European Psychiatry xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

European Psychiatry

journal homepage: http://www.europsy-journal.com

Original article

Impaired self-agency inferences in schizophrenia: The role of cognitive capacity and causal reasoning style

M. Prikken [a,*], A. van der Weiden [b], R. Kahn [a,c], H. Aarts [b], N.E.M. van Haren [a]

[a] Brain Center Rudolf Magnus, University Medical Center Utrecht, Heidelberglaan 100, 3584 CX Utrecht, The Netherlands
[b] Department of Psychology, Utrecht University, Utrecht, The Netherlands
[c] Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, USA

ARTICLE INFO

Article history:
Received 8 June 2017
Received in revised form 28 August 2017
Accepted 29 August 2017
Available online xxx

Keywords:
Schizophrenia
Psychosis
Self-agency
Cognition
Attributional style
Self-serving bias

ABSTRACT

Background: The sense of self-agency, i.e., experiencing oneself as the cause of one's own actions, is impaired in patients with schizophrenia. Normally, inferences of self-agency are enhanced when actual outcomes match with pre-activated outcome information, where this pre-activation can result from explicitly set goals (i.e., goal-based route) or implicitly primed outcome information (i.e., prime-based route). Previous research suggests that patients show specific impairments in the prime-based route, implicating that they do not rely on matches between implicitly available outcome information and actual action-outcomes when inferring self-agency. The question remains: Why? Here, we examine whether neurocognitive functioning and self-serving bias (SSB) may explain abnormalities in patients' agency inferences.

Methods: Thirty-six patients and 36 healthy controls performed a commonly used agency inference task to measure goal- and prime-based self-agency inferences. Neurocognitive functioning was assessed with the Brief Assessment of Cognition in Schizophrenia (BACS) and the SSB was assessed with the Internal Personal and Situational Attributions Questionnaire.

Results: Results showed a substantial smaller effect of primed outcome information on agency experiences in patients compared with healthy controls. Whereas patients and controls differed on BACS and marginally on SSB scores, these differences were not related to patients' impairments in prime-based agency inferences.

Conclusions: Patients showed impairments in prime-based agency inferences, thereby replicating previous studies. This finding could not be explained by cognitive dysfunction or SSB. Results are discussed in the context of the recent surge to understand and examine deficits in agency experiences in schizophrenia.

1. Introduction

The complex syndrome of schizophrenia has often been described as a disturbance of the minimal self, in which patients have a decreased sense of self-presence [1–3]. The concepts that are key to this fundamental sense of self are body ownership and self-agency [4]. Disturbances in self-agency experiences, in which patients have problems identifying the cause of their own bodily movements or thoughts, are reflected in Schneiderian first rank symptoms such as delusions of control and auditory verbal hallucinations [5]. In experimental settings, these aberrant experiences have been consistently found [6–10], but the underlying mechanisms responsible for these impairments are still under investigation.

Understanding ourselves is a prerequisite for understanding the thoughts and intentions of others, which implicates that self-disturbances underlie social cognitive, and thus social functioning deficits in patients with schizophrenia [11,12]. To better understand human interaction and patients' impairments herein, we distinguish between two routes that explain inferences of self-agency [13,14]. First, in goal-directed behavior, self-agency is generally inferred when an action-outcome matches an explicitly set goal. For example, when someone intentionally raises her voice to get attention from someone else, and that person turns around, a feeling of self-agency arises. However, human interaction does not always occur in such an explicit and deliberate way. A substantial part of our social behavior advances implicitly, without an explicit goal or prior intention. In these situations agency inferences can

* Corresponding author.
E-mail address: m.prikken@umcutrecht.nl (M. Prikken).

http://dx.doi.org/10.1016/j.eurpsy.2017.08.007
0924-9338/

result from implicitly associated cues or situations that can unconsciously pre-activate or prime an outcome representation in the agent's mind. For example, an implicitly pre-activated emotional expression can influence a feeling of self-agency over emotional expressions in others [15]. That is, although to a lesser extent than is the case in goal-directed behavior, a match between this primed outcome representation and the actual action-outcome also enhances agency experiences [16]. Whereas the process of action selection, action execution, and processing of the actual outcome of one's action *may* require cognitive control, the prime-based agency inference itself seems to materialize without much attention. Together, this illustrates that feelings of authorship in social situations can be affected unconsciously.

Interestingly, patients with schizophrenia show specific impairments in agency inferences of behavior that is not explicitly instigated by goal-directed thought [17–19]. Specifically, by employing a reliable and widely used agency task allowing to examine goal-based and prime-based agency inferences, patients (in contrast to healthy controls) showed less (or even no) enhanced experiences of self-agency over action-outcomes that match primed outcome information. The impaired prime-based agency inferences in patients could not be explained by motivational problems to conduct the task [17], problems in visual processing of primed information [18], or symptom severity [19]. Consequently, the question remains: what then causes these impaired inferences of self-agency that are thought to be involved in social interaction? This question might be answered by considering whether patients and healthy controls differ in the way they process agency cues on a cognitive, affective, and sensorimotor level [20]. In the current study, we focus on the cognitive level and examine two potential candidates that have been suggested to play a role in schizophrenia patients' decreased functioning, i.e., neurocognitive functioning and causal reasoning style.

First, overall cognitive decline is one of the core deficits of schizophrenia [21–24], which might be a potential cause for impairments in prime-based agency inferences. That is, cognitive resources are required to mobilize the selection, execution, and perception of the actions over which we infer agency. The neurocognitive deficits in schizophrenia include a broad range of domains, including executive functioning and attentional problems [22]. Although our previous research showed that individual differences in self-reported attention during task performance could not explain patients' impairments in prime-based agency inferences [17], decreased insight into their own neurocognitive functioning asks for a more objective measure [25]. Therefore, here we use a short version of a cognitive test battery to explore whether patients' impairments in prime-based agency processing are attributable to decreased neurocognitive functioning or whether they are independent constructs.

A second (social) cognitive feature that is related to self-agency pertains to the way that people attribute the cause of events to internal (e.g., ability or personality) or external factors (e.g., other people or circumstances) [26]. A well-known causal reasoning bias is the self-serving bias (or externalizing bias), which is the tendency to attribute positive events to the self and negative events to external sources [27,28]. Importantly, in patients with schizophrenia an aberrant self-serving bias has been observed compared with healthy controls. Although most studies showed a stronger self-serving bias in psychotic patients [29–32], some studies found the opposite [33,34], and others found no evidence for group differences at all [35–37]. These inconsistent findings might be explained by different methodologies or psychopathology. Therefore, in the current study, we will assess group differences in self-serving bias by employing a widely used measure of self-attributions.

Furthermore, although prime-based agency inferences are found to be relevant in social interaction [15], uncertainty exists about its relation with (impaired) social cognitive functioning. Interestingly, the social cognitive principle of the self-serving bias overlaps with the process underlying agency inferences. Specifically, when inferring self-agency over an action-outcome, matching goals or primes may give rise to a feeling of success and are more likely to be attributed to the self (i.e., a positive event leads to self-attribution) [16,38]. Conversely, a mismatch between a goal or prime and action-outcome may give rise to a feeling of failure and is more often attributed to external sources (i.e., a negative event leads to external attribution). Building on this theoretical relation between the self-serving bias and the principles underlying agency experiences, we explore whether an aberrant self-serving bias are related to patients' impairments in prime-based agency processing.

2. Methods

2.1. Subjects

Thirty-six patients with a DSM-IV diagnosis of schizophrenia and 36 healthy controls (gender and age matched) participated in this study. Diagnoses were checked with the Comprehensive Assessment of Symptoms and History [39]. Patients were recruited from the psychiatry department of the University Medical Center Utrecht (UMCU), from previous studies performed at this department, and from other psychiatric institutions in the Utrecht area. Healthy controls were recruited through advertisements on notice boards and an online recruiting company for scientific research (www.proefpersonen.nl).

Participants were aged between 18 and 50, Dutch speaking, able to give informed consent, and had a (premorbid) IQ of at least 80 [40]. Also, they had no history of closed-head injury, neurological or endocrinological disorders, and did not meet DSM-IV criteria for drug or alcohol abuse in the past six months. Participants did not chronically use medication (for patients: other than psychiatric medication). Patients were not experiencing a psychotic episode at the time of testing. Healthy controls did not have a history of psychiatric illness and did not have a first or second-degree family member with a psychotic disorder. All participants were financially compensated and the study was approved by the UMCU Human Ethics Committee.

2.2. Procedures and measures

2.2.1. Agency inference task

An agency inference task was used to measure goal-based and prime-based agency inferences [13,17]. In this task, participants believed they were in control of a rotating square that traversed along a path, see Fig. 1 (see [13,17,19], for task details). When the s-key was pressed during the start cue, two squares (one of the participant and one of the computer) started moving in opposite directions. Participants were told that when 'stop' appeared in the middle of the screen, both squares continue to move *invisibly* at the same speed. When they pressed the enter-key to stop this invisible rotation, one of the tiles turned black. They were told that the location of this tile randomly represented the final position of their own or the computer's square. After each trial, participants indicated on a 9-point scale (not at all (1) – strongly (9)) to what extent they felt they were the one that caused the square to stop at that specific location (i.e., experienced self-agency).

In the prime-based condition, an outcome location was subtly primed just before the stop-cue (see Fig. 1a; for checks regarding unawareness of the prime, see [13,16,41–43]). Conversely, in the

Please cite this article in press as: Prikken M, et al. Impaired self-agency inferences in schizophrenia: The role of cognitive capacity and causal reasoning style. European Psychiatry (2017), http://dx.doi.org/10.1016/j.eurpsy.2017.08.007