



## Review

# Self–other integration and distinction in schizophrenia: A theoretical analysis and a review of the evidence



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## ABSTRACT

Difficulties in self–other processing lie at the core of schizophrenia and pose a problem for patients' daily social functioning. In the present selective review, we provide a framework for understanding self–other integration and distinction, and impairments herein in schizophrenia. For this purpose, we discuss classic motor prediction models in relation to mirror neuron functioning, theory of mind, mimicry, self-awareness, and self-agency phenomena. Importantly, we also discuss the role of more recent cognitive expectation models in these phenomena, and argue that these cognitive models form an essential contribution to our understanding of self–other integration and distinction. In doing so, we bring together different lines of research and connect findings from social psychology, affective neuropsychology, and psychiatry to further our understanding of when and how people integrate versus distinguish self and other, and how this goes wrong in schizophrenia patients.

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## 1. Introduction

In daily life people rarely act in social isolation. To ensure fluent and efficient social interaction people have to coordinate and

*integrate* other people's thoughts, emotions, and behavioral intentions with their own (e.g., representing both one's own and another person's movements and grip when passing the salt). A prerequisite for doing this is the ability to *distinguish* between self and other. After all, when confusing self and other, one may project one's own intentions and emotions onto others, or take over the intentions and emotions of others. As such, it becomes challenging to develop a personal identity, regulate behavior, or hold one another responsible for certain behavior.

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As social beings, our brain seems to be designed to integrate our own and other people's intentions and emotions, as well as to distinguish between self and other. In most individuals integration and distinction of self and other is a well-balanced process, which occurs without effort or conscious attention. However, not everyone is blessed with the capacity to balance self–other distinction and integration. Specifically, schizophrenia patients often experience no control over their behavior and exhibit difficulties in distinguishing their own feelings, intentions, actions and their outcomes from those of others. Accordingly, recent literature has focused on self-disturbances as a possible explanation for both positive (i.e., extra thoughts, feelings, and behaviors not seen in healthy controls, e.g., delusions of control, auditory hallucinations, grandiosity, and delusions of reference) and negative symptoms of schizophrenia (Sass and Parnas, 2003; i.e., absence of normal thoughts, feelings, and behaviors, e.g., affective flattening, apathy, anhedonia, and avolition; Sass, 2014). Moreover, recent work shows that self–other disturbances (e.g., externalizing action control, aberrant self-awareness, and misunderstanding other people's intentions and emotions) are already present in early stages of the disease (Amminger et al., 2012; An et al., 2010; Parnas et al., 2011; Thompson et al., 2013, 2012) and might even be predictive of schizophrenia onset in symptomatic and genetically high risk individuals (Nelson et al., 2012; Parnas et al., 2014). Such findings indicate that self-disturbances lie at the core of the disease (Bleuler, 1911; Hemsley, 1998; Mishara et al., 2014; Sass and Parnas, 2003).

With regard to self–other processing, evidence shows that, although schizophrenia patients are able to *integrate* their own and others' (sometimes misinterpreted) behaviors and emotions (Abu-Akel and Shamay-Tsoory, 2013), they typically exhibit difficulties in *distinguishing* their own behaviors and emotions from those of others (Asai et al., 2011; Ford et al., 2007; Jardri et al., 2011, 2009). For example, some patients hear voices which they actually (sub vocally) produce themselves (Gould, 1948; Green and Kinsbourne, 1990; Van der Gaag, 2006), feel their limb movements being controlled by aliens (Frith, 2005), or think they caused events that are actually caused by someone else, as in delusions of reference (Synofzik et al., 2013a). In addition, a lack of self–other distinction may explain why patients get more easily distressed when confronted with the distress of others (i.e., emotional contagion; Montag et al., 2007).

Thus, abnormal processing of self and other is reflected in clinical symptoms, but also in an array of neural, social cognitive, and behavioral dysfunctions (Nelson et al., 2014). As such, it may be an important factor in explaining impaired social functioning in schizophrenia patients. Indeed, schizophrenia patients often struggle in social interactions (Patterson et al., 2001; Pinkham and Penn, 2006; Pinkham et al., 2007) and this is an outcome of the disease that patients find extremely difficult to cope with (Gorwood et al., 2013; Świtaj et al., 2012). The difficulties patients encounter in social interaction are usually explained by impairments in social cognition (Fett et al., 2011), for example in theory of mind (Brown et al., 2014). As social cognition is defined as 'the ability to construct representations of the relation between one-self and others and to use those representations flexibly to guide social behavior' (Adolphs, 2001, p. 231), self–other processing is a crucial aspect of social cognition, and is thus essential to social functioning.

Research on social cognition in schizophrenia has so far mainly focused on patients' ability to understand or *integrate* their own and others' intentions and emotions (e.g., emotion recognition, theory of mind). Surprisingly, little attention has been devoted to problems in self–other *distinction*. Distinguishing between the two concepts is complicated though, as integration and distinction of self and other are inextricably intertwined. That is, some processes

underlying self–other integration may also affect self–other distinction, and vice versa. In this review article, we address the difficulties patients face when it comes to integrating as well as distinguishing self and other, and zoom in on mechanisms that may underlie self–other integration and distinction.

We can distinguish two major mechanistic models. So far, most work proposes that self–other processing crucially relies on the extent to which our motor control system is able to predict our own as well as others' actions and outcomes. However, people cannot always rely on motor predictions to integrate or distinguish self and other (i.e., when one has no clear prediction of one's own or others' actions, for example when actions may result in a variety of outcomes). In line with this notion, a second model has been proposed that takes into account, and emphasizes, the role of people's cognitions about their own and others' action-outcomes.

First, we will review research that was initially developed to map the perception and understanding of behaviors, intentions, and emotions of *others* (other-perspective). This research mainly focused on self–other integration, but we will show that it also provides insight into self–other distinction. Specifically, we will discuss the role of motor prediction as reflected in mirror neuron function and its implications for theory of mind and mimicry. Next, we will review research that was initially developed to map the perception and understanding of *one's own* behaviors, intentions, and emotions as distinct from those of others (self-perspective). Here, we specifically focus on the role of motor prediction in self-awareness and self-agency phenomena. In addition, we will discuss more recent research that suggests that self–other distinction does not always arise from motor prediction processes, but may also result from cognitive expectation processes that deal with information pertaining to one's own and others' behaviors, beliefs, and emotions. Fig. 1 shows a heuristic model depicting how the different motor prediction and cognitive expectation processes that will be discussed aid self–other integration and distinction.

Essentially, we propose that motor prediction and cognitive expectation processes are both affected in schizophrenia, and may each explain disturbances in self–other integration and distinction depending on the requirements of the task or context. Thus far, research on cognitive models of self–other integration and distinction evolved independently of research on motor prediction models, although recent studies have emerged investigating the interaction between cognitive and motor processes in self-awareness and agency attribution (Gentsch and Schütz-Bosbach, 2011; Moore et al., 2009; Sato, 2009; van der Weiden et al., 2013a). Furthermore, research on self–other *integration* mainly focused on the role of motor prediction in understanding *other people's* intentions and emotions (other-perspective), whereas research on self–other *distinction* mainly focused on the role of motor prediction in understanding *one's own* intentions and emotions (self-perspective). Our aim is twofold. First, we show that processes underlying self–other integration and self–other distinction are associated and may influence each other. Second, we show that in situations where motor prediction cannot inform self, other processing is crucially affected by cognitive expectations.

Our goal is not to provide a complete overview of the available studies. Rather, we give a selective review in order to bring together these different lines of research to further our understanding of when and how people integrate or distinguish self and other, and how this is impaired in schizophrenia patients. Finally, we will briefly discuss how self–other integration and distinction as resulting from motor prediction and cognitive expectation processes may affect social functioning in healthy controls and schizophrenia patients, and as such pave the way for promising and exciting directions for future research.

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