers who had no previous experience in psychological experiments and tests, and no history of psychiatric deficits. The current experiment was the first time in which they experienced strange-face illusions in the laboratory. They were volunteers and did not receive monetary rewards. They provided informed consent following the explanation of the experiment procedures. The anonymity of participants was granted through a double-blind administration of the experimental task.

Materials

The experiment was conducted in a silent 3 m × 5 m room obscured from external light. Two chairs were positioned in the center of the room (Figure 1). The two participants were seated with about a 1 m distance between their heads. The empty space between the chairs (0.4 m) was covered with a flat opaque panel, which was fixed to the chairs with screws. Under the flat panel, at the very center of the room and halfway between the two chairs, a fixed spotlight was mounted with a halogen lamp (10 W) producing a fixed beam illumination. The spotlight beam pointed toward the floor to provide indirect and diffused lighting within the room. The flat panel served to avoid artefactual illumination of faces from below. Faces received a relatively uniform illumination without shadow and contrast artifacts. Illumination of faces was 0.8 lx. This level of illumination allowed detailed perception of fine face traits but attenuated color perception, after a few minutes of light adaptation.

The experimenter was seated about 2 m away from the pair, on one side of the room and in an orthogonal direction with respect to the participants' face. The experimenter verified that the two participants executed the experimental task correctly and did not intervene in any phase of the intersubjective-gazing task.

Measures

State dissociation (CADSS)
The 19 subjective items from Clinician Administered Dissociative States Scale (CADSS) (Bremner et al., 1998) were used to assess dissociation.
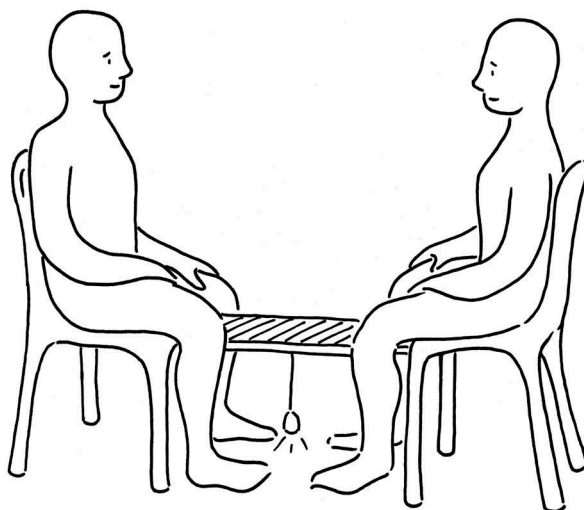

Figure 1. Installation for the eye-to-eye gazing test. Drawing by Alberto Conte.

CADSS items are shown in Table 3. The response to each item is rated on a 5-point Likert scale. The participant endorses one of a range of possible responses: 'not at all' (0), 'slightly' (1), 'moderately' (2), 'considerably' (3), 'extremely' (4).The CADSS-total score can range from 0 to 76. Subscales of CADSS provide measures of depersonalization, derealization, and dissociative amnesia. Items 3–7 give a measure of depersonalization. Items 1, 2, 8–13, 16–19 give a measure of derealization. Items 14, 15 provide a measure of dissociative amnesia.

Strange-Face Questionnaire (SFQ)

The 19 subjective items from Strange-Face Questionnaire (SFQ) (Caputo, 2015, p. 2017) were used to assess strange-face illusions. SFQ items are shown in Table 2. The response to each item is rated on a 5-point Likert scale: 'not at all' (0), 'slightly' (1), 'moderately' (2), 'considerably' (3), 'extremely' (4). Statistical analyses are performed on scores of item 1–18; item-19 was a response control. Mean scores of items are calculated among participants. SFQ-total score is calculated by adding the scores of items 1–18. SFQ-total score can range from 0 to 72.

For descriptive purposes, the number of 'yes' responses [which is indicated by n('yes') in Table 2] is calculated by the number of participants who endorsed responses from 'rarely' to 'extremely', thus excluding participants who endorsed 'not at all' response, in order to evaluate the effective frequency of each illusion among the participants that did actually perceive it. Finally, SFQ-relative scores [which is indicated by Likert('yes') in Table 2] are calculated for each item by averaging ratings from 'rarely' (1) to 'extremely' (4), relatively to n('yes') participants, in order to evaluate effective strengths of each illusion among the participants that did actually perceive it.

Procedure

The participants were randomly assigned to 45 dyads and pairs met directly at the laboratory. Random assignment to dyads produced 26 same-gender pairs (FF or MM) and 19 different-gender pairs (FM).

Participants of each dyad met at the laboratory, where they were introduced to the experimental setting. The experimenter explained that the aim of the research was "*the perception of the face of another person*". This description was chosen in order to avoid biases into the observers' expectations.

The pair of participants sat in two chairs positioned one in front of the other. They received the following written instructions: "*Maintain a neutral facial expression. Your task is to look at the other participant. Keep gazing in the eyes of the other participant. The session will last ten minutes.*"

The experimental session began with a few minutes of light adaptation. Participants were invited to relax their bodies and faces, to avoid smiling and laughing, and to customize with a neutral facial expression. Then, the 10-minute eye-to-eye gazing task followed. At the end of the session, normal light illumination of the room was turned on and participants were given a sheet of paper that contained, on one side, SFQ items and, on the other side, CADSS items (test order was counterbalanced). Items of SFQ and CADSS were not otherwise distinguishable. Participants were invited to rate their response to each item if they had perceptions described by that item or to respond 'not at all' if they had none.

Fifteen portrait artists were paired in dyads with non-artists. They were invited, after completing the questionnaires, to sketch drawings of the illusory faces that they had *perceived* in place of the actual face of the other member of the dyad.

At the end of the experiment, participants were fully debriefed by inviting them to freely describe their perceptions and feelings. This dialogue was relatively long and involved possible explanations of participants' experiences mediated by the experimenter. As found in the previous research (Brewin et al., 2013), the non-pathological dissociation produced by mirror-gazing has a short-term effect which is completely dissipated within 15 minutes of the end of the session.

Data analyses

Correlations (Pearson) were calculated between scales, subscales, and items. Cronbach's alpha was used to evaluate reliability between CADSS and SFQ scales. Partial correlations were calculated between SFQ and each one of the three CADSS subscales when controlling for the other two remaining CADSS subscales. In order to reduce type I errors, the statistical significance of correlations was established to $p < 0.01$, given that the sample of participants was relatively large.

Regression analysis was performed with linear regression in order to assess the relationship between SFQ and CADSS total scores. Regression analyses were run for evaluating effects of age of participants on SFQ and CADSS scales, subscales, and items.

Non-parametric tests of Kruskal–Wallis were used in order to assess the effects of gender on SFQ and CADSS scales, subscales, and items. The effect of dyad composition [pairs of same-gender (FF or MM) versus mixed-gender (FM)] was analyzed with non-parametric tests of Kruskal–Wallis.

Given that non-parametric two-factor statistical analysis does not exist, the interaction between gender and dyad composition was investigated through between-subject two-factor ANOVA.

Principal component analysis (PCA) on SFQ-scores was performed to obtain dimensional reduction through factor analysis. The number of factors

extracted was determined through inspection of the plot of eigenvalues, and determined by the number of components that emerged from the plateau. Matrix rotation used Promin. Correlations and partial correlations were calculated between SFQ-factors and CADSS scale and subscales. Statistical significance of correlations was established at $p < 0.01$.

Results

Regressions

Individual measures of SFQ and CADSS total scores are plotted in Figure 2. Regression analyses showed that age differences had a non-significant effect on SFQ-total scores [$F(1, 88) = 1.6$; $p > 0.2$] and CADSS scores [$F(1, 88) = 0.03$; $p > 0.9$].
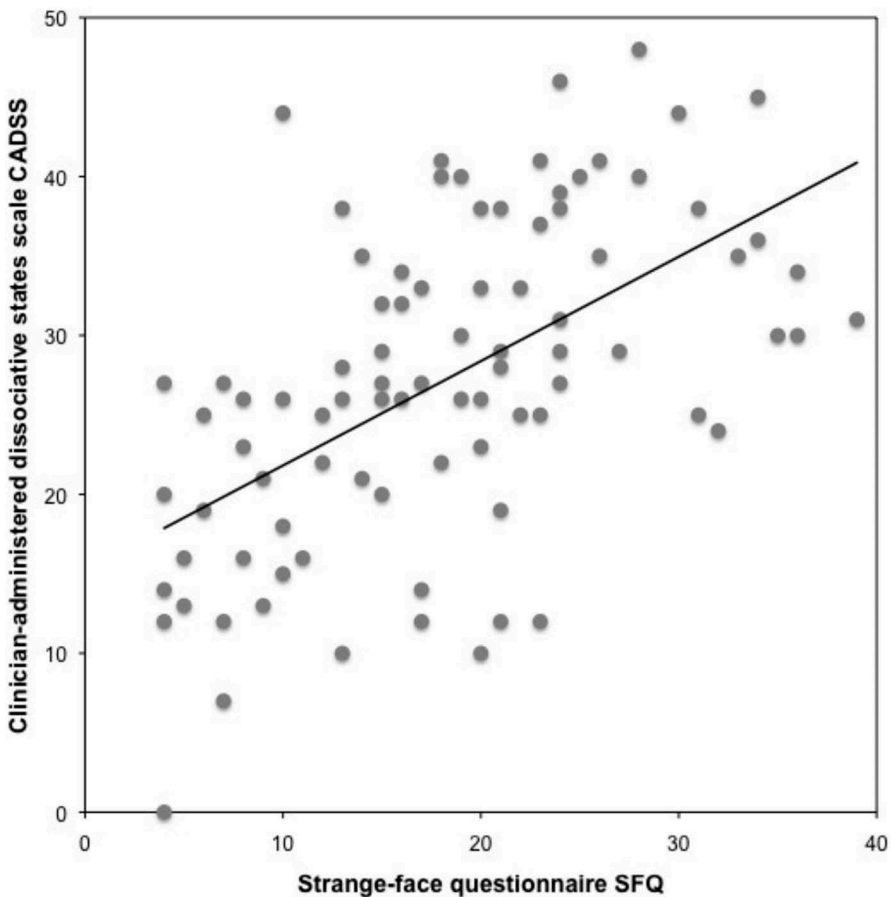

Figure 2. Individual SFQ-total and CADSS-total scores.

Non-parametric tests and ANOVAs

Non-parametric Kruskal–Wallis tests showed that differences of gender had a non statistically significant effect on SFQ-total score (p = 0.22), CADSS-total score (p = 0.79), CADSS subscales of depersonalization (p = 0.28), derealization (p = 0.86), and amnesia (p = 0.90). Single-item analyses showed that there was a significant effect of gender on item-4 (monster) of SFQ, with men scoring more monsters than women [p = 0.02; men vs. women: 1.6 (SD = 1.2) vs. 1.0 (1.1)] and on item-8 (old), with men scoring more old-person-illusions than women [p = 0.05; men vs. women: 0.9 (1.1) vs. 0.4 (0.9)]. There was a significant effect of gender on item-10 of CADSS [p = 0.03; men vs. women: 2.7 (1.0) vs. 2.2 (1.1)].

Non-parametric Kruskal–Wallis tests showed that composition of dyads [same-gender (FF or MM) vs. different-gender (FM)] had non-significant effects on SFQ-total (p = 0.32), CADSS-total (p = 0.86), CADSS-depersonalization (p = 0.67), and CADSS-derealization (p = 0.68). The effect of dyad composition was significant on CADSS-amnesia [p = 0.04; same- vs. different-gender: 3.3 (0.2) vs. 4.2 (0.3)]. The effect of dyad composition was significant on item-5 (stranger) of SFQ [p = 0.003; same- vs. different-gender: 1.5 (0.2) vs. 2.3 (0.2)], item-11 (animal) of SFQ [p = 0.005; same- vs. different-gender: 0.3 (0.1) vs. 0.8 (0.2)], item-12 (relatives) of SFQ [p = 0.02; same- vs. different-gender: 0.06 (0.0) vs. 0.4 (0.1)]. Therefore, some strange-face illusions increased when dyads were made of individuals of different-gender with respect to same-gender dyads. No significant effects were found on CADSS items.

Two-factor ANOVA showed that the interaction between gender and dyad composition was statistically significant on SFQ-total [F(1, 86) = 4.4; p = 0.04]. Post-hoc analysis showed that the effect is produced by gender within different-gender dyads [F(1, 36) = 4.7; p = 0.04], with men perceiving more strange-face illusions in women's face than the opposite [men vs. women: 22.4 (9.9) vs. 16.1 (8.0)].

Correlations

Correlations are statistically significant between SFQ-total and CADSS scale and subscales (Table 1). The three CADSS subscales were inter-correlated. Partial correlations show that SFQ-total is distinctively correlated with the derealization as measured by CADSS.

Mean scores of SFQ items (Table 2) show correlations with the CADSS scale and subscales. Correlations are mostly significant for deformation, monstrosity, immaterial 'presence', and luminosity of strange-face illusions.

SFQ items most commonly endorsed with a 'yes' response are shown in Table 2 [n('yes')]. Different strange-face illusions have different occurrences,

with some illusions perceived by most observers (e.g. dark, deformed, unknown, and inanimate faces) and others less frequent (e.g. relatives). On the other side, ratings of strange-face illusions relative to n('yes') show that different illusions are similar in subjective strength [Likert('yes') in Table 2].

Mean scores of CADSS items and correlations with SFQ-total scores are displayed in Table 3. In particular, correlations are significant for CADSS items connected to spatial-temporal world dissociation, perceptual change of colors, out-of-body experiences, and the unpredictability of illusions.

Factor analysis

Factor analysis (PCA) extracted three components, which are shown in Table 4 (coefficients lower than 0.4 are not displayed). The three factors explained 43.4% of the variance. Two factors (I and III) are correlated with CADSS measures of dissociation. Partial correlations show that factor-I is significantly correlated to CADSS-derealization and factor-III to CADSS-depersonalization.

Contrarily, factor-II is independent of CADSS measures of dissociation, as shown by lack of correlations with other measures of derealization, depersonalization and dissociative amnesia. In the Discussion section, the hypothesis is advanced that factor-II can reflect non-pathological identity dissociation, which is a compelling aspect of 'compartmentalization' (Holmes et al., 2005).

Correlations between SFQ-factors and CADSS-items (Table 5) show that: (i) CADDS-items 9 and 18 are specifically correlated to factor-I (derealization); (ii) CADSS-items 17 and 19 are specifically correlated to factor-II (supposedly, dissociative identity); (iii) CADSS-items 4, 6, 11, and 13 are specifically correlated to factor-III (depersonalization); (iv) CADSS-items 2 and 14 are correlated to both factor-I and factor-III.

Table 1. First column: mean scores ($N = 90$) obtained on scales of strange-face illusions (SFQ) and dissociation (CADSS) scale and subscales. Second column: correlations between SFQ and CADSS scale and subscales. Third column: partial correlations between SFQ and CADSS subscales. Standard deviation (SD) in parentheses.

	Mean (SD)	Corr. SFQ	Partial corr. SFQ
Strange-Face Questionnaire (SFQ)	18.1 (8.7)		
Clinician Administered Dissociative States Scale (CADSS)	27.1 (10.1)	0.56**[§]	
CADSS-derealization	17.7 (6.6)	0.56**	0.42**
CADSS-depersonalization	5.7 (3.6)	0.39**	0.14
CADSS-amnesia	3.7 (1.9)	0.32*	0.03

*p < 0.01; **p < 0.001.
[§]Cronbach's alpha = 0.72.

Table 2. First column: items of SFQ. Second column: mean scores of SFQ items. Third-to-sixth columns: correlations between scores of SFQ items and scores on CADSS scale and subscales. Seventh column [n('yes')]: number of participants (total N = 90) who endorsed SFQ items with a 'yes' response (i.e. excluding 'not at all' responses). Eighthn Likert-scale rating of SFQ items relative to n('yes').

Strange-Face Questionnaire (SFQ)	Mean (SD)	Corr. CADSS-total	Corr. CADSS-derealization	Corr. CADSS-depersonalization	Corr. CADSS-amnesia	n ('yes')	Likert ('yes')
3. Did you see a dark-face?	2.2 (1.4)	0.04	0.10	−0.05	−0.04	74	2.7 (1.0)
1. Did you see that some facial traits were deformed?	2.1 (1.4)	0.47**	0.48***	0.28*	0.30*	70	2.7 (1.0)
5. Did you see a face of a stranger or unknown person?	1.8 (1.3)	0.10	0.09	0.06	0.12	69	2.4 (1.0)
18. Did you see that the face was immobile as inanimate?	1.2 (1.1)	0.15	0.10	0.17	0.11	63	1.7 (1.1)
4. Did you see the face of a monster?	1.2 (1.1)	0.48***	0.45***	0.35***	0.32*	51	2.1 (0.8)
17. Did you perceive a 'presence' of something that physically did not exist?	1.0 (1.1)	0.44***	0.34***	0.38***	0.42**	49	1.7 (1.0)
9. Did you see the face of an adolescent?	1.3 (1.4)	0.32*	0.29*	0.28*	0.17	48	2.4 (1.0)
2. Did you see a luminous face?	1.0 (1.1)	0.40**	0.45**	0.24	0.11	46	1.9 (0.8)
15. Did you see that the face of the other had something in common with your face?	1.0 (1.2)	−0.01	−0.05	0.09	−0.03	44	2.1 (0.9)
16. Did you see two or more faces at the same time?	0.7 (0.9)	0.29*	0.32*	0.13	0.20	41	1.6 (0.8)
13. Did you see the face of a person of a different race than yours?	1.1 (1.4)	0.10	0.12	0.00	0.14	39	2.6 (1.0)
14. Did you see the face of a spiritual person?	0.8 (1.0)	0.31*	0.27	0.36**	0.05	37	1.8 (0.8)
7. Did you see the the face of a child?	0.6 (1.0)	0.16	0.21	0.04	0.03	27	1.9 (0.9)
8. Did you see the face of an old person?	0.6 (1.0)	0.27*	0.31*	0.18	0.04	25	2.0 (0.9)
11. Did you see the face of a domestic or savage animal?	0.5 (1.0)	0.33*	0.30*	0.28*	0.19	22	2.1 (1.0)
10. Did you see the face of a sexually undefined person or an androgyne?	0.4 (0.9)	0.18	0.22	0.06	0.07	21	1.9 (0.9)
6. Did you see the face of a hero or heroine?	0.4 (0.9)	0.22	0.25	0.09	0.13	20	2.0 (0.9)
12. Did you see the face of one of your relatives?	0.2 (0.7)	0.08	0.09	0.02	0.09	10	1.8 (1.1)
19. Did you see a tree?	0	0	0	0	0	0	0

*p < 0.01; **p < 0.001.

Table 3. First column: items of CADSS (Bremner et al., 1998). Second column: mean scores of CADSS items. Third column: correlations with SFQ-total scores.

Clinician Administered Dissociative States Scale (CADSS)	Mean (SD)	Corr. SFQ
1. Do things seem to be moving in slow motion?	1.6 (1.1)	0.17
2. Do things seem to be unreal to you, as if you are in a dream?	1.6 (1.3)	0.49**
3. Do you have some experience that separates you from what is happening; for instance, do you feel as if you are in a movie or a play, or as if you are a robot?	1.2 (1.1)	0.18
4. Do you feel as if you are looking at things from outside of your body?	0.9 (1.2)	0.26
5. Do you feel as if you are watching the situation as an observer or spectator?	1.6 (1.2)	0.28*
6. Do you feel disconnected from your own body?	1.1 (1.1)	0.28*
7. Does your sense of your own body feel changed: for instance, does your own body feel unusually large or unusually small?	0.9 (1.1)	0.22
8. Would people seem motionless, dead, or mechanical?	1.2 (1.2)	0.11
9. Do objects look different than you would expect?	1.3 (1.2)	0.38**
10. Do colors seem to be diminished in intensity?	2.4 (1.1)	0.30*
11. Do you see things as if you were in a tunnel, or looking through a wide angle photographic lens?	1.5 (1.3)	0.22
12. Does this experience seem to take much longer than you would have expected?	2.0 (1.5)	0.06
13. Do things seem to be happening very quickly, as if there is a lifetime in a moment?	0.9 (1.1)	0.35**
14. Do things happen that you later cannot account for?	1.5 (1.3)	0.35**
15. Do you space out, or in some other way lose track of what is going on?	2.2 (1.2)	0.14
16. Do sounds almost disappear or become much stronger than you would have expected?	1.7 (1.3)	0.26
17. Do things seem to be very real, as if there is a special sense of clarity?	1.3 (1.2)	0.20
18. Does it seem as if you are looking at the world through a fog, so that people or objects seem far away or unclear?	1.4 (1.3)	0.23
19. Do colors seem much brighter than you would have expected?	0.8 (1.1)	0.31*

*p < 0.01; **p < 0.001.

Figurative art of strange-face illusions

Fifteen artists created 19 portraits of strange-face illusions they perceived in place of the other's face. Four portraits are displayed in Figure 3.

According to the artists' words, the portraits of Figure 3 represent: (A) a stranger with apparitional features (eyewear) and noticeable facial features, (B) a monstrous monkey-woman, (C) an alien face, and (D) a cartoon-like face with both human and rabbit facial traits. The remaining artists' drawings portrayed different kinds of strange-face illusions: faces with deconstructed 'floating' features, other-race faces, monstrous faces, faces of dead people, animal faces, and faces of unknown young individuals having intense emotional mood and personality. In addition, some artists portrayed their phenomenological experience of a dynamic 'flow' or 'stream' of illusory faces.

None of the portraits corresponded to the actual faces of the others in dyads: both facial traits and global faces were modified. Only one portrait was described as a partial self-portrait of the artist, whereas all other portraits were completely different from the actual faces of the artists. All portraits showed an overrepresentation of eyes. Some portraits exhibited apparition of

Table 4. The three components extracted by factor analysis, which are displayed in decreasing order of variance loading. In the bottom rows, correlations and partial correlations between the three-factor components and CADSS scale and subscales are shown.

Strange-Face Questionnaire (SFQ)	I	II	III
11. Did you see the face of a domestic or savage animal?	0.74		
4. Did you see the face of a monster?	0.66		
5. Did you see a face of a stranger or unknown person?	0.66		
16. Did you see two or more faces at the same time?	0.55		
8. Did you see the face of an old person?	0.55		
1. Did you see that some facial traits were deformed?	0.54		
6. Did you see the face of a hero or heroine?	0.48		
10. Did you see the face of a sexually undefined person or an androgyne?	0.44		
9. Did you see the face of an adolescent?		0.75	
7. Did you see the face of a child?		0.71	
3. Did you see a dark-face?		−0.63	
13. Did you see the face of a person of a different race than yours?		0.52	
15. Did you see that the face of the other had something in common with your face?		0.52	
2. Did you see a luminous face?		0.48	
14. Did you see the face of a spiritual person?		0.49	0.67
12. Did you see the face of one of your relatives?			−0.58
17. Did you perceive a 'presence' of something that physically did not exist?			0.55
18. Did you see that the face was immobile as inanimate?			0.49
Corr. CADSS-total	0.50**	0.19	0.46**
Corr. CADSS-depersonalization	0.30**	0.17	0.43**
Corr. CADSS-derealization	0.52**	0.18	0.40**
Corr. CADSS-amnesia	0.30**	0.07	0.26*
Partial corr. CADSS-depersonalization	0.03	0.09	0.28*
Partial corr. CADSS-derealization	0.41**	0.12	0.20
Partial corr. CADSS-amnesia	0.04	−0.04	0.02

*p < 0.01; ** p < 0.001.

multiple eyes (A). Blanking of facial parts and emptying of eyes (C) were evidenced by some portraits. A specific left/right lateralization of blanking was not evident among the portraits.

Discussion

The results of the present research can be summarized as follows: (1) statistical correlations show that strange-face illusions are specifically related to derealization measured through a standard questionnaire of dissociation (CADSS); (2) however, factor analysis indicates that derealization (factor-I) and depersonalization (factor-III), albeit correlated, can be differentiated in their respective contributions to strange-face illusions; (3) factor analysis found three components of dissociation involved by strange-face illusions, and one component (factor-II of Table 4) was statistically independent of the other two, namely derealization and depersonalization; (4) finally, there are gender differences in strange-face illusions, and these differences are triggered if dyads are composed of

Table 5. Correlations between CADSS-items and SFQ-factors (derealization, dissociative identity (supposedly), and depersonalization, respectively).

Clinician Administered Dissociative States Scale (CADSS)	Corr. factor-I	Corr. factor-II	Corr. factor-III
1. Do things seem to be moving in slow motion?	0.12	0.00	0.19
2. Do things seem to be unreal to you, as if you are in a dream?	0.53**	0.08	0.30*
3. Do you have some experience that separates you from what is happening; for instance, do you feel as if you are in a movie or a play, or as if you are a robot?	0.04	0.26	0.14
4. Do you feel as if you are looking at things from outside of your body?	0.24	0.05	0.38**
5. Do you feel as if you are watching the situation as an observer or spectator?	0.19	0.14	0.18
6. Do you feel disconnected from your own body?	0.21	0.03	0.45**
7. Does your sense of your own body feel changed: for instance, does your own body feel unusually large or unusually small?	0.25	0.04	0.19
8. Would people seem motionless, dead, or mechanical?	0.08	−0.01	0.23
9. Do objects look different than you would expect?	0.38**	0.15	0.16
10. Do colors seem to be diminished in intensity?	0.26	0.02	0.24
11. Do you see things as if you were in a tunnel, or looking through a wide angle photographic lens?	0.23	−0.04	0.30*
12. Does this experience seem to take much longer than you would have expected?	−0.00	0.04	−0.04
13. Do things seem to be happening very quickly, as if there is a lifetime in a moment?	0.26	0.20	0.32*
14. Do things happen that you later cannot account for?	0.30*	0.12	0.32*
15. Do you space out, or in some other way lose track of what is going on?	0.16	−0.01	0.07
16. Do sounds almost disappear or become much stronger than you would have expected?	0.25	0.01	0.22
17. Do things seem to be very real, as if there is a special sense of clarity?	0.24	0.27*	−0.10
18. Does it seem as if you are looking at the world through a fog, so that people or objects seem far away or unclear?	0.31*	−0.10	0.21
19. Do colors seem much brighter than you would have expected?	0.16	0.43**	0.12

*$p < 0.01$; **$p < 0.001$.

individuals of different-gender, where strange-face illusions are higher in men with respect to women.

The first finding agrees with previous studies in mirror-gazing (Brewin et al., 2013; Brewin & Mersaditabari, 2013). Contrarily to an early study (Caputo, 2015), this result demonstrates that both interpersonal eye-to-eye-gazing and mirror-gazing share similar dissociative illusions at a low level of illumination. However, the prevalence of derealization, as found by statistical correlations, over the other dissociative facets, may be explained as a consequence of the fact that standard measures of dissociations (e.g. CADSS) do not involve questions concerning faces, whereas they rest upon basic perceptual features. Correlations between scales and items (Tables 2 and 3) showed, indeed, that measures of strange-face illusions were sparsely correlated to CADSS items. Also, in questionnaires of dissociative identity (Steinberg & Schnall, 2001), no item entails the dissociation of self-face or dissociation of the other's face.
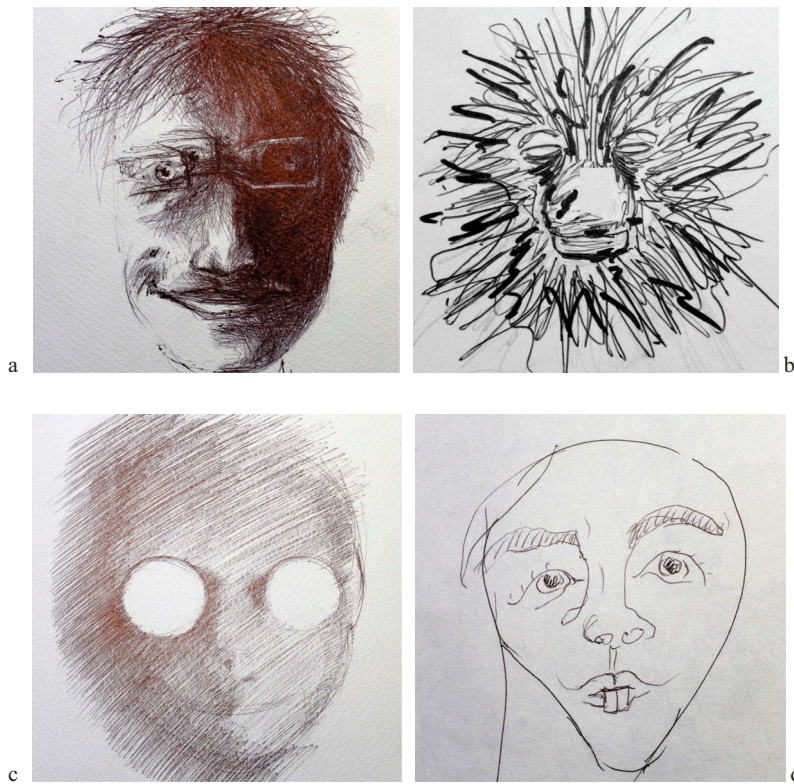
Figure 3. Four examples of strange-face illusions sketched by portrait artists: (A) a stranger with apparitional features (eyewear) and noticeable facial feature, (B) a monstrous monkey-woman, (C) an alien face, (D) a cartoon-like human-rabbit face.

Eye-to-eye contact is among the most relevant behavior involved in social cognition, intersubjective coordination of action, and joint attention (Hesslinger, Carbon, & Hect, 2017; Schilbach, 2015; Senju & Johnson, 2009). Mutual eye-to-eye gaze produces inter-individual synchronization of brain activity, through involvement of brain areas that are responsible for embodied social cognition and bodily self-consciousness (Hirsch, Zhang, Noah, & Ono, 2017; Kinreich, Djalovski, Kraus, Louzoun, & Feldman, 2017; Osaka et al., 2015; Saito et al., 2010). Indeed, inter-individual synchronicity of strange-face illusions was described in dyads (Caputo, 2013). From an evolutionary perspective, Tsoukalas (2018) proposed that eye-to-eye contact could be the precursor of theory-of-mind in humans through the evolution of tonic immobility and immobilization stress. In fact, during eye-to-eye gazing, postural immobilization is a compelling behavior that can be easily observed in participants. In healthy individuals, the onset of postural immobilization begins after about one minute of eye-to-eye gazing in concomitance to the onset of strange-face illusions (Caputo, 2010b; Derome et al., 2018; Fonseca-Pedrero et al., 2015). Usually, the hallmark of postural

immobilization is the illusory perception of left-right eye shifting or illusory perception of the mouth opening-closing.

The second finding indicates that derealization and depersonalization can be different in accordance with previous research (Bremner et al., 1998). This conclusion does not completely agree with the current position that considers depersonalization/derealization indistinguishable (American Psychiatric Association, 2013) or as aspects of 'detachment' (Holmes et al., 2005). As shown by factor-I of Table 4, *derealization* reflects deformation of facial features, huge changes of facial shape and strangeness of illusions. This effect of derealization of strange-face illusions can be explained by discontinuities in the normal integration of spatial/temporal representations in face representation (see also Silverstein, Demmin, & Skodlar, 2017). In the model of self-referential processing (Northoff et al., 2006), factor-I can reflect the first level of 'bodily-self'.

Instead, *depersonalization* (factor-III) reflects illusions of lifeless bodily faces (item-18) and feelings of immaterial 'presences' (item-17), which are counterbalanced (within the sample of young participants) by illusions of living relatives (item-12). This last result agrees with mirror-gazing studies (Fonseca-Pedrero et al., 2015; Derome et al., 2018; see also Daniel & Mason, 2015), which found correlations between depersonalization-like strange-face illusions and schizotypy in adolescents. Immateriality of the illusory body is correlated to depersonalization (see item-5 and item-6 of CADSS, Table 3) through illusions similar to out-of-body experience (OBE: Brugger, 2002; Brugger & Lenggenhager, 2014). This effect of depersonalization of strange-face illusions can be explained by discontinuities in the normal integration of face representation into one's own body representation, hence producing a temporary loss of feeling of 'mineness' (see also Brugger & Lenggenhager, 2014). In the model of self-referential processing (Northoff et al., 2006), factor-III can reflect the second ego-referential level of 'minimal-self'.

The third finding shows that, in addition to derealization and depersonalization, strange-face illusions involve other dissociative perceptions, which are independent of 'detachment'. This type of illusions forms a component (factor-II) that is not measured by CADSS subscales. Three hypotheses may be envisaged regarding factor-II. A first hypothesis is that factor-II may reflect a mere low-level perceptual illusion of face darkening (item-3), such as the Troxler-illusion, whereas this explanation is not completely supported by correlation, within the same factor, of high-level illusions, such as adolescent (item-9) and child (item-7) apparitions.

A second hypothesis is that factor-II can measure *dissociative identity*. This account is mainly supported by item-15 (the subject's self-face is 'projected' into the other's face). It is noteworthy noting that item-3 (dark-face), which is the most endorsed SFQ item, has a negative coefficient within factor-II, hence suggesting that illusory darkening of faces (a phenomenon that

commonly occurs in the first few minutes of mirror-gazing or eye-to-eye-gazing) can be similar to hysteric blankness, which is a defense mechanism (Cardeña, 1994) in opposition to identity dissociation. Perception of dark-faces is counterbalanced by perception of luminous-faces (item-2). Apparitions of faces of different-race (item-13) can be interpreted, according to psychoanalysis, as 'projections' of so-called 'shadow of the self' (Jung, 1970), which are in fact dissociative identities. Adolescent-face (item-9) and child-face (item-7) illusions also load on factor-II. Our preliminary speculation is that both illusions represent the subject's idealized identity. Phenomenologically and statistically, idealized strange-faces of children and adolescents are associated with their shining and enlightening. Finally, spirituality of strange-face illusions (item-14) is correlated to both depersonalized immaterial body (OBE: factor-III) and idealized identity (factor-II). In the model of self-referential processing (Northoff et al., 2006), factor-II can reflect the third identity level of 'autobiographical' or 'narrative-self' – or 'identity-self'.

A third hypothesis is that factor-II might reflect a dimension of strange-face illusions that is somewhat associated with creativity at a high-level of mental processing. In the case of strange-face illusions, creativity may engender new faces with new features and new global Gestalts with respect to the actual other's face in the dyad. Creativity may explicitly involve the production of artistic exotic portraits and, generally, may generate novel identities (Dollinger & Dollinger, 2017). A previous study (Caputo, 2016) found a correlation between the number of strange-face illusions that are perceived by observers and their personality trait of 'fantasy' (i.e. one's tendency to identify with fictional stories and characters; Davis, 1980). In fact, second and third hypotheses are not in contrast, since this link between 'narrative self' and self-identity/identities is produced at the third level of processing in the model of the self (Northoff et al., 2006).

In summary, our speculative hypothesis is that strange-face illusions can be organized around three 'prototypes' as follows: (i) deformed, monstrous faces (factor-I); (ii) immaterial, out-of-body faces (factor-III); and (iii) enlightened, idealized faces (factor-II). These three prototypes can be conceptualized as illusions that are produced in connection to the three levels of processing of the self (Northoff et al., 2006), respectively: self-body illusions, minimal-self illusions, and identity illusions. These illusions can be produced by momentary discontinuities in the normal integration of representations at each of these three levels, thus causing different states of consciousness, respectively: non-pathological derealization, non-pathological depersonalization, and (supposedly) non-pathological dissociative identity.

Our hypothesis says that strange-face illusions engage 'compartmentalized' dissociation of identity, which is independent of 'detachment' from both body (i.e. depersonalization) and external world (i.e. derealization).

This conclusion agrees with the model of dissociation proposed by Holmes et al. (2005), who hypothesizes the separation or independence between 'detachment' and 'compartmentalization'. In general, strange-face illusions can be hallucination-like perceptions (or pseudo-hallucinations; Brown, 2006), which are 'projections' of the subject's non-conscious representations into the other's face. In this context, 'projection' means that the subject can perceive the subject's dissociated identity only into the other's face. In other words, 'projections' involve 'compartmentalization' of an identity that is integral but not connected to the subject's conscious awareness of the Self.

Nonetheless, the lack of correlation of factor-II with dissociative amnesia seems incongruent with the hypothesis that dissociative identity is involved during strange-face illusions. However, it should be noted that CADSS subscale for dissociative amnesia is based solely on two items, which seem largely inadequate for measuring memory gaps and other memory dysfunctions. For example, mirror-gazing increases memory misidentification, recognition failure, and unusual experiences in both healthy individuals and psychotic patients (Bortolon et al., 2017); these aspects are not measured by CADSS items. Further research will be required to investigate non-pathological dissociative amnesia in strange-face illusions, in particular, the subject's experience of consciously perceiving something that seems to abruptly emerge from its unconscious. This phenomenon suggests that strange-face identities are somewhat dissociated or 'compartmentalized' in the form of multiple-selves within the subject's unconscious, but still waiting for a 'narrative coherence' or, in the case of drawings, for a 'figurative structure'. Such an organization of a cohesive narrative/portrait into one conscious identity presumably takes places at the third level of self-referential processing.

The fourth finding of experimental results indicates that interpersonal dissociation is increased in dyads of mixed gender compared to same-gender dyads. The interpersonal setting seems to trigger or exacerbate the gender differences, with men being more prone than women toward overt dissociation in pairs of mixed gender. Individuals characterized by a higher strange-face illusion frequency have a lower feeling of connection with other people (Caputo, 2017). Therefore, mixed dyads can produce less interpersonal links (or suffer more interpersonal conflicts) than same-gender dyads. Conversely, mixed-gender dyads can potentially enhance self-consciousness more in males than in females – through enhanced 'projection' of the man's illusions in the woman's bodily face.

Current views consider dissociative states as a way for identity integration in order to consciously elaborate unconscious contents and trauma (Chiu, Chang, & Hui, 2017). Identity integration – which is a subjective perception of stability, consistency, and coherency – may be a protective factor because

it may reduce dissociative conflicts in consequence of trauma. Otherwise, identity differentiation – that is elevated diversity in alternative identities – can be a factor associated with resilience in coping with aversive life events and avoiding pathological dissociation (Showers, Zeigler-Hill, & Limke, 2006; Steinberg, Pineles, Gardner, & Mineka, 2003). In fact, the perception of strange-face illusions can offer the possibility for conscious integration and differentiation of the individual's dissociative identities.

Portrait artists employed in the experiment were completely unaware of the possibilities offered by interpersonal-gazing (as well as mirror-gazing) for generating strange-face illusions. They discovered new ways of drawing unconscious perceptions of other people. Most probably, this can open new creative endeavors for both artistic achievements and individual self-knowledge. Strange-face illusions can be used for enhancing the consciousness of the different aspects of the Self toward identity integration. Drawing portraits of dissociative experiences can be a tool for conscious integration of dissociative identities (Steinberg & Schnall, 2001), otherwise known as individuation (Jung, 1970).

Limitations of the research

The present research shows some limitations that can be summarized as follows: the first limitation is that eye-to-eye fixation was not scanned (for example, through two digital cameras). Certainly, control of eye fixation had required the employment of observers who were experienced in psychophysical tasks and skilled at maintaining eye fixation for a long time. The two-camera system would also provide control for smiling, laughing, and other face and body movements. Preliminary trials by experienced observers showed that strange-face illusions are greatly increased in strength and duration with respect to naive observers [as predicted by the postural immobilization hypothesis (Tsoukalas, 2018), while perceptual hypotheses (e.g. Troxler effect) are inadequate]. The second limitation is that scales for dissociation used in the current research were not well tailored for measuring all facets of dissociative amnesia and dissociative identity disorder.

Acknowledgments

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Publishing.

Baker, D., Hunter, E. C. M., Lawrence, E., Medford, N., Sierra, M., Lambert, M., … David, A. S. (2003). Depersonalisation disorder: Clinical features of 204 cases. *British Journal Psychiatry*, *182*, 428–433. doi:10.1192/bjp.182.5.428

Bernstein, E. M., & Putnam, F. W. (1986). Psychometric properties of the dissociative experiences scale. *Journal Nervous Mental Disease*, *174*, 727–735. doi:10.1097/00005053-198612000-00004

Bernstein, I. H., Ellason, J. W., Ross, C. A., & Vanderlinden, J. (2001). On the dimensionalities of the Dissociative Experiences Scale (DES) and the Dissociation Questionnaire (DIS-Q). *Journal Trauma Dissociation*, *2*, 103–123. doi:10.1300/J229v02n03_07

Bortolon, C., Capdevielle, D., Altman, R., Macgregor, A., Attal, J., & Raffard, S. (2017). Mirror self-face perception in individuals with schizophrenia: Feelings of strangeness associated with one's own image. *Psychiatry Research*, *253*, 205–210. doi:10.1016/j.psychres.2017.03.055

Bremner, J. D., Krystal, J. H., Putnam, F. W., Southwick, S. M., Marmar, C., Carney, D. S., & Mazure, C. M. (1998). Measurement of dissociative states with the clinician-administered dissociative states scale (CADSS). *Journal Traumatic Stress*, *11*, 125–136. doi:10.1023/A:1024465317902

Brewin, C. R. (2014). Episodic memory, perceptual memory and their interaction: Foundations for a theory of post traumatic stress disorder. *Psychological Bulletin*, *140*, 69–97. doi:10.1037/a0033722

Brewin, C. R., Ma, B. Y. T., & Colson, J. (2013). Effects of experimentally induced dissociation on attention and memory. *Consciousness Cognition*, *22*, 315–323. doi:10.1016/j.concog.2012.08.005

Brewin, C. R., & Mersaditabari, N. (2013). Experimentally-induced dissociation impairs visual memory. *Consciousness Cognition*, *22*, 1189–1194. doi:10.1016/j.concog.2013.07.007

Brown, R. J. (2006). Different types of "dissociation" have different psychological mechanisms. *Journal Trauma Dissociation*, *7*, 7–28. doi:10.1300/J229v07n04_02

Brugger, P. (2002). Reflective mirrors: Perspective-taking in autoscopic phenomena. *Cognitive Neuropsychiatry*, *7*, 179–194. doi:10.1080/13546800244000076

Brugger, P., & Lenggenhager, B. (2014). The bodily self and its disorders: Neurological, psychological and social aspects. *Current Opinion Neurology*, *27*, 644–652. doi:10.1097/WCO.0000000000000151

Caputo, G. B. (2010a). Strange-face-in-the-mirror illusion. *Perception*, *39*, 1007–1008. doi:10.1068/p6466

Caputo, G. B. (2010b). Apparitional experiences of new faces and dissociation of self-identity during mirror-gazing. *Perceptual Motor Skills*, *110*, 1125–1138. doi:10.2466/pms.110.3c.1125-1138

Caputo, G. B. (2013). Strange-face illusions during inter-subjective gazing. *Consciousness Cognition*, *22*, 324–329. doi:10.1016/j.concog.2012.08.007

Caputo, G. B. (2015). Dissociation and hallucinations in dyads engaged through interpersonal gazing. *Psychiatry Research*, *228*, 659–663. doi:10.1016/j.psychres.2015.04.050

Caputo, G. B. (2016). Empathy and mirror-gazing. In D. F. Watt & J. Panksepp (Eds.), *Psychology and neurobiology of empathy* (pp. 377–398). New York, NY: Nova Science Publishers.

Caputo, G. B. (2017). Strange-face illusions during interpersonal gazing and personality differences of spirituality. *Explore: Journal Mental Healing*, 13, 379–385. doi:10.1016/j. explore.2017.04.019

Caputo, G. B., Ferrucci, R., Bortolomasi, M., Giacopuzzi, M., Priori, A., & Zago, S. (2012). Visual perception during mirror gazing at one's own face in schizophrenia. *Schizophrenia Research*, 140, 46–50. doi:10.1016/j.schres.2012.06.029

Cardeña, E. (1994). The domain of dissociation. In S. J. Lynn & J. W. Rhue (Eds.), *Dissociation: Clinical and theoretical perspectives* (pp. 15–31). New York, NY: The Guilford Press.

Cardeña, E., & Carlson, E. (2011). Acute stress disorder revisited. *Annual Review Clinical Psychology*, 7, 245–267. doi:10.1146/annurev-clinpsy-032210-104502

Carlson, E. B., & Putnam, F. W. (1993). An update on the dissociative experiences scale. *Dissociation*, 6, 16–27.

Chiu, C. D., Chang, J. H., & Hui, C. M. (2017). Self-concept integration and differentiation in subclinical individuals with dissociation proneness. *Self and Identity*. doi:10.1080/15298868.2017.1296491

Chiu, C. D., Tseng, M. C., Chien, Y. L., Liao, S. C., Liu, C. M., Yeh, Y. Y., & Hwu, H. G. (2015). Cumulative traumatization associated with pathological dissociation in acute psychiatric inpatients. *Psychiatry Research*, 230, 406–412. doi:10.1016/j.psychres.2015.08.029

Collerton, D., Taylor, J. P., Tsuda, I., Fujii, H., Nara, S., Aihara, K., & Katori, Y. (2016). How can we see things that are not there? Current insight into complex visual hallucinations. *Journal Consciousness Studies*, 23, 195–227.

Daniel, C., & Mason, O. J. (2015). Predicting psychotic-like experiences during sensory deprivation. *BioMed Research International*, Article ID 439379. doi: 10.1155/2015/439379.

Davis, M. H. (1980). A multi-dimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, 10, 85–99.

Dell, P. F. (2013). Three dimensions of dissociative amnesia. *Journal Trauma Dissociation*, 14, 25–39. doi:10.1080/15299732.2012.724762

Derome, M., Fonseca-Pedrero, E., Badoud, D., Morosan, L., Van De Ville, D., Lazeyras, F., … Debbané, M. (2018). Resting-state networks of adolescents experiencing depersonalization-like illusions: Cross-sectional and longitudinal findings. *Schizophrenia Bulletin*, 44, S501–S511. doi:10.1093/schbul/sby031

Dollinger, S. J., & Dollinger, S. C. (2017). Creativity and identity. In M. Karwowski & J. C. Kaufman (Eds.), *The creative self* (pp. 49–64). Cambridge, MA: Academic Press.

Dorahy, M. J., Peck, R. K., & Huntjens, R. J. C. (2016). The impact of dissociation on perceptual priming and intrusions after listening to auditory narratives. *Journal Trauma Dissociation*, 17, 410–425. doi:10.1080/15299732.2015.1134746

Fonseca-Pedrero, E., Badoud, D., Antico, L., Caputo, G. B., Eliez, S., Schwartz, S., & Debbané, M. (2015). Strange-face-in-the-mirror illusion and schizotypy during adolescence. *Schizophrenia Bulletin*, 41, S475–S482. doi:10.1093/schbul/sbt194

Frewen, P., & Lanius, R. (2015). *Healing the traumatized self: Consciousness neuroscience treatment*. New York, NY: Norton & Company.

Hesslinger, V. M., Carbon, C. C., & Hect, H. (2017). The sense of being watched is modulated by arousal and duration of the perceptual episode. *i-Perception*, 8. doi:10.1177/2041669517742179

Hirsch, J., Zhang, X., Noah, A., & Ono, Y. (2017). Frontal temporal and parietal systems synchronize within and across brains during live eye-to-eye contact. *Neuroimage*, 157, 314–330. doi:10.1016/j.neuroimage.2017.06.018

Holmes, E. A., Brown, R. J., Mansell, W., Fearon, R. P., Hunter, E. C., Frasquilho, F., & Oakley, D. A. (2005). Are there two qualitatively distinct forms of dissociation? A review

and some clinical implications. *Clinical Psychology Review*, *25*, 1–23. doi:10.1016/j.cpr.2004.08.006

Holmes, E. A., Oakley, D. A., Stuart, A. D. P., & Brewin, C. R. (2006). Investigating peritraumatic dissociation using hypnosis during a traumatic film. *Journal Trauma Dissociation*, *7*, 91–113. doi:10.1300/J229v07n04_06

Hood, B. (2012). *The Self Illusion*. New York, NY: Oxford University Press.

Hunter, E. C. M., Phillips, M. L., Chalder, T., Sierra, M., & David, A. S. (2003). Depersonalization disorder: A cognitive behavioural conceptualisation. *Behavioural Research Therapy*, *41*, 1451–1467. doi:10.1016/S0005-7967(03)00066-4

Huntjens, R. J. C., Dorahy, M. J., & van Wees-Cieraad, R. (2013). Dissociation and memory fragmentation. In F. Kennedy, H. Kennerley, & D. Pearson (Eds.), *Cognitive behavioural approaches to the understanding and treatment of dissociation* (pp. 92–103). New York, NY: Routledge.

Huntjens, R. J. C., Postma, A., Peters, M. L., Woertman, L., & van der Hart, O. (2003). Interidentity amnesia for neutral, episodic information in dissociative identity disorder. *Journal Abnormal Psychology*, *112*, 290–297. doi:10.1037/0021-843X.112.2.290

James, E. L., Lau-Zhu, A., Clark, I. A., Visser, R. M., Hagenaars, M. A., & Holmes, E. A. (2016). The trauma film paradigm as an experimental psychopathology model of psychological trauma: Intrusive memories and beyond. *Clinical Psychology Review*, *47*, 106–142. doi:10.1016/j.cpr.2016.04.010

Jenkinson, P. M., & Preston, C. (2017). The 'not-so-strange' body in the mirror: A principal components analysis of direct and mirror self-observation. *Consciousness Cognition*, *48*, 262–272. doi:10.1016/j.concog.2016.12.007

Jung, C. G. (1970). *Mysterium Coniunctionis*. Princeton, NJ: Princeton University Press.

Kinreich, S., Djalovski, A., Kraus, L., Louzoun, Y., & Feldman, R. (2017). Brain-to-brain synchrony during naturalistic social interactions. *Nature Scientific Reports*, *7*. doi:10.1038/s41598-017-17339-5

Leonard, K. N., Telch, M. J., & Harrington, P. J. (1999). Dissociation in the laboratory: A comparison of strategies. *Behavioural Research Therapy*, *37*, 49–61. doi:10.1016/S0005-7967(98)00072-2

Lickel, J., Nelson, E., Lickel, A. H., & Deacon, B. (2008). Interoceptive exposure exercises for evoking depersonalization and derealization: A pilot study. *Journal Cognitive Psychotherapy*, *22*, 321–330. doi:10.1891/0889-8391.22.4.321

Miller, P. P., Brown, T. A., DiNardo, P. A., & Barlow, D. H. (1994). The experimental induction of depersonalization and derealization in panic disorder and nonanxious subjects. *Behavioural Research Therapy*, *32*, 511–519. doi:10.1016/0005-7967(94)90138-4

Northoff, G., Heinzel, A., de Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain: A meta-analysis of imaging studies on the self. *Neuroimage*, *31*, 440–457. doi:10.1016/j.neuroimage.2005.12.002

Osaka, N., Minamoto, T., Yaoi, K., Azuma, M., Shimada, Y. M., & Osaka, M. (2015). How two brains make one synchronized mind in the inferior frontal cortex: FNIRS-based hyperscanning during cooperative singing. *Frontiers Psychology*, *6*, 1–11. doi:10.3389/fpsyg.2015.01811

Putnam, F. W. (1997). *Dissociation in children and adolescents: A developmental perspective*. New York, NY: The Guilford Press.

Ross, C. A., Ellason, J. W., & Anderson, G. (1995). A factor analysis of the Dissociative Experiences Scale in dissociative identity disorder. *Dissociation*, *8*, 229–235.

Ross, C. A., Joshi, S., & Currie, R. (1990). Dissociative experiences in the general population. *American Journal Psychiatry*, *147*, 1547–1552. doi:10.1176/ajp.147.11.1547

Saito, D. N., Tanabe, H. C., Izuma, K., Hayashi, M. J., Morito, Y., Komeda, H., … Sadato, N. (2010). Stay tuned: Inter-individual neural synchronization during mutual gaze and joint attention. *Frontiers Integrative Neuroscience*, 4, 1–12. doi:10.3389/fnint.2010.00127

Sakson-Obada, O., Chudzikiewicz, P., Pankowski, D., & Jarema, M. (2018). Body image and body experience disturbances in schizophrenia: An attempt to introduce the concept of body self as a conceptual framework. *Current Psychology*, 37, 390–400. doi:10.1007/s12144-016-9526-z

Schilbach, L. (2015). Eye to eye, face to face and brain to brain: Novel approaches to study the behavioural dynamics and neural mechanisms of social interactions. *Current Opinion Behavioral Sciences*, 3, 130–135. doi:10.1016/j.cobeha.2015.03.006

Senju, A., & Johnson, M. H. (2009). The eye contact effect: Mechanisms and development. *Trends Cognitive Science*, 13, 127–134. doi:10.1016/j.tics.2008.11.009

Showers, C. J., Zeigler-Hill, V., & Limke, A. (2006). Self-structure and childhood maltreatment: Successful compartmentalization and the struggle of integration. *Journal Social Clinical Psychology*, 25, 473–507. doi:10.1521/jscp.2006.25.5.473

Sierra, M, & Berrios, G.E. (1998). Depersonalization: neurobiological perspectives. *Biological Psychiatry*, 44, 898–908. doi: 10.1016/S0006-3223(98)00015-8

Silverstein, S. M., Demmin, D., & Skodlar, B. (2017). Space and objects: On the phenomenology and cognitive neuroscience of anomalous perception in schizophrenia. *Psychopathology*, 50, 60–67. doi:10.1159/000452493

Simeon, D. (2009). Neurobiology of depersonalization disorder. In P. F. Dell & J. A. O'Neil (Eds.), *Dissociation and the dissociative disorders: DSM-V and beyond* (pp. 367–372). New York, NY: Routledge.

Simeon, D., Knutelska, M., Nelson, D., Guralnik, O., & Schmeidler, J. (2003). Examination of the pathological dissociation taxon in depersonalization disorder. *Journal Nervous Mental Disease*, 191, 738–744. doi:10.1097/01.nmd.0000095126.21206.3e

Spiegel, D. (1997). Trauma, dissociation, and memory. *Annual. N.Y. Academy Sciences*, 281, 225–237. doi:10.1111/j.1749-6632.1997.tb48282.x

Spiegel, D., Lewis-Fernandez, R., Lanius, R., Vermetten, E., Simeon, D., & Friedman, M. (2013). Dissociative disorders in DSM-5. *Annual Review Clinical Psychology*, 9, 299–326. doi:10.1146/annurev-clinpsy-050212-185531

Stanghellini, G., Ballerini, M., Blasi, S., Mancini, M., Presenza, S., Raballo, A., & Cutting, J. (2014). The bodily self: A qualitative study of abnormal bodily phenomena in persons with schizophrenia. *Comprehensive Psychiatry*, 55, 1703–1711. doi:10.1016/j.comppsych.2014.06.013

Steele, K., Dorahy, M. J., Van der Hart, O., & Nijenhuis, E. R. (2009). Dissociation versus alterations in consciousness: Related but different concepts. In P. F. Dell & J. A. O'Neil (Eds.), *Dissociation and the dissociative disorders: DSM-V and beyond* (pp. 155–170). New York, NY: Routledge.

Steinberg, J. A., Pineles, S. L., Gardner, W. L., & Mineka, S. (2003). Self-complexity as a potential cognitive buffer among abused women. *Journal Social Clinical Psychology*, 22, 560–579. doi:10.1521/jscp.22.5.560.22929

Steinberg, M., & Schnall, M. (2001). *The stranger in the mirror: Dissociation – The hidden epidemic*. New York, NY: Harper Collins.

Stockdale, G. D., Gridley, B. E., Balogh, D. W., & Holtgraves, T. (2002). Confirmatory factor analysis of single- and multiple factor competing models of the Dissociative Experiences Scale in a nonclinical sample. *Assessment*, 9, 94–106. doi:10.1177/1073191102009001011

Tsoukalas, I. (2018). Theory of mind: Towards an evolutionary theory. *Evolutionary Psychological Science*, 4, 38–66.

Waller, N., Putnam, F. W., & Carlson, E. B. (1996). Types of dissociation and dissociative types: A taxometric analysis of dissociative experiences. *Psychological Methods*, *1*, 300–321. doi:10.1037/1082-989X.1.3.300

Waller, N. G., & Ross, C. A. (1997). The prevalence and biometric structure of pathological dissociation in the general population: Taxometric and behavior genetic findings. *Journal Abnormal Psychology*, *106*, 499–510. doi:10.1037/0021-843X.106.4.499