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From Embodiment to Enfacement. Exploring the Role of Technologies for the Manipulation and Creation of Digital Faces in Schizophrenia Research

Ente di afferenza:
Università di Torino (unito)

FROM EMBODIMENT TO ENFACEMENT

EXPLORING THE ROLE OF TECHNOLOGIES FOR THE MANIPULATION AND CREATION OF DIGITAL FACES IN SCHIZOPHRENIA RESEARCH

Giovanni Pennisi

Abstract

This paper delves into the potential of technologies for creating and manipulating digital faces in treating symptoms of schizophrenia, such as deficits in recognizing one's own face and auditory hallucinations. Deficits in recognizing one's own face are linked to the loss of the self-other boundary, a typical manifestation of schizophrenia that has been experimentally replicated even in healthy subjects through the enfacement illusion. After detailing the phenomenon of enfacement, a thought experiment is proposed in which this illusion is used to allow the schizophrenic patients, through interaction with an avatar, to «re-embody» their own face. Subsequently, the specific aspects of Avatar Therapy, a clinical protocol for treating auditory hallucinations, are examined, highlighting the role of avatars as means of participatory sense-making and embodiment. In the conclusions, the points of continuity between the potential clinical uses of technologies for creating and manipulating digital faces are outlined.

Keywords: Schizophrenia, Enfacement, Avatar Therapy, Participatory Sense-Making, Embodiment.

INTRODUCTION

Schizophrenia, a complex mental disorder, manifests in various forms, challenging conventional perceptions of reality and self. Characterized by hallucinations, delusions, and disorganized thinking (see Schultz *et al.* 2007), schizophrenia disrupts an individual's cognitive and emo-

tional processes, often leading to profound disturbances in perception and behavior. However, beyond the diagnostic criteria lies a profound and often overlooked aspect of the condition – the blurring of boundaries between the self and the other (Scharfetter 2003; Parnas *et al.* 2005; Gipps 2020). This symptom can be classified among the so-called «anomalies of the embodied self» (Szczotka, Majchrowicz 2018), given that «at the most fundamental, phenomenological level self is tantamount to a sense of having a first-person perspective and being a specific entity with clearly demarcated physical boundaries between oneself and the environment» (p. 200).

The loss of the self-other boundary manifests precisely as the patient's impression that he and his interlocutor are «mixed up or interpenetrated, in the sense that he loses his sense of whose thoughts, feelings, or expressions originate in whom» (Parnas *et al.* 2005, 254). The predisposition to confusion between the self and the other emerges from many patients' self-reports, like those analyzed by Scharfetter (2003): «I am not aware of my boundaries and feel myself unsheltered» (p. 273); «I felt I was defenseless, at the mercy of influences beyond my control. I could not defend myself, and I was not aware of my own boundaries anymore» (p. 286); «I became one with other creatures or objects. I lost the sense of my own boundaries» (p. 287). Moreover, confirmations of the occurrence of the loss of the self-other boundary in schizophrenia come from the experimental literature on the Rubber Hand Illusion (RHI, see Botvinick, Cohen 1998). Several studies employing this paradigm, in fact, have demonstrated how schizophrenic patients exhibit a greater susceptibility to the illusion of 'embodiment' of an external piece of the world compared to control subjects (Peled *et al.* 2003; Thakkar *et al.* 2011; Torregrossa, Park 2022), suggesting «more malleable body boundaries in schizophrenia» (Rossetti *et al.* 2020, 295).

There is an experimental paradigm openly inspired by the RHI that aims to generate the illusion of «embodiment» not of a fake limb but of the face of another person – it is called *enfacement* (Sforza *et al.* 2010; Tajadura-Jimenez *et al.* 2012; Porciello *et al.* 2018). The literature on enfacement and schizophrenia is very limited; however, there is an experiment (Sandsten *et al.* 2020) that has shown how the enfacement effect – namely, the sensation that another person's face is one's own – arises in patients even before the sensory stimulation usually employed to generate this illusion, thus corroborating the existence of a tendency toward confusion between the self and the other in the pathology.

In this paper, I describe the experimental setup utilized to induce the enfacement effect, followed by a thought experiment employing this setup to investigate and envision the treatment of a symptom of schizophrenia associated with the loss of the self-other boundary: the deficit in recognizing one's own face. The proposed experiment involves the use of avatars and immersive technologies, which are tools that have already demonstrated high efficacy in treating other symptoms of schizophrenia, such as auditory hallucinations. Therefore, I will dedicate the second half of the paper to an overview of Avatar Therapy's specificities and accomplishments, framing this clinical approach as a means of participatory sense-making and embodiment. In the Conclusion, I will provide further insights into the idea of making the digital face a form of treatment.

THE ENFACEMENT ILLUSION IN PHYSICAL EXPERIMENTS AND A MENTAL ONE

More than a decade ago, an experimental protocol inspired by the literature on the Rubber Hand Illusion (Botvinick, Cohen 1998) allowed for demonstrating that the blurring of the boundary between the self and the other – specifically, between one's own face and that of another – is a condition that can be replicated in the laboratory, even in individuals who do not suffer from any psychopathology. The artificial production of this illusory perception is referred to as «enfacement» (Sforza *et al.* 2010), and it is achieved through an ingenious setup structured as follows:

– Two same-sex subjects are seated facing each other at a distance of 140 cm. One of them (subject A) wears a rigid visor that occludes peripheral vision, allowing only the oval of the face of the person in front (subject B) to be seen. Both subjects are instructed to maintain their gaze fixed on the other's face, while an experimenter uses a brush for each to stroke their cheeks (right cheek for subject A and left cheek for subject B, or vice versa), performing movements from top to bottom and bottom to top. The stimulation process, during which the tip of the brush touching subject B's cheek must be perfectly visible to subject A, lasts for two minutes and is divided into two phases: one of asynchronous stimulation – movements of the brush

touching subject A's cheek delayed by one second compared to those of the brush touching subject B's cheek – and one of synchronous stimulation. Each two-minute stimulation session (asynchronous and synchronous) is repeated three times.

– After each of the three asynchronous stimulation sessions, subject A is asked to remove the visor and sit in front of a screen. On this screen, she observes a photo of her own face undergoing a gradual process of morphing into a photo of subject B's face. This gradual transformation is achieved by a specialized morphing software, which, starting from two input images (the photo of subject A's face and that of subject B's face), generates a continuum of images showing facial features progressively less of subject A and more of subject B, until exclusively displaying a representation of the latter's face. As the images follow one another on the screen, subject A is asked to precisely indicate the frame (frame X) where she stops perceiving her own face and begins perceiving subject B's. The same procedure is then repeated following each of the three synchronous stimulation sessions. Finally, the average of the responses obtained after each morphing phase is calculated and compared with the response obtained following a morphing phase where subject A must indicate frame X after sitting in front of subject B without either receiving any tactile stimulation (control condition).

The authors of this experiment found that, following the synchronous stimulation sessions, subject A tends to identify frame X significantly later than she does after the asynchronous stimulation sessions or after exposure to the control condition. This indicates that the perfect spatiotemporal congruence between the visual stimulus (observing the brush touching another's cheek) and the tactile stimulus (feeling the brush touching one's own cheek) resulted in higher scores in the subject's self-identification with the other's face. By extension, this suggests that, under certain circumstances, the notion of self can expand to include features of the other's identity, and even the most intimately subject-specific trait – namely, the face (see Tajadura-Jimenez *et al.* 2012; Porciello *et al.* 2018; Sforza *et al.* 2010).

In the context of this paper, the phenomenon of enfacement is particularly interesting not only because, in the words of Porciello and colleagues (2018), it is «a window into the plasticity of the self», but also due to the insights it provides into some symptoms of schizophre-

nia. There is a study (Sandsten *et al.* 2020), in fact, that employed the experimental paradigm of enfacement to investigate the loss of the self-other boundary in schizophrenic patients, corroborating the evidence that this manifestation is typical of the pathology. This emerges from the fact that, even before being subjected to tactile stimulation, the schizophrenic patients involved in the experiment tended to identify frame X much later than a control group composed of non-pathological subjects, thus showing a spontaneous propensity for confusion between their own face and the face of the other.

The natural predisposition to the enfacement effect that characterizes schizophrenia might lead one to believe that it is pointless to conceive experiments attempting to artificially generate this illusion in patients. However, this assumption could prove erroneous if we were to imagine changing the object in which the individual must identify, by designing a setting in which the face to be incorporated into one's self-representation is not that of another person, but one's own, or a reproduction thereof. The literature on anomalous self-experiences in schizophrenia, in fact, shows that patients often struggle to recognize their own faces in pictures (Kircher *et al.* 2007; Lee *et al.* 2007) or in the mirror (Harrington *et al.* 1989; Bortolon *et al.* 2017; Sandsten *et al.* 2022), and that this symptom is correlated to the loss of the self-other boundary (Bortolon *et al.* 2017; Sandsten *et al.* 2020). In light of this, it is worth asking whether the mechanism of enfacement could be employed to intervene on the deficit in recognizing one's own face, serving as a means to adjust the patients' altered and disembodied perception of their facial image.

At the current state of the art, it is not possible to answer this question. However, there is a study (Gonzalez-Franco *et al.* 2020) that has demonstrated that the enfacement effect can occur when one interacts not only with the flesh-and-blood face of another person, or with a picture depicting it, but also with a digital avatar – a type of non-photorealistic representation that can hypothetically simulate any appearance, including one's own. In this experiment, it was observed that, under circumstances such as synchronization between the movements of the subject's body and lips and those of an avatar experienced through Virtual Reality (VR), it is possible to generate the impression that the avatar's face is the face of the individual wearing the headset, regardless of the level of similarity between the two. Compared to other enfacement studies, this is the only one discussing the potential ap-

plicability of a technology that, owing to the creative freedom available in the avatar design phase, could be perfectly suited to replicate all the elements that individuals with a distorted or partial representation of their own face would identify as constitutive of their facial identity.

Therefore, one could envision an experimental setup in which an avatar generated based on the description of one's own face provided by a schizophrenic patient (data A) and a realistic image – e.g., a photo – of his/her face (data B) are the inputs for a facial morphing software that treats them as the two extremes of a continuum. Subsequently, the patient could be asked to identify frame X – that is, the exact moment when he/she begins to perceive his/her own face – during a process of digital morphing from the avatar to the photo. It would suffice for frame X to correspond to a moment just slightly after the starting state of the transformation process, so that we would have a new input (data C) closer to data B than data A was. If the experiment were replicated by substituting data C for data A, and then, in turn, substituting data D for data C, data E for data D, and so on, progressively more faithful images of the patient's face would be obtained. Hence, the patient would identify with facial representations gradually becoming more lifelike, undergoing an unconscious activity of «re-embodiment» of his/her own face.

The thought experiment just described is just one example of the potential applications that immersive technologies and the use of avatars could have in the field of psychopathology research, particularly in the study of schizophrenia. Further evidence of the effectiveness of such tools in treating specific symptoms of schizophrenia is found in the literature on Avatar Therapy, which I will explore in the next section.

AVATAR THERAPY AS A MEANS OF PARTICIPATORY SENSE-MAKING AND EMBODIMENT

Avatar Therapy (AT) is a psychological intervention designed to help individuals experiencing distressing auditory hallucinations, commonly associated with psychopathological conditions, and especially schizophrenia (Leff *et al.* 2013; 2014; Rus-Calafell *et al.* 2015). In this therapy, patients collaborate with a therapist to create a computer-generated avatar representing the facial features they associate to the

source of their hallucinations. During therapy sessions, the patient interacts with this avatar through a computer interface, while the therapist controls the avatar's responses, speaking on behalf of the hallucinated voices.

The therapy unfolds through structured dialogues between the patient and the avatar (see Beaudoin *et al.* 2021; 2023). Initially, the avatar may adopt a confrontational stance, mirroring the adversarial relationship the patient may have with the hallucinations. However, as therapy progresses, the therapist guides the patient in gaining control and challenging the authority of the avatar. Through guided interactions, patients learn to express their feelings, confront the avatar, and assert their dominance over the hallucinated voices. Over time, the avatar's demeanor may shift from hostile to cooperative, reflecting the patient's growing sense of empowerment and control. The therapist helps patients reconstruct the meaning and significance of their auditory hallucinations, often reframing them as remnants of past traumas or unresolved issues. The ultimate goal of AT is to alleviate the distress caused by auditory hallucinations, reduce their frequency and intensity, and empower patients.

AT is currently utilized as a clinical protocol on a broad scale, as evidenced by its application to large patient cohorts (see Smith *et al.*, 2022). Moreover, like many other avatar-based treatments, it is found to be particularly promising and effective (see Franco *et al.* 2021). However, the significance of this approach goes beyond its clinical impact, encompassing philosophical ramifications that involve phenomenological concepts such as participatory sense-making (De Jaegher, Di Paolo 2007; Fuchs, De Jaegher 2009) and embodiment.

Participatory sense-making is the process through which individuals collectively construct meaning and understanding by actively engaging in shared activities, conversations, or experiences within a social context. As De Jaegher and Di Paolo (2007) put it, this term refers to «the coordination of intentional activity in interaction, whereby […] *new domains of social sensemaking* can be generated that were not available to each individual on her own» (p. 497, emphasis added).

Although the concept of participatory sense-making has been previously discussed within the realm of psychotherapy (see de Haan 2020; Garcia 2021), it remains notably absent in the context of AT research. Yet, AT sessions have proven to be opportunities for the creation of those «new domains of social sense-making» that De Jaegher

and Di Paolo (2007) speak of, especially in the phase of avatar co-design that involves both the patient and the therapist (see Garcia *et al.* 2023). It is during this stage, in fact, that hallucinations – which are typically ineffable, obscure, and inaccessible to others – are transformed into a form of mutual communicative exchange that solidifies into an object – the avatar – which can be experienced, manipulated, and shared by both parties. The function of reification of an otherwise invisible symptom, played by the avatar, is as important as the dialogue established between the avatar and the patient because the former allows the latter to both shape and provide concrete evidence of the existence of a phenomenon traditionally perceived as the hallmark of madness and alienation. As Campaner and Costerbosa (2023) put it, «the design of the avatar is part and parcel of the therapy itself. By acting along with the patient to externalize the disorder and make it an object of a sharable sensory experience, the therapist seriously takes the patient's claims and suffering into account» (p. 47).

This final point allows the concept of embodiment to enter the equation. As Rus-Calafell and colleagues (2015) claim, in fact, giving a physical representation to the personified but disembodied voice is «a *virtual embodiment* of the experience» (p. 194). By describing this process as virtual embodiment, the authors highlight how avatars serve as a conduit between the patient's inner world of delusions and the external reality of therapeutic intervention, much like other techniques of embodiment – such as body-ownership illusions (Peck *et al.* 2013; Banakou *et al.* 2016) and body swapping (Thériault *et al.* 2021) – act «as a device to bridge the lacuna across subject experiences as a kind of faux merger» (Jarvis 2019, p. 127).

Moreover, AT can be said to transform hallucinations into embodied experiences rather than disembodied ones because it makes them more vivid and concrete. The fact that this positively impacts symptom treatment is particularly impressive, especially considering that many patients report hearing the voice of the devil in their heads and interact with avatars simulating the uncanny appearance of demonic entities (see Garcia *et al.*, 2023). This points to the conclusion that the mere possibility of embodying or, to be more specific, of *giving a face* to the hallucination, is a crucial step in the healing process. Ultimately, this sheds light on the role that tools for creating and manipulating digital faces can play in schizophrenia research.

CONCLUSION

The advantages associated with using tools for creating and manipulating digital faces in the context of treating certain symptoms of schizophrenia can be summarized as follows.

Firstly, the process of avatar creation is highly flexible, involving active participation from both the patient and the therapist, and allowing for the generation of images that vary in realism based on the therapeutic objectives. Additionally, avatars can serve as intermediaries between the patient's subjective world and the reality shared by other people, including those close to the patient. Thus, one can imagine using avatars to make the presence of hallucinations tangible not only to the therapist but also to friends and relatives, for instance, by inviting them to use the VR headset to experience firsthand the face associated with the hallucinated voice. This form of sharing could foster greater understanding and acceptance of the delusional experiences, potentially mitigating the feelings of isolation and estrangement commonly associated with schizophrenia.

Secondly, software such as those used in the experimental context of enfacement can replicate specific perceptual phenomena, such as the loss of the self-other boundary or the blending of one's own face with that of another, which often occur spontaneously in schizophrenia. A similar dynamic has already been observed in some studies on distorted mirror self-face perception involving both healthy subjects (Caputo 2010) and schizophrenic patients (Caputo *et al.* 2012). These studies have demonstrated that under certain experimental conditions, it is possible to observe, in individuals without any psychopathology, the emergence of mirror anomalous perceptions entirely comparable to those characterizing the schizophrenic experience. The results of these experiments, as well as those obtained from research on enfacement and schizophrenia, allow us to place the actions of psychopathological and healthy subjects within a continuum, revealing the nuances of common perceptual experiences and thereby leading to a greater understanding of the challenges faced by patients affected by the disorder. This adds to the potential clinical applicability of the enfacement paradigm suggested in the thought experiment. However, much research is still required to verify whether the paths outlined here are indeed feasible.

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