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Change in delusions is associated with change in "jumping to conclusions"

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ABSTRACT

Evidence has been put forward that premature termination of data collection and jumping to conclusions behavior (JTC) is associated with delusions. However, few investigations have attempted to track associations between changes in delusions and changes in JTC measures. In the current study individuals with schizophrenia spectrum disorders completed a version of the JTC task (involving fishing from lakes as opposed to drawing beads from a jar) at two timepoints 12 weeks apart. The results revealed significant negative correlations between change in task performance (number of requested pieces of information) and change in delusion scores over time. This evidence is consistent with the contention that the JTC task is sensitive to the cognitive systems underlying delusions in schizophrenia spectrum disorders.

1. Introduction

Delusions are consensually defined as fixed false beliefs not amenable to contrary evidence, and are hallmark symptoms of schizophrenia spectrum disorders. Although it was initially proposed that delusional ideation cannot be explained by a pathology of reasoning (Maher, 1988), recent work has revealed a number of aberrations in reasoning in individuals with schizophrenia with current or past delusional ideas (Bell et al., 2006; Blackwood et al., 2001; Davies et al., 2001; Garety and Freeman, 1999).

One of the most commonly studied reasoning paradigms is known as the jumping to conclusions (JTC; Garety et al., 1991; Huq et al., 1988) paradigm, and is widely cited and reviewed (Bell et al., 2006; Blackwood et al., 2001; Davies et al., 2001; Garety and Freeman, 1999). JTC paradigms typically involve the beads task, where the subject is presented with jars containing beads of two colours (e.g., black and white beads divided 60–40 in one jar and 40–60 in the other) and are asked from which jar beads are being drawn when the jars have been hidden from view. Individuals with schizophrenia tend to request fewer beads before deciding on which jar is the source of the beads (draws-to-decision procedure). The dominant interpretation of this finding is that individuals with schizophrenia display a data gathering bias, in that they seek less information before reaching a decision (Garety and Freeman, 1999).

However, the literature on whether or not JTC correlates with delusions is mixed, as a JTC bias has been observed for both currently deluded and non-deluded individuals with schizophrenia (Menon et al., 2006; Moritz and Woodward, 2005), and in some studies an association with delusions is absent (McKay et al., 2007; Young and Bentall, 1997). Some studies report that the association with delusions depends on methodological variables, such as the requirement to self-terminate the trial by indicating that they have enough information to decide (Garety et al., 1991; Moritz and Woodward, 2005; van Dael et al., 2006), and/or high working memory load (i.e., the jars are hidden from view and the bead is replaced in the jar after being viewed; Menon et al., 2006).

Unfortunately cross sectional studies cannot provide definitive evidence for the cognitive underpinnings of delusions, for two main reasons. First, between-group comparisons of conditions (e.g., delusional vs. nondelusional individuals) are less powerful than within-group comparisons, because any differences between the subjects contribute to the error term in the between-group design, but much of this source of error is subtracted out of the error term when each subject is used as his or her own control. Second, individuals currently displaying delusions may tend to possess certain characteristics that would not change if the delusions were to go into remission, such as a genetic predisposition that affects cognitive performance and/or a pre-existing cognitive style. A longitudinal study is more powerful and interpretable, because pre-existing differences between nondelusional and delusional conditions will be held constant as delusions change.

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This is feasible because delusions change in their severity over time in response to treatment, or spontaneously (Eaton et al., 1995; Gunduz-Bruce et al., 2005; Lieberman et al., 1993; Sherwood et al., 2006). A computational model of JTC behavior (Moore and Sellen, 2006), for which a gain parameter was employed to model increases and decreases in dopamine levels in delusional individuals, predicted that changes in delusions should correspond with changes in JTC behavior.

Longitudinal studies investigating the association of change in JTC with change in delusions over time have been carried out in the past using the beads task, with mixed results. In a recent longitudinal study, a JTC pattern in delusional individuals was stable over time despite improving symptomatology (Peters and Garety, 2006). A different study found that although performance on a beads task predicted subsequent change in positive symptoms, non-significant correlations between changes in task performance and changes in symptomatology were observed (Menon et al., 2008).

Although both of these studies employed the draws-to-decision procedure, only one and two series of beads, respectively, were administered, leading to less stable JTC estimates compared to when multiple series are administered. In addition, in past studies our group has noted that individuals with schizophrenia have had difficulty comprehending the beads procedure (Moritz and Woodward, 2005). In order to increase comprehensibility of the task instructions, we developed a new JTC paradigm that involved a scenario of a fisherman fishing from two lakes, and developed a number of conditions that allowed four series of "beads" (or fish in this case) to be presented. We used this variation of the beads task (Huq et al., 1988) with a draws-to-decision procedure (Dudley et al., 1997; Fear and Healy, 1997; Menon et al., 2008; Moritz and Woodward, 2005) in a longitudinal study involving pre- and post-assessment of a sample of individuals undergoing group cognitive behavioral therapy (CBT; Lecomte et al., 2008) or control treatments. According to an account holding that the JTC bias is a cognitive underpinning of delusions, we expected to observe a correlation between change in delusion scores and change in task performance, such that a decrease in JTC behavior should correspond with a decrease in delusions, and vice versa.

2. Method

2.1. Participants

All participants were taking part in a longitudinal randomized controlled trial on group CBT for early psychosis (Lecomte et al., 2008). Potential participants were recruited from Early Psychosis Intervention programs and community mental health clinics in Quebec and British Columbia, Canada. Individuals were eligible if aged between 18 and 35, fluent (verbally as well as reading and writing skills) in one of the official languages (English and French), currently presenting with persistent or fluctuating psychotic symptoms (defined as delusions or hallucinations appearing occasionally, such as in periods of stress), having consulted for the first time a mental health professional for psychotic symptoms in the past 2 years, and being followed by a psychiatrist (and therefore receiving antipsychotic medication). Individuals were only recruited once they had been discharged from the hospital and considered 'stabilized' by their psychiatrist. Exclusion criteria included: suffering from an organic disorder, having already received one of the interventions, and not being able to give informed consent. Capacity to give informed consent was verified by a true–false questionnaire given after the study and consent form were explained.

In order to estimate symptom severity, all participants were assessed by trained clinicians with the Brief Psychiatric Rating Scale semi-structured interview (BPRS; Ventura et al., 1993) at both Time 1 and Time 2. The BPRS is a widely used psychiatric rating scale that consists of 24 symptom constructs, each reaching from 1 ('not present') to 7 ('extremely severe'). Delusion scores were assessed by computing the mean of BPRS 8 ('grandiosity'), BPRS 9 ('suspiciousness') and BPRS 11 ('unusual thought content').

The JTC fish task was administered pre- (Time 1) and post-treatment (Time 2) to a subset of 26 individuals with schizophrenia in the trial. The 19 individuals showing changes in delusion scores from Time 1 to Time 2 were included in the analysis. Fifteen individuals displayed decreases in delusions from Time 1 to Time 2, with the mean delusion score being $M = 3.56$ (S.D. = 1.40) at Time 1 and $M = 1.87$ (S.D. = 1.07) at Time 2. Four individuals displayed increases in delusions from Time 1 to Time 2, with the mean delusion score being $M = 2.58$ (S.D. = 1.20) at Time 1 and $M = 3.50$ (S.D. = 1.26) at Time 2. Of these individuals, 6 displayed decreases on hallucinations (BPRS item 10; Time 1 $M = 4.67$, Time 2 $M = 1.67$) and 4 displayed increases (Time 1 $M = 2.00$, Time 2 $M = 4.75$), 7 displayed decreases on depression (BPRS item 3; Time 1 $M = 3.57$, Time 2 $M = 1.57$) and 3 displayed increases (Time 1 $M = 2.00$, Time 2 $M = 3.67$), and 2 displayed decreases on thought disorder (BPRS item 15; Time 1 $M = 3.00$, Time 2 $M = 1.00$). None displayed increases on thought disorder, and none changed on negative symptoms (computed as the mean of BPRS items blunted affect, emotional withdrawal, and motor retardation). None of these symptom changes correlated with the JTC measures, so they will not be discussed further.

Eleven of the 19 were treated with group CBT (see Lecomte et al., 2003), four completed a skills training Symptom Management Training (SM; Liberman et al., 1988) and four were in a wait-list control group. Participants received 24 sessions of either CBT or SM, twice a week, for three months. The CBT protocol integrates the principles and philosophy of individual CBT for psychosis, but adapted to a group format and tailored for first episodes. A detailed description of the intervention is described elsewhere (Lecomte et al., 2003). The Symptom Management (SM) module was developed by UCLA Psychiatric Rehabilitation Consultants (Liberman et al., 1988). The treatment aims at building four skill areas: 1) identifying warning signs of relapse, 2) managing warning signs, 3) coping with persistent symptoms and, 4) avoiding alcohol and street drugs.

Fourteen individuals had an established Diagnostic and Statistical Manual of Mental Disorders (DSM) IV (American Psychiatric Association, 2000) diagnosis of schizophrenia (paranoid: $n = 13$, undifferentiated: $n = 1$). One participant was diagnosed with schizoaffective disorder. The remaining four individuals were diagnosed with psychosis NOS, with three also having an Axis I diagnosis of substance abuse. All diagnoses were confirmed by trained clinicians using the computerized version of the Structured Clinical Interview for DSM-IV Axis I disorders (SCID; First et al., 1997). With respect to demographic information, the mean age was 24.53 (S.D. = 6.04), mean illness duration/years was 2.69 (S.D. = 4.59), mean years of education was 12.95 (S.D. = 1.65), and the gender ratio (female:male) was 3:16.

2.2. Materials

Materials prepared for this task consisted of (1) two lakes, each containing 50 fish, with 60%:40% of white:black fish in the top lake, and the complementary ratio in the bottom lake, labeled Lake A and Lake B respectively, printed on an 8.5×11 piece of paper, (2) pictures of white and black fish, 3 cm high and 12 cm long, printed onto 8.5×11 pieces of paper with a grey background, and (3) a scoresheet, used and seen only by the experimenter, whereby the experimenter indicated whether or not each fish of the possible 10 fish were requested to be viewed. The 10 pages representing the 10 fish to be viewed for each series of fish were placed into a three ring binder in the appropriate order, and a page was turned and exposed to the subject each time a fish was "caught".

2.3. Procedure

The experimenter began by stating to the participant "I'm going to show you pictures of two different lakes. Lake A has 60% white fish, and 40% black fish. Lake B, on the other hand, has 40% white fish, and 60% black fish. Just to make sure that you understand, I'm going to ask you, which lake has more white fish than black fish? Which lake has more black fish than white fish?" Once the participants respond with correct answers including the names of the lakes, the experimenter said "Now, I'm going to show you some pictures, one at a time, of fish that were caught from one of these lakes. After each fish is caught, it is put back in the lake and allowed to swim away. All of these fish that I'm about to show you will be caught from the same lake. Your task will be to decide whether you think that they're all caught from Lake A, or all caught from Lake B. After each fish that I show you, indicate whether you want to see more fish, or you have decided. Here is a picture of a fish that was caught from one of the lakes." At that point, the first picture of an individual fish was displayed. After this and each following picture was shown, the experimenter asked "Do you want to see more fish, or have you decided?" Each fish that was shown was recorded on the scoresheet.

Series 1 and 2 differed in that verbal prompting regarding the ratios of fish in the lakes was provided by the experimenter in Series 1, but not in Series 2, creating a higher cognitive load condition in the latter series, possibly leading to reduced conservativism. In Series 3 and 4, there was monetary reward for correct responses in order to introduce a motivational component. The purpose of this manipulation was that reward may increase conservativism, possibly increasing the number of requested pieces of information and avoiding a floor effect for delusional participants. In Series 3, participants were rewarded $0.25 for a correct response (Lake A or B, whichever most closely matched the proportion of fish presented) independent of the number of fish they requested to view. In Series 4, participants were rewarded $5. For the reward conditions, the instructions were: "Now, we're going to do a task similar to the one we just did, but with new lakes and a new group of fish that have been caught. If you answer correctly, you will win 25 cents/5 dollars. If not, you won't get to keep this money." The order of series administration was not randomized, because it was necessary to introduce that most basic task instructions before moving on to the more complex series (e.g., involving motivational manipulations). The four series of fish were presented in the following order:

Series 1: B–B–W–B–W–W–B–W–B–B
Series 2: W–W–B–W–B–B–W–W–B–W
Series 3: B–B–W–B–W–B–W–B–W–B
Series 4: W–W–B–W–B–W–W–W–B–B

where B = black fish and W = white fish.