Self- and other-agency in people with passivity (first rank) symptoms in schizophrenia

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ARTICLE INFO

Article history:
Received 18 November 2016
Received in revised form 10 April 2017
Accepted 11 April 2017
Available online xxxx

Keywords:
Schizophrenia
Passivity symptoms
Self-agency
Other-agency
Projected hand illusion

ABSTRACT

Individuals with passivity (first-rank) symptoms report that their actions, thoughts and sensations are influenced or controlled by an external (non-self) agent. Passivity symptoms are closely linked to schizophrenia and related disorders yet they remain poorly understood. One dominant framework posits a role for deficits in the sense of agency. An important question is whether deficits in self-agency can be differentiated from other-agency in schizophrenia and passivity symptoms. This study aimed to evaluate self- and other-agency in 51 people with schizophrenia (n = 20 current, 10 past, 21 no history of passivity symptoms), and 48 healthy controls. Participants completed the projected hand illusion (PHI) with active and passive movements, as well as immediate and delayed visual feedback. Experiences of agency and loss of agency over the participant’s hand and the image (‘the other hand’) were assessed with a self-report questionnaire.

Those with passivity symptoms (current and past) reported less difference in agency between active and passive movements on items assessing agency over their own hand (but not agency over the other hand). Relative to the healthy controls, the current and never groups continued to experience the illusion with delayed visual feedback suggesting impaired timing mechanisms regardless of symptom profile. These findings are consistent with a reduced contribution of proprioceptive predictive cues to agency judgements specific to self representations in people with passivity symptoms, and a subsequent reliance on external visual cues in these judgements. Altogether, these findings emphasise the multifactorial nature of agency and the contribution of multiple impairments to passivity symptoms.

1. Introduction

People who experience passivity (first-rank) symptoms (Schneider, 1946) do not feel in control of their actions, thoughts and perceptions, believing them to be influenced by an external agent. Along with other domains, clinicians use passivity symptoms as a diagnostic aid for schizophrenia and related disorders. Despite this importance, these symptoms remain under-researched compared to other symptom domains such as hallucinations or delusions. One dominant explanatory framework posits that passivity symptoms are deficits in the sense of agency, which arise from a mismatch between motor predictions and actual sensory outcomes (the forward model; Frith, 1987; Frith and Done, 1989; Miall and Wolpert, 1996). There is growing recognition that the predictive components of this model are altered in people with schizophrenia and passivity symptoms (Blakemore et al., 2000; Graham-Schmidt et al., 2016b; Lindner et al., 2005). However, this framework may explain why actions are not perceived to be self-initiated, but does not explain why actions are perceived to be generated by an external agent (Gallagher, 2004; Graham and Stephens, 2000).

The sense of agency is thought to comprise multiple inter-related elements (Moore and Fletcher, 2012; Synofzik et al., 2013). One element, self-agency, is the subjective awareness that one has initiated and executed one’s actions, while other-agency is the representation of events caused by another person or agent. Self- and other-agency are rarely examined independently due to the assumption that they represent opposite sides of the same phenomenon, i.e. an absence of self-agency causes the sensation of other-induced agency. However, functional imaging studies have uncovered different brain regions underlying self- and other-agency. For example, the insular cortex is activated during...
experiences of self-agency, while the temporoparietal junction, pre-supplementary motor area and precuneus are activated during experiences of other-agency (Sperduti et al., 2011). Additionally, the voluntary motor system is facilitated by viewing the actions of another agent, but is impeded by viewing one’s own actions, again indicative of separate systems (Schütz-Bosbach et al., 2006). An examination of both agency processes in passivity symptoms has yet to be conducted and so such an examination is warranted.

Agency is often measured on motor tasks involving congruent and incongruent visual feedback, through temporal or spatial manipulations. People with schizophrenia and passivity symptoms make many errors on these tasks when reporting the agent of their actions (Dapratì et al., 1997; Franck et al., 2001; Schnell et al., 2008). These agency errors are thought to be due to abnormal internal timing processes in schizophrenia (Spence, 1996; Waters and Jablensky, 2009). Normal internal timing contributes to precisely timed action elements and correct agency attributions as the subjective experience of an action-sequence plays a key role in agency judgements (Haggard and Clark, 2003; Haggard et al., 1999). Conversely, individuals with schizophrenia and passivity symptoms have impaired timing (Martin et al., 2013) and a widened perceptual binding window for sensory events when making self-agency decisions, resulting in insensitivity to temporal incongruence (Graham et al., 2014).

The question remains whether similar temporal patterns exist in schizophrenia when making other-agent decisions. This question is valuable to (i) further describe the processes underlying self- and other-agency, (ii) better understand and potentially treat problems of agency in passivity symptoms and (iii) design better tasks to assess agency.

We explored the issue with the Projected Hand Illusion (PHI), a digitised variant of the rubber hand illusion (Botvinick and Cohen, 1998). In this paradigm, participants are shown a visual image of their own hand on a screen. Participants are asked to either make simple movements or to rest their hand while it is made to move by the experimenter. A temporal delay can also be introduced in each condition, so that the visual image of the hand no longer corresponds to the felt sensation of the person’s hand movement (Ijsselsteijn et al., 2006; Kammers et al., 2009).

Overall, the aim of the current study was to assess the sense of agency using the PHI in a sample of people with schizophrenia classified according to their lifetime history of passivity symptoms, and age-matched controls.

According to the phenomenological continuity model of schizophrenia (Sass, 2003; Sass and Parnas, 2003), passivity symptoms are the most elaborated form of self-disturbances (Jansson, 2015). As passivity symptoms tend to re-occur in successive psychotic episodes in the same person, it is likely that there are trait-like abnormalities that engender susceptibility to these symptoms (Jablensky et al., 1992). Such trait-like disturbances in key sources of somatic information that contribute to agency processes have been demonstrated previously in people with a past or current history of passivity symptoms (Graham-Schmidt et al., 2016a; Graham et al., 2014). In line with this conceptualisation, there should be differences in the severity of agency alterations between subgroups of individuals with schizophrenia classified on their passivity symptom profile. We hypothesised the greatest errors in agency judgements would occur in the order: people currently experiencing passivity symptoms, people with a past history of passivity symptoms, those with no history of passivity symptoms and then healthy controls, and that these errors would be confined to judgements of self-agency over the other hand.

2. Methods

2.1. Participants

The clinical sample included individuals with schizophrenia or schizoaffective disorder (53 total, 36 males) from the research database of the WA Family Study of Schizophrenia (Jablensky, 2004). All patients met ICD-10 and DSM-IV criteria for a diagnosis of schizophrenia or schizoaffective disorder and were community outpatients treated with neuroleptic medication. Exclusion criteria included comorbid organic brain disease, substance-use disorder, or language difficulties. Healthy controls (48 total, 24 males) were recruited through community advertising. Exclusion criteria were a history of a psychotic disorder, or a diagnosis of schizophrenia, schizophrenia-spectrum, or bipolar affective disorder in a first-degree relative. One control and two people with schizophrenia could not complete all experimental conditions and were removed from the analysis. See Table 1 for demographic and clinical information. The study protocol was explained to all participants and written consent was obtained. The study was approved by the institutional research ethics committee and conformed to the appropriate regulatory standards.

2.2. Clinical evaluation

Clinical evaluation was conducted with the Scales for the Assessment of Positive and Negative Symptoms (SAPS and SANS; Andreasen, 1984a, 1984b). Passivity symptoms were assessed using the Passivity Symptoms Interview (Waters et al., 2009) with items from the Schedule for Clinical Assessment in Neuropsychiatry (SCAN, Version 2.1; see Wing et al., 1990). All symptoms were rated in accordance with stringent definitions and assessed for lifetime history and presence in the last 4 weeks, determined by case-note reviews and self-report respectively. The frequency of passivity symptoms in the patient groups can be seen in Table 2. Independent classification of patients into groups was conducted by two of the investigators (KGS and FW) and rated based on consensus; only presence/absence of the symptoms was used for classification. Patient groups were:

- ‘Current’, at least two passivity symptoms present within four weeks of testing date (n = 20).
- ‘Past’, at least two passivity symptoms present in the past, but not within four weeks of testing date (n = 10).
- ‘Never’, no passivity symptoms present during any period (n = 21).

2.3. Projected hand illusion

The same PHI equipment as described previously was used (Graham et al., 2014). Briefly, participants sat in front of a horizontally-oriented video monitor with their right hand hidden behind a curtain. A video camera captured an image of the right hand and transmitted it to the monitor. The hand and the image were separated by 15 cm. There were two movement conditions. In the Passive condition, the participant’s right index finger was rested on a brace that was used by the experimenter to move the participant’s finger (out of the participant’s vision). In the Active condition, participants wore the same brace but were instructed to make random, irregular voluntary movements with their right index finger. Additionally, each movement condition was presented with synchronous (<10 ms video feedback) and asynchronous (an additional imposed 500 ms delay) visual feedback. Participants completed each movement/delay combination once (3 min each). After each condition, participants completed a questionnaire assessing agency over the participant’s own hand (“It seemed like I was in control of moving my finger”), agency over the other hand on the screen (“It seemed like the movements on the screen were my own”), loss of agency over the participant’s own hand (“It seemed like something else was forcing my finger to move”) and loss of agency over the other hand on the screen (“It seemed like something else was forcing the finger on the screen to move.”). Each item was rated on a 7-point Likert scale ranging from −3 (strongly disagree) to +3 (strongly agree).
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