

A phenomenological take on mirror self-face perception in schizophrenia

Giovanni Pennisi^{1*}

¹ Department of Philosophy and Education Sciences, University of Turin, Turin, Italy

ABSTRACT



Studies concerning social deficits in schizophrenia has often been restrained to exploring facial recognition. Various investigations have shown that those diagnosed with schizophrenia have difficulties in perceiving the identities and emotions of those around them merely through observing their facial features. A few others have also taken into account the issue of self-face recognition in individuals with schizophrenia, finding that their capacity to associate photos or videos of their own face to themselves is hindered due to the illness. However, to my knowledge, only a few studies have so far delved into the intricacies of how individuals with schizophrenia or schizotypal traits perceive their own facial features during mirror gazing. Some authors highlighted that it is imperative to differentiate between the ability of identifying one's own face in photographs or videos and while mirror gazing, not only in virtue of the fact that mirror self-recognition arises earlier than photo self-recognition, but also because the neural responses elicited by the former are distinct from those generated by the latter. In light of this, it is crucial to elucidate the developmental aspects of the cognitive mechanism of mirror self-recognition. I will do so in order to introduce a discussion on the results of the studies on mirror self-face perception in schizophrenia, which will be carried out through an approach inspired by phenomenological theories of schizophrenia and self-consciousness. Finally, the Conclusions will provide further comments on the linkages among schizophrenia, mirror self-face perception, and self-consciousness.

Category: Review

Received: February 06, 2023

Accepted: March 21, 2023

Published: April 25, 2023

Keywords:

mirror, self-face recognition, schizophrenia, phenomenology, corollary discharges

*Corresponding author:

Giovanni Pennisi,

Department of Philosophy and Education Sciences,
University of Turin, Turin, Italy

E-mail: g.pennisi@unito.it

Introduction

Research on social impairments in schizophrenia has often focused on one particular aspect of the intersubjective sphere, that is, facial recognition. Many studies have proved that schizophrenia patients have a deficit in discerning the others' identity and emotions by looking at their faces [1-3]. For a comprehensive review, see the work written in extenso by Bortolon, Capdevielle & Raffard [4]. Some others have addressed the issue of self-face recognition in schizophrenia [5-8], finding that the ability to associate pictures and videos of one's own face to oneself is compromised in this pathology. However, to my knowledge, only three studies [9-11] have analyzed what happens when schizophrenia patients or individuals with schizotypal traits have to extrapolate features of their own face during sessions of mirror gazing, and one [12] investigated the relationship between anomalous mirror

experiences and basic self-disorders in a subject at familial high risk for schizophrenia. As Bortolon et al. claim [11], it is important to discriminate between identification of one's own face in pictures or videos and in mirror gazing, for it has been shown not only that mirror self-recognition emerges earlier than photo self-recognition [13], but also that the neural responses called forth by the former are different than the ones activated by the latter [14]. In light of this, it is fundamental to give a brief overview of the developmental aspects of the mirror self-recognition cognitive mechanism. This will be propaedeutical to a discussion of the results of the studies on mirror self-face perception in schizophrenia, which will be carried out through an approach inspired by phenomenological theories on this illness and self-consciousness. Further comments on the correlation among schizophrenia, mirror self-face perception, and self-consciousness will be made in the Conclusions section.

Discussions

Mirror self-recognition is a turning point in the ontogenetic development of the individual. Jacques Lacan coined the expression “mirror stage” (1949/1966) to refer to a process of identification that can take place from the sixth to the eighteenth month, a time window during which the subject “assumes an image that (...) have to be called the ‘ideal I’ (...), in the sense that it will also be the rootstock of secondary identifications” [15]. What Lacan has in mind when he speaks of a transition from a primary to a secondary form of identification, is specifically a passage “from a fragmented image of the body to (...) an ‘orthopedic’ form of its totality” (p. 97). In later interpretations, the “fragmented body” – which, for Lacan, is a developmental phase marked by a sense of incompleteness that is reflected in the child’s dreams of “disconnected limbs or of organs exoscopically represented” (ibid.) – would “correspond to a primordial, polymorphous auto-erotic state that is prior to the constitution of the ego, whereas the mirror stage marks the coming of the ego and therefore of narcissism proper” [16]. Here is the core of the mirror stage: it is a process whereby the child becomes increasingly more aware of his/her own presence in the world as distinct from that of the others, and starts to perceive his/her own body as a cohesive whole. However, the most interesting aspect of the mirror stage is that it does not unfold in a linear way: the integrity of the body that the child contemplates in the mirror is contrasted by the lack of overall control that he/her still has over it, and this adds up to the confusion engendered by the perception of being both “in” the mirror and “outside” of it. This is why Lacan (1949/1966) conceives the mirror stage as “a drama whose internal thrust is precipitated from insufficiency to anticipation” (p. 97): by being reflected, the child’s body image slowly emerges as the result of a self-fueling spiral between projection and retroaction [15]. To say it with Gallop, in front of the mirror “the self is constituted through anticipating what it will become, and then this anticipatory model is used for gauging what was before” (p. 121). I will come back to this issue below [16].

The mirror stage has been described by Rochat as a process characterized by five different levels of self-consciousness [17]; see also other authors that are summarized in Table 1 [12,18]. According to Poletti & Raballo, it is likely that the “perceptual mapping between 2-dimensional specular projection (primary representation) and 3-dimensional embodied self-awareness (secondary representation)”, which corresponds to the transition from Level 2 (situation) to Level 3 (identification), is the origin point of anomalous mirror self-experiences in schizophrenia [12]. The authors develop this hypothesis by examining the case of a 11 years old boy at familial high risk of schizophrenia and diagnosed with an attenuated

psychosis syndrome, who explains his relationship with mirrors as follows:

“When I look myself at the mirror, I have the feeling that I do not exist [...], as if the mirror makes me forget who I am... my image at the mirror is always the same, it doesn’t change... then I try to close my eyes but when I open them, I have the same feeling” (p. 319).

For Poletti & Raballo, the patient’s impression of not being there and sense of immobility associated with mirror self-perception may be correlated to a deficit in Corollary discharges (CDs) [12]. CDs are cross-species – they have been found in humans, primates, fishes, birds, and insects [19-21] “motor signals sent to sensory areas that allow for the prediction of future sensory states and the ability to distinguish self-generated from externally generated events” [22]. This cognitive mechanism is responsible for many features of our perception that involve anticipation: for instance, it enables particular brain regions to make suitable modifications in expectation of the incoming sensory information, and to adjust motor responses accordingly [21]; it is at the base of the matching between visual and auditory signals, and other forms of intersensory coordination [23]; finally, CDs make a crucial contribution to the perception of continuity within the visual field across saccades [24], letting a smooth transition that leaves no gaps in time between one retinal image and the other.

At this point, it is critical to note that CDs are impaired in schizophrenia [25-28], and that this deficit has been correlated to symptoms such as auditory hallucinations and misattribution of inner speech to external sources [29-31]. However, the effect of CDs abnormal functioning I would like to focus on is the disruption in the sense of continuity within the visual field, for two interlocking reasons: first, because it has been associated to disorders in time perception typical of schizophrenia [32]; second, because it is feasible that the role that CDs play in determining the ongoing character of time perception lies also in granting unproblematic mirror experiences, so that when impairments in CDs occur, unusual mirror-related events follow accordingly [12].

Disturbances of time perception in schizophrenia have been known for a long time. In his seminal book *Lived time*, Minkowski described the temporality experienced by schizophrenic subjects as marked by a constant sense of immobility, which was captured in vivid terms by one of his patients [33]:

“There is an absolute fixity around me. I have even less mobility for the future than I have for the present and the past. There is a kind of routine in me which does not allow me to envisage the future. The creative power in me is abolished. I see the future as a repetition of the past” (p. 277).

Drawing from Fuchs [34], I & Gallagher [35] have argued that “what Minkowski’s patient depicts in terms of

a pervasive and unescapable feeling of motionlessness is rooted in an initial impairment in the protentional function of consciousness” [33]; which is to say, that the lack of temporal continuity characteristic of the schizophrenic subject’s mode of existence depends on a disruption of the basic structure of consciousness, which for Husserl consists in the perpetual integration of the three following aspects [36]:

- the primal impression, which is a mode of appearance of the intentional object that cannot provide us with any temporal information about it, as it is constituted by every single ‘now’ in which a portion of the object is given to the senses;
- retention, namely a particular kind of non-representational, “primary memory that continuously attaches itself to the [primal] impression” (p. 32) and that, adding to the actual ‘now’ of every perception, allows us to experience the intentional object as a phenomenon that extends across a time span;
- protention, which is the intuition that something is about to happen in the very next phase of the perceptual process; it is an anticipation based upon the combination of the retentive sense of the just-past moments and that manifests itself as the expectation we have towards the future modes of appearance of the intentional object.

In schizophrenia, and especially in its prodromal stages, it happens that the patient experiences the emergence of “gaps” in the passage of time [34], something that phenomenology would explain in terms of a lack in the feeling of being “protentionally oriented toward what is to happen next” [37]. One of the first symptoms to arise, thus, is a general incapacity to foresee even the most predictable outcomes in the progression of perceptual events (for an extensive discussion on this phenomenon, see [38]), which results in the impossibility to make sense of the (immediate) future modes of appearance of the intentional object. For instance, a patient of Bin Kimura complained about the fact that [39]:

“while watching TV [...], though I can see every scene, I don’t understand the plot. Every scene jumps to the next, there is no connection. The course of time is strange, too. Time splits up and doesn’t run forward anymore” (p. 194).

Interestingly, the words of Kimura’s patient resonate with those of Poletti’s & Raballo’s young patient (see above) [12], as they both report the fragmentation, inconsistencies, and immobility within the perceptual scene, with the difference that the former referred to the experience of an external object, while the latter to the perception of his own body image. This informs us about the essential involvement of anticipatory processes in the perception of outer events as well as in the integration of information about the self, suggesting a prominent role for the cognitive mechanisms – the CDs – responsible for the

Lacanian circle of projection and retroaction that shapes our body image. When we look ourselves in the mirror, the protentional function of our consciousness manifests itself in the “online” updating of the sensorial data about our face, which comes along with a tacit (pre-reflective) awareness of what would happen if, say, we would rotate the head, redirect our gaze, or change the expression. However, when such temporal continuity collapses (“my image at the mirror is always the same, it doesn’t change”), the subject needs to extrapolate information about his/her own face in ways other than protention, filling the “latent space” represented by his/her visage with other images.

Table 1. The five levels of self-consciousness associated with mirror self-recognition; adapted from Rochat [17].

| | |
|--|--|
| Level 0: <i>Confusion</i> | The individual is unaware of the mirror, confusing the specular images with the surrounding environment and interacting with people’s reflections as if they were real persons |
| Level 1: <i>Differentiation</i> | Infants start to sense a difference between the mirror and the surrounding environment, perceiving that there is a correspondence between their movements and those reflected by the surface |
| Level 2: <i>Situation</i> | Infants engage in systematic exploration of the connection between their movements and the reflection in the mirror, developing a quasi-narcissistic contemplative stance towards the specular image |
| Level 3: <i>Identification</i> | Children recognize their reflection as themselves, explicitly referring to themselves while exploring their specular image. This level includes passing the mirror-mark test |
| Level 4: <i>Permanence</i> | The self is identified beyond the immediate mirror experience, and it is recognized as existing not only in relation to the contingency of one’s own reflection |
| Level 5: <i>Self-consciousness</i> | The individual recognizes him/herself as a subject from both a first-person and third-person perspective, becoming aware of how he/she is perceived by others |

But what images?

To answer this question, I will turn my attention to the (scarce) literature on mirror self-face perception in schizophrenia and schizotypy. This issue has been addressed in three papers [9-11], which focused on the effects of prolonged sessions of mirror gazing in both clinical and non-clinical subjects. In the first study, the authors assessed the frequency and quality of strange-face apparitions during 7 minutes of mirror gazing in a darkened room in a sample of 16 schizophrenic patients as compared to a sample of 21 control subjects, classifying the types of apparitions in: deformed facial features, apparitions of archetypal faces, apparitions of monstrous faces;

moreover, they tested whether the patients tended to perceive apparitions of another person in the mirror more often than controls. What they found is that:

“the frequency of strange-faces was higher in patients than in controls: hugely deformed features (100% vs. 71%), archetypal faces (50% vs. 19%), and monstrous faces (88% vs. 29%). Patients' archetypal and monster faces were usually satanic beings. Conversely, [...] controls tended to perceive apparitions of another person in the mirror instead of themselves more often than patients (patients 13% vs. controls 48%)” (Caputo et al. 2012, p. 49) [9].

The second study replicated the same setting, but was designed to elucidate whether the dimensions of schizotypal traits in a sample of adolescents were differentially related to phenomena such as strange-face apparitions arising during prolonged sessions of mirror gazing. The authors reported results that were consistent with those of Caputo et al. [9], finding a high prevalence of self-face illusions in association with schizotypal traits within the sample of young adults, suggesting that “one of the pathways through which schizotypy is predictive of full-blown psychosis is by virtue of its association with an increased propensity to experience ASE (anomalies of subjective experience) in low stimulation settings” [10].

Finally, in the third study the experimenters asked the subjects – 24 schizophrenia patients and 25 healthy controls – to sit in front of a mirror in a well-lit room for 2 minutes, and to describe their image in the process. The answers of the two samples were used to assess the onset of misidentification (having the impression of looking at someone else's face), recognition failures (impossibility to recognize one's own face without mistaking it for someone else's), and unusual experiences (finding one's own face to be strange or unusual). Whereas no statistically significant differences were found between the two groups with regard to misidentification and recognition failures, consistently with the results obtained by Caputo et al. [9] the authors observed that “schizophrenia patients tend to perceive their face as strange or unusual more often than healthy individuals do, and that this tendency seems to be heightened when the experimental conditions are designed to trigger mirror self-face illusions” [11].

The above experiments corroborate a pretty intuitive assumption, that is, that schizophrenic patients experience hallucinations or uncanny sensations more easily and frequently than non-clinical subjects, in conditions of both high and low visibility. However, there is a datum that in my view needs to be further examined, which emerges from the first study: the fact that more controls than patients perceive the apparition of another face in place of their own in poor lighting conditions.

Phenomena of misidentification during sessions of mirror gazing in non-pathological subjects were already

known. In an experiment conducted earlier than the ones on mirror self-face perception in schizophrenia, Caputo showed that the prolonged exposure to one's own face in the mirror in a dimly lit room produced a dissociation from the reflection [40], and that “participants reported feeling that new faces did not belong to them but to another, strange person” (p. 1127), an effect which he refers to as “conscious dissociative identity” (p. 1136). According to Caputo, conscious dissociative identity is the outcome of a breakdown in the process of integration between the somatosensory – kinesthetic and proprioceptive – information about oneself and the visual perception of one's own figure in the mirror, which gets distorted by poor lighting and the static nature of the task. This hypothesis is perfectly consistent with what I stated about mirror stage and the cognitive function of mirror itself: if the mirror has the crucial role of piecing the synchronic and the diachronic aspects of one's own body perception together, thereby enabling the sense of self to emerge and stabilize, then it is comprehensible why the mismatch between the tacit understanding of one's own body – i.e., knowing how one looks like – and the sensorial data coming from abnormal mirror experiences might result in a temporary deficit in self-recognition and misidentification. However, one question remains unanswered: why do schizophrenic individuals report failures in self-recognition less often than non-clinical subjects in experimental settings specifically designed to trigger mirror self-face illusions?

To address this issue, it might be useful to introduce the notion of hyper-reflexivity [41-44], one of the core symptoms of schizophrenia, which takes (at least) two forms: a passive and an active one. Passive hyper-reflexivity is “a process in which the normally transparent experiential texture (a primary field of presence) fades or dissolves and so yields to popping up of unusual sensations, feelings or thoughts which have an object-like quality” [44]; active hyper-intentionality, on the other hand, is a compensatory – though not voluntary – mechanism that manifests itself, for instance, “in the pseudo-obsessive, ruminative efforts of a schizophrenic patient who tries to make up for the more primary slippery sense of self and feelings of unnaturalness and perplexity” (ibid.). One of the side effects of the active, compensatory form of hyper-reflexivity is that it “can easily become a kind of self-propagating spiral. The person who attempts, for example, to reassert control and re-establish a sense of self by means of introspective scrutiny may end up exacerbating his self-alienation and fragmentation” [43]. This is when hyper-reflexivity turns into morbid rationalism [33,45], an exaggerated tendency to see oneself and the others as driven by merely algorithmic rules, the application of highly rigid logical principles that follows the desperate need to overcome the loss of the usual common-sense background which allows individuals to

navigate the societal and pragmatic realm with ease – or, to say it with Blankenburg [46], the “loss of natural self-evidence”. As I & Gallagher argued elsewhere, we might say that morbid rationalism is “the paradigmatic example of what happens when rationality is reduced to simply knowing-that” [35].

One of the most notorious and frequently mentioned examples of morbid rationalism is that of “a schizoid father, who buys, as a Christmas present for his dying daughter, a coffin [...]. The act is rational from a formal-logical point of view, because a coffin is something that the daughter eventually is going to need, yet nevertheless it is bizarre by any ordinary human standard” [47].

By interpreting the data on misidentification reported by Caputo et al. [9] in light of the phenomenological constructs of hyper-reflexivity and morbid rationalism, we might be able to sketch out a hypothesis that accounts for the different incidence of self-recognition failures between controls and schizophrenic patients. Such failures, in fact, can be conceived as momentary “blackouts” in rational thought. Controls are aware that the bizarre face they are looking at in the mirror is their own, and that no other person is sitting beside them; however, the perceptual distortion elicited by the experimental setting is so powerful that they cannot help the feeling of being in front of someone that just is not themselves. Schizophrenic subjects, on the other hand, are more prone – we might even say more “used to” – stick to a rational explanation for abnormal impressions, since they experience them on a daily basis. Just like controls, they know that the face in the mirror is their own, but maintain such belief even when sensorial data suggest otherwise because of their tendency to frame a world of inconsistent information and disordered perceptions in strictly logical terms. Of course, this is just a supposition; however, it might be one worth empirical testing.

Conclusions

The literature on mirror self-face perception in schizophrenia is full of fascinating suggestions on the nature of the correlation between mirror recognition, schizophrenia, and self-consciousness. In this paper I reviewed the role that the anticipatory processes elicited by Corollary discharges might play in mirror perception of one’s own face, and found support for the hypothesis that the disruption of CDs in schizophrenia might explain abnormal experiences such as the collapse of the protentional function of time consciousness in both mirror self-face recognition and the perception of external events. Then, I suggested that the reason why more non-pathological individuals than schizophrenia patients are subject to misidentification during sessions of mirror gazing in low visibility conditions might lie in the hyper-reflexive and overly rational attitude of the patients.

Indeed, further research is needed to provide experimental data that corroborate these and other insights coming from a phenomenological framework.

Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

References

1. Baudouin JY, Martin F, Tiberghien G, Verlut I, Franck N. Selective attention to facial emotion and identity in schizophrenia. *Neuropsychologia*. 2002;40(5):503-11. doi:10.1016/s0028-3932(01)00114-2
2. Martin F, Baudouin JY, Tiberghien G, Franck N. Processing emotional expression and facial identity in schizophrenia. *Psychiatry Res*. 2005;134(1):43-53. doi:10.1016/j.psychres.2003.12.031
3. Akbarfahimi M, Tehrani-Doost M, Ghassemi F. Emotional face perception in patients with schizophrenia: an event-related potential study. *Neurophysiology* 2013;45(3):249-257. doi: 10.1007/s11062-013-9363-8
4. Bortolon C, Capdevielle D, Raffard S. Face recognition in schizophrenia disorder: A comprehensive review of behavioral, neuroimaging and neurophysiological studies. *Neurosci Biobehav Rev*. 2015;53:79-107. doi:10.1016/j.neubiorev.2015.03.006
5. Irani F, Platek SM, Panyavin IS, et al. Self-face recognition and theory of mind in patients with schizophrenia and first-degree relatives. *Schizophr Res*. 2006;88(1-3):151-60. doi:10.1016/j.schres.2006.07.016
6. Kircher TT, Seiferth NY, Plewnia C, et al. Self-face recognition in schizophrenia. *Schizophr Res*. 2007; 94(1-3):264-272. doi:10.1016/j.schres.2007.04.029
7. Heinisch C, Wiens S, Gründl M, Juckel G, Brüne M. Self-face recognition in schizophrenia is related to insight. *Eur Arch Psychiatry Clin Neurosci*. 2013; 263(8):655-662. doi:10.1007/s00406-013-0400-9
8. Bortolon C, Capdevielle D, Salesse RN, Raffard S. Self-Face Recognition in Schizophrenia: An Eye-Tracking Study. *Front Hum Neurosci*. 2016;10:3. doi: 10.3389/fnhum.2016.00003
9. Caputo GB, Ferrucci R, Bortolomasi M, et al. Visual perception during mirror gazing at one's own face in schizophrenia. *Schizophr Res*. 2012;140(1-3):46-50. doi:10.1016/j.schres.2012.06.029

10. Fonseca-Pedrero E, Badoud D, Antico L, et al. Strange-face-in-the-mirror illusion and schizotypy during adolescence. *Schizophr Bull.* 2015;41 Suppl 2(Suppl 2):S475-S482. doi:10.1093/schbul/sbu196
11. Bortolon C, Capdevielle D, Altman R, Macgregor A, Attal J, Raffard S. Mirror self-face perception in individuals with schizophrenia: Feelings of strangeness associated with one's own image. *Psychiatry Res.* 2017; 253:205-210. doi:10.1016/j.psychres.2017.03.055
12. Poletti M, Raballo A. Uncanny Mirroring: A Developmental Perspective on the Neurocognitive Origins of Self-Disorders in Schizophrenia. *Psychopathology.* 2019;52(5):316-325. doi: 10.1159/000504676
13. Courage ML, Edison SC, Howe ML. Variability in the early development of visual self-recognition. *Infant Behavior and Development* 2004;27(4):509-532. doi: 10.1016/j.infbeh.2004.06.001
14. Butler DL, Mattingley JB, Cunnington R, Suddendorf T. Mirror, mirror on the wall, how does my brain recognize my image at all?. *PLoS One.* 2012; 7(2):e31452. doi:10.1371/journal.pone.0031452
15. Lacan J. (1949). Le stade du miroir comme formateur de la fonction du Je [The mirror stage as formative of the function of the I as revealed in psychoanalytical experience]. In *Écrits*, vol. 1, 92–99. Paris: Seuil, 1966.
16. Gallop J. (1982). Lacan's "mirror stage": Where to begin. *SubStance*, 11, 118-128. doi:10.2307/3684185
17. Rochat P. Five levels of self-awareness as they unfold early in life. *Conscious Cogn.* 2003;12(4):717-731. doi:10.1016/s1053-8100(03)00081-3
18. Lobaccaro L, Bacaro M. What is in the Mirror? On Mirror Self-Recognition, Semiotics, and Material Engagement. In *Reti, saperi, linguaggi, Italian Journal of Cognitive Sciences* 2021;8(1):103-124. doi: 10.12832/101347
19. Sperry RW. Neural basis of the spontaneous optokinetic response produced by visual inversion. *J Comp Physiol Psychol.* 1950;43(6):482-489. doi: 10.1037/h0055479.
20. Holst EV, Mittelstaedt H. The principle of reafference: interactions between the central nervous system and the peripheral organs. *Naturwissenschaften* 1950;37:464-476.
21. Crapse TB, Sommer MA. Corollary discharge across the animal kingdom. *Nat Rev Neurosci.* 2008;9(8):587-600. doi:10.1038/nrn2457
22. Thakkar KN, Schall JD, Heckers S, Park S. Disrupted Saccadic Corollary Discharge in Schizophrenia. *J Neurosci.* 2015;35(27):9935-9945. doi:10.1523/JNEUROSCI.0473-15.2015
23. Stark L, Bridgeman B. Role of corollary discharge in space constancy. *Percept Psychophys.* 1983;34(4):371-380. doi:10.3758/bf03203050
24. Wurtz RH. Corollary Discharge Contributions to Perceptual Continuity Across Saccades. *Annu Rev Vis Sci.* 2018;4:215-237. doi:10.1146/annurev-vision-102016-061207
25. Feinberg I, Guazzelli M. Schizophrenia--a disorder of the corollary discharge systems that integrate the motor systems of thought with the sensory systems of consciousness. *Br J Psychiatry.* 1999;174:196-204. doi:10.1192/bjp.174.3.196
26. Ford JM, Mathalon DH, Heinks T, Kalba S, et al. Neurophysiological evidence of corollary discharge dysfunction in schizophrenia. *Am J Psychiatry.* 2001; 158(12):2069-2071. doi:10.1176/appi.ajp.158.12.2069
27. Ford JM, Gray M, Faustman WO, Roach BJ, Mathalon DH. Dissecting corollary discharge dysfunction in schizophrenia. *Psychophysiology.* 2007;44(4):522-529. doi:10.1111/j.1469-8986.2007.00533.x
28. Ford JM, Mathalon DH. Corollary discharge dysfunction in schizophrenia: can it explain auditory hallucinations?. *Int J Psychophysiol.* 2005;58(2-3): 179-189. doi:10.1016/j.ijpsycho.2005.01.014
29. Heinks-Maldonado TH, Mathalon DH, Houde JF, Gray M, Faustman WO, Ford JM. Relationship of imprecise corollary discharge in schizophrenia to auditory hallucinations. *Arch Gen Psychiatry.* 2007;64(3):286-296. doi:10.1001/archpsyc.64.3.286
30. Ford JM, Mathalon DH. Electrophysiological evidence of corollary discharge dysfunction in schizophrenia during talking and thinking. *J Psychiatr Res.* 2004; 38(1):37-46. doi:10.1016/s0022-3956(03)00095-5
31. Salomon R, Progin P, Griffo A, et al. Sensorimotor Induction of Auditory Misattribution in Early Psychosis. *Schizophr Bull.* 2020;46(4):947-954. doi: 10.1093/schbul/sbz136
32. Giersch A, Lalanne L, Isope P. Implicit Timing as the Missing Link between Neurobiological and Self Disorders in Schizophrenia?. *Front Hum Neurosci.* 2016;10:303. doi:10.3389/fnhum.2016.00303
33. Minkowski E. (1970). *Lived time: Phenomenological and psychopathological studies.* Evanston (IL): Northwestern University Press. ISBN-10: 0810103222
34. Fuchs T. The temporal structure of intentionality and its disturbance in schizophrenia. *Psychopathology.* 2007;40(4):229-235. doi:10.1159/000101365
35. Pennisi G, Gallagher S. (2021). Embodied and disembodied rationality: What morbid rationalism and hyper-reflexivity tell us about human intelligence and intentionality. In V. Cardella & A. Gangemi (Eds.), *Psychopathology and the Mind: What mental disorders can tell us about our minds* (pp. 263-286). Routledge. eBook ISBN: 9781003009856
36. Husserl E. (1966). *Zur Phänomenologie des inneren Zeitbewußtseins (1893–1917)*, Husserliana X. The Hague: Martinus Nijhoff. On the Phenomenology of

- the Consciousness of Internal Time (1893–1917). Trans. J. Brough. Dordrecht: Kluwer Academic Publishers, 1991.
37. Colombetti, G. (2013). Psychopathology and the enactive mind. In K. W. M. Fulford, M. Davies, R. G. T. Gipps, G. Graham, J. Z. Sadler, G. Stanghellini, & T. Thornton (Eds.), *The Oxford handbook of philosophy and psychiatry* (pp. 1083–1102). Oxford University Press.
38. Sass L, Pienkos E, Skodlar B, Stanghellini G, Fuchs T, et al. EAWE: Examination of Anomalous World Experience. *Psychopathology*. 2017;50(1):10-54. doi: 10.1159/000454928
39. Kimura B. Psychopathologie der Zufaelligkeit oder Verlust des Aufenthaltsortes beim Schizophrenen. *Daseinsanalyse* 1994;11:192–204.
40. Caputo GB. Apparitional experiences of new faces and dissociation of self-identity during mirror gazing. *Percept Mot Skills*. 2010;110(3 Pt 2):1125-1138. doi:10.2466/pms.110.C.1125-1138
41. Sass LA. (1992). *Madness and modernism: Insanity in the light of modern art, literature, and thought*. New York: Basic Books. ISBN-10: 0465043127
42. Sass LA. (2000). Schizophrenia, self-experience, and the so-called negative symptoms. In D. Zahavi (Ed.), *Exploring the self: Philosophical and psychopathological perspectives on self-experience* (pp. 149-182). Amsterdam: Benjamins. doi: 10.1075/aicr.23.11sas
43. Sass LA. Self and world in schizophrenia: Three classic approaches. *Philosophy, Psychiatry, & Psychology* 2001;8(4):251-270. doi:10.1353/ppp.2002.0026
44. Parnas, J. (2000). The self and intentionality in the pre-psychotic stages of schizophrenia: A phenomenological study. In D. Zahavi (Ed.), *Exploring the self: Philosophical and psychopathological perspectives on self-experience* (pp. 115–147). John Benjamins Publishing Company. doi: 10.1075/aicr.23.10par
45. Urfer-Parnas A. (2019). Eugène Minkowski. In G. Stanghellini, M. R. Broome, A. V. Fernandez, P. Fusar-Poli, A. Raballo, & R. Rosfort (Eds.), *Oxford Handbook of Phenomenological Psychopathology*. Oxford: Oxford University Press.
46. Blankenburg W. (1971). *Der Verlust der natürlichen selbstverständlichkeit: ein Beitrag zur Psychopathologie symptomarmer Schizophrenien*. Stuttgart: Enke.
47. Parnas J, Bovet P, Zahavi D. Schizophrenic autism: clinical phenomenology and pathogenetic implications. *World Psychiatry*. 2002;1(3):131-136.