Differential lexical correlates of social cognition and metacognition in schizophrenia; a study of spontaneously-generated life narratives

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Abstract

Objectives: Social cognition and metacognition have been identified as important cognitive domains in schizophrenia, which are separable from general neurocognition and predictive of functional and treatment outcomes. However, one challenge to improved models of schizophrenia has been the conceptual overlap between the two. One tool used in previous research to develop cognitive models of psychopathology is language analysis. In this article we aimed to clarify distinctions between social cognition and metacognition in schizophrenia using computerized language software.

Methods: Fifty-eight (n = 58) individuals with schizophrenia completed the Metacognitive Assessment Scale Abbreviated and measures of social cognition using the Hinting, Eyes, BLERT and Picture Arrangement test. A lexical analysis of participants' speech using Language Inquiry and Word Count software was conducted to examine relative frequencies of word types. Lexical characteristics were examined for their relationships to social cognition and metacognition.

Results: We found that lexical characteristics indicative of cognitive complexity were significantly related to level of metacognitive capacity while social cognition was related to second-person pronoun use, articles, and prepositions, and pronoun use overall. The relationships between lexical variables and metacognition persisted after controlling for demographics, verbal intelligence, and overall word count, but the same was not true for social cognition.

Conclusions: Our findings provided support for the view that metacognition requires more synthetic and complex verbal and linguistic operations, while social cognition is associated with the representation and clear identification of others.

1. Introduction

Recent research has focused on the relationships between cognitive and clinical variables and functional outcome in schizophrenia. In particular, two cognitive variables – social cognition [1,2] and metacognition [3,4] – have provided important information about the processes involved in recovery. Social cognition is broadly defined as the ability of individuals to correctly identify and adaptively make sense of others' thoughts, emotions, intentions and social cues. It is separable from neurocognition [5], related to functional outcomes [6], and responsive to psychosocial interventions [7]. Metacognition, on the other hand, describes the ability of an individual to make and hold complex representations of self and other over time. Measured primarily through spontaneous communication in narrative [4], metacognition has similarly demonstrated relationships to functioning in schizophrenia across domains, including work [8] and social functioning [9,10], and has also been shown to be related to but not synonymous with general neurocognition [11].

Although social cognition and metacognition have both individually provided important information as treatment targets and predictors of outcome in schizophrenia, there exists confusion regarding the boundaries between these two domains. In wide scale reviews of social cognition in this population, Green et al. [12,13] and Pinkham et al. [14] regarded identifying the relationships between social cognition and other related domains as vital to continued effective

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research in this area. There are a number of reasons that the distinction between social cognition and metacognition presents an area of confusion. First, both areas identify cognitive operations related to reflecting on cognitive processes, whether of one's own or of others. Second, both domains are theorized to at least partially moderate the relationships between general neurocognition and functioning in schizophrenia [10,15,16]. Further, one of the sub-domains that comprise metacognition is the ability of an individual to understand and form ideas about the minds of others [17,18], which overlaps considerably with other domains traditionally regarded as involving social cognition, like emotion perception and theory of mind. A lack of conceptual clarity between these domains remains an important obstacle to clear and parsimonious modeling of the cognitive variables involved in predicting functioning in schizophrenia.

Lysaker et al. [17,18] have provided one possibility for modeling the differences between these two important domains, suggesting that reflective cognitive operations exist along a continuum from discrete to synthetic operations. Highly discrete metacognitive judgments typically require straightforward awareness of thoughts, while moderately discrete judgments frequently require a circumscribed right-or-wrong assessment (e.g. correctly identifying the emotion in the face of an actor). More synthetic metacognitive operations call on individuals to take several cognitive pieces and put them together to form a more complex and balanced idea of self, others, or the world (rather than a "right-or-wrong" answer). The Metacognition Assessment Scale—Abbreviated (MAS-A; [3,4]) could be described as a more synthetic measure, as it assesses an individual's ability to integrate many different kinds of psychological phenomena (e.g. memories, reflections, emotions, thoughts) into a coherent story that makes sense of one's life events. Alternately, prominent social cognition measures (e.g. Reading the Mind Through The Eyes Task [19] or the Penn Emotion Recognition Task ER-40; [20]) could be described as discrete, as they typically isolate one cognitive domain of interest, whether it be the ability to infer an other's motives or read emotions from the face or body language.

While these theoretical divisions have provided important avenues to examine, little empirical work has examined the specific differences in the correlates between these domains. Only one factor analytic study has suggested that assessments of social cognition and metacognition load on different factors and may represent distinct phenomenon [17,18]. One tool that has been used to unpack the phenomenological, attentional, and cognitive components of differing processes in psychopathology is the examination of language. In general, characteristics of the word selection or communication style of individuals have been shown to indicate several psychological phenomena as well as indicate potential cognitive mechanisms that underlie them (For a review, see [21]). For example higher frequency of negative emotion words in positive contexts predicts clinically-rated anhedonia [22], as

well as global affective flattening [23],[1] though others have shown some conflicting results [24]. Individuals with anticipatory anhedonia have also demonstrated a lower frequency of past-related words in spontaneous narratives and the use of first-person plural ("we") [25]. Additionally, lexical variables have been used to predict symptoms and functioning [26], as well as distinguish between individuals with schizophrenia and non-patient controls [25,27]. Specific to cognitive variables, Fertuck et al. [28]) were able to use text analysis to validate a computerized version of the Reflective Functioning (RF) Scale, a measure that assesses individuals' ability to reflect on one's own and others' beliefs and motivations. Several lexical characteristics have also been shown to differentiate patients with schizophrenia according to their length of stay in a care home [29].

It is possible that examining the language used in reflective processes might reflect important differences in thinking that better distinguish social cognition and metacognition. Previous work has suggested that language and communication in appropriate contexts can provide information about social cognition skill [30] or reflective functioning [28], a domain partially related to metacognition. This work has not been extended to specific lexical characteristics nor have these tools been used to distinguish metacognition and social cognition. In the current study, we explored two categories of lexical variables derived from previous work in the lexical characteristics of speech as well as study of these characteristics in a schizophrenia sample. The first of these categories includes words reflecting cognitive complexity, as several lexical characteristics have been linked with the presence of more complex communication, including the use of inclusive words, exclusive words, and conjunctions [21,31]. To examine this area, the LIWC software provides an entire category of cognitive mechanism words, though only a subset has been studied as indicators of cognitive complexity of speech. We hypothesize that metacognition will be significantly related to these cognitive complexity variables (in particular with inclusive words, exclusive words, and conjunctions) because metacognitive operations involve a complex synthesis of mental states.

Second, we hypothesize that social cognition will demonstrate significant negative relationships with pronouns. The correct use of pronouns requires a representation of the listener's mind such that the speaker knows what the listener needs clarified (e.g. who exactly "she" represents in a sentence) and thus could reflect social cognitive skill. This is consistent with prior work showing that individuals with schizophrenia frequently ineffectively explain to whom one is referring when using pronouns [32], and frequently refer back to themselves in prolonged speech [33]. These early theoretical observations were supported by more recent empirical work [25] as individuals with schizophrenia demonstrated a greater

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[1] It is worth noting that Cohen et al. [23] demonstrated that affective flattening was associated with fewer negative words expressed, while Cohen et al. [22] demonstrated that individuals with clinically-rated anhedonia used *more* negative words in positive contexts.