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Relation between jumping to conclusions and cognitive functioning in people with schizophrenia in contrast with healthy participants

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ABSTRACT

'Jumping to conclusions' (JTC) is a reasoning bias consisting of a tendency to take a decision without having enough information about an event. It has been related to the presence of delusions. The aim of the present study was to assess the relationship between three tasks differing in complexity and concept which assess JTC and cognitive functioning in a sample of people with schizophrenia and healthy participants. We also assessed which cognitive variables, after controlling for psychotic symptoms, explained the presence of JTC in each sample. A total of 43 patients with schizophrenia and 57 healthy participants were assessed with a cognition battery including executive function, verbal memory, and IQ. JTC was assessed with three tasks (probability of 85:15; 60:40, and 60:40 with emotional component). Patients were also assessed on psychotic and affective symptoms and the healthy participants on proneness to hallucinations and delusion. The present study demonstrates a clear relationship between JTC and cognitive functioning, especially in working memory, verbal memory, and cognitive processing speed in people with schizophrenia and in healthy participants. However no relationship was found in the emotional task of JTC. Hallucinations (in people with schizophrenia) and proneness to hallucinations (in the healthy participants) are related to JTC. Our results suggest that diverse psychological interventions such as cognitive remediation, cognitive behavioral therapy and meta-cognitive training might contribute to reducing JTC bias.

1. Introduction

The phenomenon known as 'jumping to conclusions' (JTC) is a reasoning bias consisting of a tendency to make a decision about an event without having enough information about it. The most common task for the assessment of JTC is the bead probabilities. The subject receives information about two jars with two different probabilities of color beads; the evaluator indicates that one of the jars has been selected and the subject is asked to indicate which jar it is after removing the number of beads he/she wants. One of the JTC tasks uses an emotional component where subjects extract positive or negative comments from the jars. The following studies have used these tasks for the assessment of JTC. Mortimer et al. (1996) described how 42% of people with schizophrenia only needed to draw one bead from the jar after to take a decision, thus working without sufficient information. Several studies show that patients with delusions have a greater tendency to jump to conclusions than people without mental disorders or with other mental disorders (Dudley et al., 1997; Fear and Healy, 1997; Conway et al., 2002; Garety et al., 2005). Some studies indicate that JTC is stable in people with schizophrenia; it is present even when there are no delusions at the time of the evaluation and it is more frequent in relatives of people with schizophrenia and in people with high risk of psychosis than healthy participants (Peters et al., 1999a; Peters and Garety, 2006; Van Dael et al., 2006; Broome et al., 2007). However, other studies have suggested that JTC improves after pharmacological and psychological interventions (Menon et al., 2008; Moritz et al., 2011). Salvatore et al. (2012) proposed theoretical models suggesting that cognitive bias such as JTC may lead the subject to attend only to information that confirms the patient's hypothesis in contrast to others, so certain interpersonal events could contribute to the emergence of persecutory delusions. The study of JTC, then, is a step toward explaining the forming and maintaining of delusions that may be useful for the design of intervention programs.

Regarding JTC in healthy participants, few studies have been done. Freeman et al. (2008) suggest that people who jump to conclusions present higher levels of subclinical delusional conviction and perceptual anomalies (Freeman et al., 2008). However, Warman and Martin (2006) found that JTC was related to proneness to delusions only in the emotional salient stimulus of the task.

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1.1. Cognitive functioning and JTC

Individuals with schizophrenia have impaired cognitive function, especially in executive function (several subdomains including working memory), and verbal memory (Bilder et al., 2000; Rund et al., 2004; Keefe et al., 2005; Lee and Park, 2005; Forbes et al., 2009). It is to be expected that a cognitive alteration in these areas would affect decision-making in a probabilistic task and this may be useful in order to create intervention strategies. However, few studies have assessed the relationship between cognitive functioning and JTC, and most of these have assessed it as a secondary aim.

The most widely studied cognitive domains related to JTC are Intellectual Quotient (IQ) and impulsivity. Regarding IQ some researchers have found that people with lower intelligence performed worse in JTC tasks (Mortimer et al., 1996; Van Dael et al., 2006). However, Lincoln et al. (2010) found that IQ only mediated the relationship between JTC and symptoms. Regarding impulsivity, the studies did not find a relationship between JTC and impulsivity (Moritz and Woodward, 2005; Rubio et al., 2011).

Few studies have assessed the relationship between JTC and executive function. Woodward et al. (2009) in a small sample of people with schizophrenia found that JTC was associated with executive functioning, using the Rule Extraction Test, which consists in participants being presented with a series of paired drawings and then determining which of the two stimuli presented contains the target element. Rubio et al. (2011) pointed in the same direction, finding a relationship between JTC and the executive control component of the Attentional Network Task, consisting in processing task-relevant information. However, Buck et al. (2012) did not find any relationship between JTC and perseverative errors of the WCST, although they found a correlation between WCST and confidence in the judgment. Specifically in relation to working memory, Garety et al. (2013), in a sample of people with schizophrenia, found a relationship between altered working memory and JTC. In people with high risk, Broome et al. (2007) found a negative relationship between the amount of information required and memory errors. On the other hand, Buck et al. (2012) did not find a relationship between auditory verbal memory and JTC. Moreover, of all the studies reviewed, only Garety et al. (2013) used a specific battery of tests for the assessment of the relationship between JTC and cognitive functioning, including measures of premorbid IQ, verbal learning memory, processing speed and working memory. Previous studies had not collected all of these together in a single study. However, the study of Garety et al. (2013) did not include healthy participants. There are no studies regarding the relationship between the emotional task of JTC and cognitive functioning. Woodward et al. (2009) used the emotional component, but as a unique measure of JTC, mixing this salient task with the other two tasks of JTC.

The relationship between cognitive functioning and JTC in healthy people has barely been studied. Only Freeman et al. (2008) studied IQ in the general population, finding a trend toward worsened functioning in people who jump to conclusions. However, no research has been conducted to assess the relationship with other cognitive domains. It would be interesting to learn whether the same relationship between JTC and cognitive functioning exists in people without any mental disorder as in people with schizophrenia, in order to better establish the mechanisms of JTC.

In summary, few studies have assessed the relationship between cognitive functioning and JTC, and only in one of them was it the main aim; none of them has assessed its functioning in healthy people nor has any assessed the relationship between the emotional component of JTC and cognitive functioning. Therefore, the aim of the present study was to assess the relationship between three different complexity and conceptual tasks of JTC and cognitive functioning in people with schizophrenia and healthy participants. The second aim was to assess which cognitive variables were at play after controlling for symptoms, thereby explaining the presence of JTC in each sample.

2. Material and methods

2.1. Participants

The participants were stable non-acute patients with schizophrenia at the Parc Sanitari Sant Joan de Déu who were attended in a middle and long stay unit of the center. Inclusion criteria were DSM-IV-R criteria for schizophrenia and age between 18 and 65. Exclusion criteria were alcohol abuse/dependence or abuse/dependence of other substances (DSM-IV-R criteria) during the previous 6 months, a history of organic mental disease, intellectual disability, brain injury, dementia, and having a severe physical illness.

The healthy participant group was composed of people without a mental disorder and was adjusted to the patient group by age and gender. The healthy participants were recruited in the general population through newspaper advertisements and posters near the institution. The exclusion criteria for this group were the same as for patients, with the addition of no presence of mental disorder. The participants were screened by telephone interview regarding a past or present mental disorder (list of several mental disorders) and substance abuse.

All the participants signed their informed consent. The study was approved by the Research and Ethics Committee of the center.

2.2. Evaluation

2.2.1. Jumping to conclusions

Three different computer tasks were used in the study (Fig. 1). In Task 1, jars contained balls of two different colors; in one of them the proportion was 85 black versus 15 orange balls and in the other the ratio was reversed. Task 2 was the same as Task 1 but with a proportion of 60:40 in each jar. Finally, Task 3 was similar to Task 2 but instead of balls, the jars contained positive or negative comments with a proportion of 60:40. The patients had to decide which to jar belonged the extracted balls or comments. At all times the participants had information about the balls previously extracted, in order to control the effect of memory. The subjects could remove as many balls as needed to make their final decision (Garety et al., 2005). JTC was considered as taking a decision after extracting 1 or 2 balls (Brett-Jones et al., 1987). The tasks used for the assessment of JTC were the most commonly used in studies previously commented upon, especially Tasks 1 and 2.

2.2.2. Cognitive performance

- Phonological Verbal Fluency (PVF), regarding response initiation process, was assessed using the letter P. The participants were required to produce words starting with this letter during a 1 minute period. Moreover, semantic verbal fluency was assessed by requiring participants to produce as many names of animals as they could within 1 min (Thurstone, 1962).
- Digit Symbol Substitution Test (DSST) from the WAIS-III was used for the assessment of cognitive speed. Participants had a list of digits associated with a symbol. They had to fill in the correct symbol as quickly as possible, for 90 s. Moreover, the Digit Copy (DC) test from the WAIS-III was administered for assessment of motor speed. In this case participants only had to copy the symbols for 1 min (Seisdedos et al, 1999).
- Forward Digit Span (FDS) from the WAIS-III was used for assessment of short-term memory. The FDS comprises a series of numbers that must be repeated in the same order and the total number of correct trials was recorded.
- Backward Digit Span (BDS) and Letter–Number (LN) subscale were used to assess working memory. The BDS from the WAIS-R consists of a series of digits that must be repeated in reverse order and the total number of correct trials was recorded. Moreover, the LN consists of the repetition of a series of digits and letters in a reorganized order, first putting the digits in ascending order, and then the letters in alphabetical order. The total number of correct trials was included.