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On the multi-causal nature of jumping to conclusions in psychosis

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ABSTRACT

Background and objectives: Jumping to conclusions (JTC) is the most widely researched cognitive bias in schizophrenia. Notwithstanding meta-analyses demonstrating a higher level of JTC across the psychosis spectrum, important research questions remain unanswered. First, whether JTC is a primary process or in part an epiphenomenon reflecting contributions of other variables is still unresolved, which may explain why interventions targeting cognitive biases are effective on positive symptoms but less so on reducing JTC. Secondly, the beads task, the traditional procedure to capture JTC, is a complex procedure prone to misunderstanding and vulnerable to inattentive and careless responding. In this study, we tested a video assessment of the beads task aiming to reduce errors due to misunderstanding and to gain more insight into the processes contributing to JTC.
Methods: A sample of 801 participants from the general population was divided into various levels of paranoid ideation, based on cut-off criteria. The newly developed video JTC task, which is available at no cost at https://clinical-neuropsychology.de/jtc/, was presented online, as were the Revised Green et al. Paranoid Thoughts Scale (R-GPTS) and other psychological scales that served to separate individuals scoring high versus low on paranoia.
Results: As hypothesized, participants scoring high on both the ideas of social reference and persecution subscales of the R-GPTS showed more JTC than those with lower scores. Yet, a large number of participants (24 %) made illogical responses or showed signs of careless performance. Important contributors to JTC were lack of motivation, skipping some of the instructions, and speeding through the trials. Yet, significant differences remained when these influences were accounted for with matched samples.
Conclusions: While the newly developed video task was able to confirm elevated JTC in individuals scoring higher on paranoid ideation, core problems seen in prior versions of the beads task remain. Researchers are advised to develop alternative tests, preferably ones that allow repeated measurement. Our results indicate that JTC is a multi-causal bias that is unlikely to be explained by a single cognitive or psychopathological process.

1. Introduction

Since the late 1980s, much evidence has been gathered supporting the involvement of cognitive biases in the formation and maintenance of positive symptoms in schizophrenia, particularly paranoid delusions and hallucinations (Samson et al., 2024; De Rossi & Georgiades, 2022; Garety & Freeman, 1999; Gawęda et al., 2024; McLean et al., 2017; Moritz et al., 2017a). Unlike neurocognitive impairments, cognitive biases are aberrations, not deficits, in the way humans collect, process, weigh, and recall information. Cognitive biases are not pathological per se. While some biases, such as unrealistic optimism, have been implicated in mental well-being (Pohl, 2004; Weinstein, 1980, 2005), other biases are closely tied to psychopathology in psychosis but also to other psychological disorders (Gawęda et al., 2024; Lavigne et al., 2024; Moritz et al., 2017a).

In psychosis, the jumping to conclusions (JTC) bias has received the most attention over the past decades (the first study on JTC in schizophrenia was by Huq et al., 1988). In the beads task, the standard task

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tapping JTC, participants are typically shown beads of two colors in an opposing ratio (standard: 85:15 %) that are drawn from one of two jars. The beads are usually displayed to the participants in a fixed order. After each bead, participants are asked to estimate the probability that the person is drawing beads from jar A versus jar B and are asked to indicate whether they want to decide on the jar. Systematic reviews and meta-analyses have found that individuals with psychosis/schizophrenia and those with attenuated positive symptoms not meeting full diagnostic criteria for psychosis collect less information than non-psychotic controls before deciding for a jar (Dudley et al., 2016a; Gawęda et al., 2024; McLean et al., 2017; So et al., 2016). However, this does not extend to a relationship between JTC and strength of belief (see Doherty et al., 2025). Encouraged by these promising findings, psychological treatments have been devised, which aim at *reducing cognitive distortions*, with jumping to conclusions as its core target; examples are metacognitive training (Moritz et al., 2022), reasoning training (Waller et al., 2011), and SlowMo therapy (Garety et al., 2021). Interestingly, while these approaches are indeed effective in reducing positive symptoms, their impact on JTC is weaker (Penney et al., 2022; Sauvé et al., 2020) than would be expected if this bias was the main moderator of change.

Moreover, the beads task itself has been subject to criticism as it may tap into aspects beyond decision-making such as poor motivation, carelessness, and misunderstanding. For example, it has been suggested that participants may decide prematurely because there is no incentive to remain engaged with the task, and thus participants may opt to abort as soon as possible (van der Leer & McKay, 2014). However, the 'graded-estimates' versions of the task, where participants have to rate the probability of the jar being correct, including "simulated decisions" (a decision for jar A or B does not end the task prematurely), after seeing a fixed number of beads, challenges this critique as patients with schizophrenia still signal that they would be ready to decide much earlier in the bead sequence (e.g., Moritz & Woodward, 2005). In subsequent years, the original beads task has been modified using other stimuli, such as fish (Speechley et al., 2010) or sheep (Moritz et al., 2016), to improve engagement and comprehension, but these changes did not fundamentally address the task's conceptual problems as the same basic probabilistic structure and task rules were retained and the misunderstanding problems lingered. To address this, conceptually simpler tasks such as the box task were created (Balzan et al., 2017; Moritz et al., 2017b), but problems remained as patients with schizophrenia and psychosis-prone individuals actually appear to be more *conservative* on the box task compared to controls (Balzan et al., 2017; Moritz et al., 2020). Searching for the underlying mechanisms of hasty decision-making, another study (Gabbert et al., 2024) utilized the balloon analogue risk task (BART) as an alternative measure of risky decision making. Interestingly, psychosis-prone individuals showed more risk aversion in the BART compared to those low on paranoia (i.e., fewer burst balloons due to earlier termination). These results support the claim that the JTC bias in psychosis proneness is related to data gathering and not to risk aversion (see also Strube et al., 2022).

Carelessness (Sulik et al., 2023) and illogical responses on the beads task (Balzan et al., 2012a; Balzan et al., 2012b; Jolley et al., 2014; Moritz & Woodward, 2005), mainly reflecting the false belief that the jars are switched between trials (a false belief that is actually even mentioned in most instructions), are common as well, leading to premature or incorrect decisions (Balzan et al., 2012b). Perhaps relatedly, low intelligence (Jolley et al., 2014; Tripoli et al., 2019) as well as problems with working memory (Freeman & Garety, 2014) and poor neuropsychological functioning in general (González et al., 2018; Ochoa et al., 2014) have also been implicated in hasty decision-making.

While JTC has been associated with a (familial) liability to psychosis and delusional ideation (Henquet et al., 2022), several emotional and cognitive factors are associated with paranoia as well (e.g., low quality of life), so it is important to examine these related constructs concurrently as they are perhaps more important correlates of JTC than paranoia.

The present study is a trial on the construct validity of a video paradigm of the beads task (available at no cost at https://clinical-neuropsychology.de/jtc/) developed in an effort to reduce participants' misunderstanding of the task (particularly the belief that the jars are switched during the task). The task allows collection of time-sensitive parameters and decision motives to inform about confounders and moderators of performance (e.g., poor motivation, speeding, skipping the instructions). Along with paranoid ideation, we also assessed impulsivity and fear of negative evaluation; the latter is a construct with some conceptual proximity to paranoia (e.g., worries about being judged negatively by other people), allowing us to examine the specificity of paranoid ideation for JTC versus more general interpersonal problems/fears.

2. Methods

2.1. Recruitment and procedure

Using the WiSo Panel® (Göritz, 2009), we recruited 801 participants from the general population with full data (see Table 1). Participants were recruited using diverse sources (e.g., word-of-mouth, participant referral scheme, online marketing) and sampling approaches (e.g., random population samples, convenience samples). Data collection was carried out using Qualtrics®.

2.2. Revised Green et al. Paranoid Thoughts Scale

The Revised Green et al. Paranoid Thoughts Scale (R-GPTS; Freeman et al., 2019; Williams et al., 2023) measures paranoid thinking and consists of two subscales: an eight-item Reference scale assessing ideas of social reference (e.g., "People definitely laughed at me behind my back") and a 10-item Persecution scale ("I was sure someone wanted to hurt me") assessing persecutory ideation. Items are rated on a 5-point Likert-scale from 0 ("Not at all") to 4 ("Totally"). The R-GPTS score ranges are defined as follows: average (subscale Reference: 0–9; subscale Persecution: 0–4); elevated (Reference: 10–15; Persecution: 5–10); moderately severe (Reference: 16–20; Persecution: 11–17); severe (Reference: 21–24; Persecution: 18–27); and very severe (Reference: 25+; Persecution: 28+). The recommended cut-offs on the Persecution scale are 11 to identify clinical levels of persecutory ideation and 18 to indicate a likely persecutory delusion (Freeman et al., 2019).

According to Freeman and colleagues (2019), the scales have excellent psychometric properties with very good reliability (Cronbach's $\alpha > 0.90$) in clinical and non-clinical levels of paranoia (see also Williams et al., 2023). The R-GPTS also shows validity; it correlates well with interview and self-report measures of paranoia, delusional thought, and social functioning (Williams et al., 2023), making it a robust tool for assessing paranoia in both clinical and subclinical populations.

2.3. Brief Fear of Negative Evaluation Scale (B-FNE)

The Brief Version of the Fear of Negative Evaluation Scale (Leary, 1983) taps into individuals' expectations of looking foolish, being negatively evaluated, and making a bad impression on others and is a widely used measure of social anxiety. With its 12 general statements on a 5-point Likert scale (1 = "Not at all characteristic of me" to 5 = "Extremely characteristic of me"), the short version of the Fear of Negative Evaluation Scale covers social situations and performance situations. An example item is: "I usually think about how I come across to others."

The English version of the B-FNE has demonstrated good to excellent internal consistency and one-month test-retest reliability ($r = .75$) (Leary, 1983; Rodebaugh et al., 2004) in non-clinical and clinical populations, with better results for the revised straightforwardly worded version (Carleton et al., 2006).

Table 1
Demographic information on extreme subgroups (not matched; R-GPTS = Revised Green et al. Paranoid Thoughts Scale).

	R-GPTS Reference			R-GPTS Persecution		
Variable	Low (n = 677)	High (n = 62)	Statistics	Low (n = 668)	High (n = 88)	Statistics
Demographic background						
Age in years	57.77 (13.26)	50.90 (12.40)	t (737) = 3.93, p < .001, d = .521	57.35 (13.41)	52.22 (13.70)	t (754) = 3.67, p < .001, d = .382
Sex (female, male)	56.9 %/43.1 %	58.1 %/41.9 %	χ^2 (1) = .03, p = .856	57.6 %/42.4 %	52.3 %/47.7 %	χ^2 (1) = .91, p = .340
Education level	4.05 (1.06)	3.81 (1.13)	t (737) = 1.75, p = .100, d = .232	4.06 (1.06)	3.70 (1.13)	t (754) = 2.92, p < .001, d = .382
Decision making						
JTC (decision after bead 1)	31.5 %	51.6 %	χ^2 (1) = 10.41, p < .001	30.8 %	51.1 %	χ^2 (1) = 14.44, p < .001
JTC (decision after bead 1 or 2)	51.8 %	74.2 %	χ^2 (1) = 11.41, p < .001	51.0 %	71.6 %	χ^2 (1) = 13.18, p < .001
Draws to decision	3.45 (2.90)	2.33 (2.23)	t (737) = 3.22, p = .002, d = .354	3.39 (2.91)	2.40 (2.33)	t (754) = 7.71, p < .001, d = .347

Notes. Education, 1 = no degree, 2 = 9 years of school, 3 = 10 years of school, 4 = 13 years of school, 5 = university degree, 6 = doctorate.

2.4. WHO-5 well-being index

The WHO-5 Index (Bech, 2004; Bech et al., 2003) is a self-assessment for determining well-being in the last two weeks (e.g., "In the last two weeks I've been happy and in a good mood."). It includes five positively formulated, equally weighted items on a 6-point Likert Scale (0 = "At no time" to 5 = "All the time").

The index value is calculated by adding up the five item values (total score ranges from 0 to 25), with higher values indicating better well-being. The WHO-5 index can be used as a screening instrument; an index value below 13 indicates low or poor well-being, which should be interpreted as an indication for the diagnosis of major depression (Brähler et al., 2007). The German version of the WHO-5 has demonstrated excellent internal consistency and good construct validity in a representative sample of the German population (Brähler et al., 2007).

2.5. The Impulsive Behavior Short Scale–8 (I-8)

The I-8 scale (Groskurth et al., 2022) is an economical, reliable, and valid measure of impulsivity and impulsive behavior. It captures the four factors of impulsivity from the UPPS model (Whiteside & Lynam, 2001): urgency (e.g., "I sometimes do things to cheer myself up that I later regret"), lack of premeditation (e.g., "I usually think carefully before I act"), lack of perseverance (e.g., I always bring to an end what I have started"), and sensation seeking (e.g., "I am willing to take risks"), each containing two items. All eight items are rated on a 5-point Likert scale, ranging from "does not apply at all" (1) to "applies completely" (5).

The reliability of the I-8 ranges from Cronbach's α of .65–.92 in different samples, indicating acceptable to excellent reliability. Factor analytical examinations, as well as correlations with the UPPS scales (r = .66 to .76), delinquent behavior, job satisfaction, and age, support the validity of the scale (Kovaleva et al., 2012). A recent replication study shows that the I-8 scale is both reliable and valid, with comparable psychometric properties for its English and German versions (Groskurth et al., 2022).

2.6. Video beads task

We implemented the video beads task using Qualtrics®. The task was adapted from a version developed by Howe et al. (2018). We recorded the experimental set-up on video along with audio instructions. The verbal instructions are also displayed as subtitles to improve comprehension. On the video, participants saw two transparent jars, each containing 100 small beads colored either yellow or blue. The left jar (A, point of view of participant) contained 85 yellow and 15 blue beads, while the right jar (B) contained 85 blue beads and 15 yellow beads. The instructor explained that she would randomly select one of the jars and draw beads from it, and then the participants would need to deduce which jar the beads had been drawn from. The instructions emphasized that the jars would not be switched at any point during the trial. As shown in the video, each jar was placed inside one of two identical white (non-transparent) larger containers, ensuring that the jars were no longer visible. The two identical white containers were then removed from view, and afterwards one jar was selected and shown again. The instructor shook this container multiple times. Then, the instructor reached into the transparent jar inside the white container and removed a bead. The bead was shown and then placed back into the container. The sequence of beads drawn was displayed with beads at the bottom of the screen.

The task allowed participants to skip the instructions at any point, although they were encouraged to view each video sequence fully until the end (the time spent on the instructions was recorded; see Results). After each bead was drawn, participants were asked by the computer to indicate which jar they thought the bead came from: jar A (85 yellow, 15 blue) or jar B (85 blue, 15 yellow) or if they had no preference. Participants had to provide an estimate for their level of confidence (i.e., guessed, somewhat unsure, somewhat sure, 100 % confident) and were asked whether they wanted to submit their decision or continue the task and see another bead. The beads sequence for all participants was as follows: YYYBYYYYBY (Y = yellow, B = blue). The chosen jar (jar A, inside its non-transparent container) always remained in sight of the participant, thus removing the possibility that the participant would incorrectly assume the containers had been switched. During every new draw, the previously drawn beads were displayed on the screen.

At the end of the task, participants were asked several questions pertaining to possible misunderstandings: how many blue beads were contained in the jar with yellow 85 beads (free response format; correct answer: 15); whether participants thought that the containers were never switched (no, somewhat no, unsure, somewhat yes, yes); whether they had done their best on the task (no, somewhat no, unsure, somewhat yes, yes); whether they thought the beads were drawn randomly (no, somewhat no, unsure, somewhat yes, yes); and whether they had decided very early to terminate the task quickly (yes, no).

2.7. Attention checks

Two attention check questions (Moritz et al., 2024) were embedded in different sections of the survey. The first, "I cannot hear, smell, or see anything," was included in the Brief Resilience Scale (BRS) and had to be answered on a 5-point scale ranging from "strongly disagree" to "strongly agree." The second, "Have you ever felt sick in your life?" had to be answered with "yes" or "no." Participants passed the first attention check if they selected "strongly disagree" and passed the second if they answered "yes." Failing both attention checks resulted in exclusion.

2.8. Strategy of data analysis

Two strategies for analyses were adopted. The main analyses pertained to the high-scoring group (moderately severe to very severe symptoms) versus low-scoring group (average scores) on the R-GPTS. We first looked at the entire sample and only removed participants older than 80 years of age and those below 18 years of age (n = 23).

As the two extreme groups differed on aspects other than psychosis, especially on age (see Table 1), thereby making it difficult to interpret

Table 2
Speed and attention parameters, divided by presence vs. absence of jumping to conclusions (JTC).

Variable	No JTC (n = 355)	JTC (n = 423)	Statistics
Failed attention check	1.4 %	6.6 %	χ^2 (1) = 12.90, p < .001
Too fast (entire experiment)	0.3 %	4.7 %	χ^2 (1) = 14.53, p < .001
Did not watch all of instructions	9.6 %	16.3 %	χ^2 (1) = 7.62, p = .007

group differences in terms of paranoia, we conducted a subsequent analysis with extreme samples matched on age, sex, and level of education using cardinality matching from the MatchIt R package (Randolph et al., 2014), performed by the solver Gurobi (Gurobi Optimization, LLC, 2023). After matching, the two groups had the same sample size and identical age (p = 1), sex at birth (p = 1), and similar education (p = .870 for R-GPTS A and p = .983 for R-GPTS B).

For the matched sample analyses (R-GPTS Reference, each n = 33; R-GPTS Persecution, each n = 49), we adopted a more rigorous approach and prior to matching excluded a total of 158 participants for the following reasons blind to results (multiple criteria could apply): older than 80 years or younger than 18 years of age (n = 23), did not watch video instructions until the end (n = 109), did not pass the attention checks (n = 35), and gave responses too quickly (n = 21).

3. Results

As can be seen in Table 1, high scorers on the R-GPTS subscales showed greater JTC and fewer draws to decision (DTD) in comparison to low scorers, with the latter parameter showing a small to medium effect size for both R-GPTS subscales. As shown in Tables 2 and 3, poor attention, fast responses, and not watching all of the instruction video causing the participant to miss essential information were strongly associated with JTC, and both poor attention and fast responses were also more frequent among the high scorers on both R-GPTS scales. Adopting multiple criteria, 76 % of the sample showed a proper response pattern; 24 % made illogical decisions, sped through the task, did not fully read the instructions, and/or did not pass the attention check.

However, those high on delusional ideation were younger and less educated (persecution scale only) than those with low or average scores, indicating that the decision-making parameters may have been confounded. Thus, we proceeded with samples matched for sociodemographic characteristics (see Table 4). We view these analyses as the primary analyses because they take into account several confounders (i.e., those showing speeding/carelessness or poor attention as well as those who did not watch the instructions completely were removed). Table 4 shows the results for the samples. High scorers on the persecution subscale again showed a significantly enhanced level of JTC, but their levels of DTD now only achieved a statistical (nonsignificant) trend (p < .1).

Median duration times, illogical responses, certainty level at decision, invested effort, and recall of the beads ratio were similar between groups. Interestingly, accuracy of the final decision was less often correct in those high on persecutory ideas than those low and average. Those scoring high on social reference ideas more often thought the jars had been switched and less often thought the order was random. Those high on persecutory ideas also acknowledged having made an early decision to terminate the task at statistical trend level (p = .054).

With respect to impulsivity, those high on social reference ideas showed more urgency; none of the other comparisons were significant. Quality of life was also nonsignificant. However, those high on both R-GPTS subscales showed higher scores on the B-FNE.

3.1. Regression

We performed a logistic regression analysis with the variables in Table 4 as predictors and JTC as the outcome variable (1 = decision after first or second trial, 0 = decision at later trials) using the forward method. The model was terminated after six variables had been entered, $\chi^2(6) = 106.98$, p < .001, Nagelkerke's R^2 = 17. No remaining variable had a residual predictive power of p < .05 (all p > .06). The six variables that best predicted JTC were high scores on R-GPTS persecution (Wald = 6.86, p < .001), speeding/carelessness (Wald = 5.55, p = .019), high score on B-FNE (Wald = 11.63, p < .001), belief that the jars had been switched (Wald = 7.48, p = .006), did not invest much effort (Wald = 5.24, p = .022), and early decision to terminate the task (Wald = 29.01, p < .001). We did not find any relationship of JTC with age (p = .267, d = .095) or with sex ($\chi^2(1) = .99$, p = .319).

4. Discussion

The present study examined a new video task for the assessment JTC to improve understanding of the mechanisms of action of JTC in psychosis. As hypothesized from prior reviews and meta-analyses (Dudley et al., 2016b; Gawęda et al., 2024; Ross et al., 2015; So et al., 2016), those scoring high on persecutory delusions showed less JTC than those with average scores on the R-GPTS. Results on JTC were essentially sustained when confounding variables were accounted for by rigorous matching. Yet, under this stricter procedure, draws to decisions discriminated those high versus low on paranoia only at statistical trend level. While our prior studies have stressed that secondary factors are negligible (Gabbert et al., 2024; Moritz et al., 2022), we would like to soften this conclusion, at least for the beads task (see also Sulik et al., 2023), as poor motivation, speeding, and paying less attention to the instructions were all associated with JTC as well as with severity of paranoia in the current study. This is in line with Ashinoff et al. (2022) who suggest that JTC may sometimes reflect general cognitive limitations (Klein & Pinkham, 2018) or poor task engagement rather than specific inferential deficits.

Results from the group comparisons (Tables 2 and 3) were corroborated using logistic regression analysis showing that in addition to the R-GPTS persecution score, speeding, the belief that the jars had been switched during the trial, lack of effort, and poor motivation predicted JTC (in addition, high scores on the B-FNE also predicted JTC). The association between the B-FNE and social anxiety is interesting given a study by Díaz-Cutraro et al. (2022) in which individuals with JTC showed poorer processing of social information. Previous research also suggests that engagement (i.e., how much it matters to the participant to get each task right) has an effect on JTC (Ashinoff et al., 2022; Peinado et al., 2024).

JTC is thus perhaps best characterized as a multicausal phenomenon that is associated with paranoid delusions (for high-risk research,

Table 3
Speed and attention parameters of extreme subgroups.

Variable	R-GPTS Reference			R-GPTS Persecution		
Variable	Low (n = 677)	High (n = 62)	Statistics	Low (n = 668)	High (n = 88)	Statistics
Failed attention check	1.6 %	24.2 %	χ^2 (1) = 85.23, p < .001	1.8 %	23.9 %	χ^2 (1) = 90.71, p < .001
Too fast (entire experiment)	1.0 %	12.9 %	χ^2 (1) = 40.24, p < .001	1.0 %	15.9 %	χ^2 (1) = 63.59, p < .001
Did not watch all of the instructions	13.1 %	19.4 %	χ^2 (1) = 1.86, p = .173	13.2 %	19.3 %	χ^2 (1) = 2.45, p = .117

Table 4
Comparisons of matched samples on decision-making parameters and psychopathology.

	R-GPTS Reference			R-GPTS Persecution		
Variable	Low (n = 33)	High (n = 33)	Statistics	Low (n = 49)	High (n = 49)	Statistics
Decision-making						
JTC (decision after bead 1 or 2)	54.5 %	69.7 %	χ^2 (1) = 1.61, p = .205	42.9 %	65.3 %	χ^2 (1) = 4.97, p = .026
DTD	3.45 (3.09)	2.33 (2.23)	t(64) = 1.69, p = .096, d = .416	3.39 (2.80)	2.61 (2.39)	t(96) = 1.47, p = .072, d = .298
Median duration in sec. (entire experiment)	1176.91 (677.69)	1200.61 (732.07)	t(64) = .14, p = .892, d = .034	1214.65 (883.70)	1097.41 (512.29)	t(96) = .80, p = .424, d = .162
Illogical responses (selecting wrong jar during first three trials)	12.1 %	9.1 %	χ^2 (1) = 1.60, p = .689	6.1 %	14.3 %	χ^2 (1) = 1.78, p = .182
Certainty level at final decision*	2.64 (1.17)	2.55 (1.06)	t(64) = .33, p = .742, d = .081	2.43 (1.24)	2.37 (1.11)	t(96) = .26, p = .798, d = .052
Decision correct (1 = no decision, 2 = correct, 3 = incorrect, 4 = decision but no preference)	6.1 %, 81.8 %, 6.1 %, 6.1 %	3.0 %, 81.8 %, 9.1 %, 6.1 %	χ^2 (1) = .53, p = .912	8.2 %, 85.7 %, 4.1 %, 2.0 %	4.1 %, 75.5 %, 14.3 %, 6.1 %	χ^2 (1) = 4.02, p = .045
Number of blue beads in the jar with 85 yellow beads (correct answer: 15)	14.12 (2.65)	15.09 (3.67)	t(64) = 1.23, p = .223, d = .303	15.06 (1.64)	15.63 (7.03)	t(96) = .55, p = .582, d = .112
Belief that jars were *not* switched during the task (1 = no, 2 = somewhat no, 3 = unsure, 4 = somewhat yes, 5 = yes)	4.06 (1.20)	3.24 (1.37)	t(64) = 2.58, p = .012, d = .636	3.63 (1.48)	3.43 (1.32)	t(96) = .72, p = .474, d = .145
Invested effort in the task (1 = no, 2 = somewhat no, 3 = unsure, 4 = somewhat yes, 5 = yes)	4.45 (1.00)	4.09 (1.01)	t(64) = 1.47, p = .147, d = .361	4.29 (1.04)	4.12 (1.09)	t(96) = .76, p = .451, d = .153
Belief that the order of the beads was random (1 = no, 2 = somewhat, 3 = unsure, 4 = somewhat yes, 5 = yes)	4.61 (.83)	3.88 (.89)	t(64) = 3.43, p < .001, d = .845	4.22 (1.10)	4.00 (.96)	t(96) = 1.08, p = .285, d = .217
Made early decision to end the task (% yes)	27.3 %	36.4 %	χ^2 (1) = .63, p = .428	24.5 %	42.9 %	χ^2 (1) = 3.70, p = .054
Psychopathology/well-being						
I-8 urgency	2.29 (.97)	2.92 (1.17)	t(64) = 2.41, p = .019, d = .594	2.39 (.95)	2.78 (1.21)	t(96) = 1.77, p = .080, d = .357
I-8 premeditation	3.59 (1.02)	3.85 (.91)	t(64) = 1.09, p = .282, d = .267	3.65 (.96)	3.66 (.96)	t(96) = .05, p = .958, d = .011
I-8 lack of perseverance	3.98 (.77)	3.59 (.99)	t(64) = 1.81, p = .075, d = .446	3.81 (.88)	3.51 (1.09)	t(96) = 1.48, p = .142, d = .299
I-8 sensation seeking	2.77 (1.12)	2.73 (1.33)	t(64) = .15, p = .881, d = .037	2.81 (1.20)	2.63 (1.19)	t(96) = .72, p = .475, d = .145
I-8 total score	2.37 (.57)	2.55 (.75)	t(64) = 1.10, p = .273, d = .272	2.43 (.46)	2.56 (.65)	t(96) = 1.10, p = .272, d = .223
WHO-5 Well-Being Index (WHO-5)	15.85 (6.10)	17.55 (4.90)	t(64) = 1.25, p = .217, d = .307	15.86 (6.23)	17.82 (5.78)	t(96) = 1.61, p = .110, d = .326
Brief Fear of Negative Evaluation Scale (B-FNE)	2.17 (1.01)	3.16 (.85)	t(64) = 4.33, p < .001, d = 1.066	2.06 (1.03)	2.88 (1.00)	t(96) = 4.03, p < .001, d = .813

Notes. * certainty level: 0 = no final decision, 1 = guessed, 2 = very uncertain, 3 = certain, 4 = 100 % sure.

however, the evidence has become equivocal over the years, see Doherty et al., 2025). These findings agree with a recent study (Sulik et al., 2023) whose authors go one step further, claiming that many well-established relationships between cognitive biases and delusion-like beliefs may be artifacts of careless responding. Our hope that the video task would eliminate comprehension problems was not fulfilled. Only 76 % showed a proper response pattern. Our findings highlight the importance of accounting for inattention and poor motivation in assessing JTC.

Of note, decisions made by those scoring higher on delusions were given with almost the same level of confidence as those by the controls. This seems at odds with the liberal acceptance account (Moritz et al., 2008, 2009; Moritz et al., 2017a) claiming that individuals with (heightened levels of) psychosis have a lower threshold for arriving at decisions (Peinado et al., 2024). Yet, research on LA rests on probability ratings (0–100 %) and measures the threshold at which a probability is deemed sufficient for a decision. The ratings here are based on level of confidence, which is not interchangeable with probability estimates (Moritz et al., 2006; Moritz et al., 2017a; Moritz, 2017b).

4.1. Limitations and future research

Several limitations need to be addressed. First, we did not examine a patient group with schizophrenia nor a psychiatric control group. In light of findings on, for example, the box task (Balzan et al., 2017; Moritz et al., 2020; Moritz, 2017b) showing that results obtained in psychosis-prone individuals cannot be fully translated to patients with psychosis, repeating the study with patients with schizophrenia and in laboratory situations is essential. Whether the video beads task is superior to pictorial versions of the beads task also has yet to be tested. A direct head-to-head comparison, however, should not be made using a within-groups design as practice affects (and improves) subsequent task performance, given that the order of bead sequences is usually predetermined and the participant is thus no longer naive. Instead, a large sample should be recruited, and participants should be randomized to one of the tasks. Results for each of the tasks should be compared on a number of parameters, including extent of illogical responses.

While most studies, including this one, agree that JTC is related to positive symptoms of psychosis, some newer research has found associations with suicidal behavior (Sastre-Buades et al., 2021) but not with a diagnosis of borderline personality disorder (Scheunemann et al., 2025). Researchers should also explore further possible contributors to JTC, including positive mood (Grimes et al., 2025) as well as cognitive factors such as poor hypothesis generation (Hillman et al., 2024).

5. Conclusion

Our video task, a modified version of the beads task that is available to clinicians and researchers for free at https://clinical-neuropsychology.de/jtc/, aimed to enhance participants' understanding of the task and thereby reduce the number of illogical responses, which in some studies on JTC was observed in approximately half of the sample (Balzan et al., 2012a; Moritz & Woodward, 2005). By tracking time parameters, we

aimed to examine whether participants listened to or read the complete instructions before moving to the first item (bead), and we used speed of performance overall as another proxy for hasty decision-making. While the beads task seems of use in psychosis research and as a screening for JTC, our findings do not support its broad use as a diagnostic screening tool in cognitive psychology as the primary outcome, JTC, is influenced by many underlying processes, thus complicating interpretation.

The present task shows some promise, particularly with respect to its association with positive symptoms of psychosis, but it requires further testing and optimization, especially in view of the high rate of confounding variables. We also recommend that researchers continue to develop alternative tasks that also allow for repeated measurement (e.g., McLean et al., 2018).

CRediT authorship contribution statement

Steffen Moritz: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Lara Wille:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **Anja S. Göritz:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Tana Gabbert:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Rose Doherty:** Writing – review & editing, Writing – original draft, Validation, Methodology. **Ryan Balzan:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Jakob Scheunemann:** Writing – review & editing, Writing – original draft, Validation, Software, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

All authors declare that they have no conflict of interest.

Data availability

Data will be made available on request.

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