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Repetition is good? An Internet trial on the illusory truth effect in schizophrenia and nonclinical participants

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ABSTRACT

Background and objectives: The investigation of cognitive biases has considerably broadened our understanding of the cognitive underpinnings of schizophrenia. This is the first study to investigate the illusory truth or validity effect in schizophrenia, which denotes the phenomenon that the renewed exposure to difficult knowledge questions shifts responses toward affirmation. We hypothesized an excess of the truth effect in schizophrenia, which may play a role in the maintenance of the disorder, particularly relating to positive symptoms.
Methods: The study was set up over the Internet. The final analyses considered 36 patients with a probable diagnosis of schizophrenia, and a sample of 40 healthy subjects. Both groups took part on two occasions. In the baseline survey, difficult knowledge questions on neutral (e.g., "On each continent there is a town called Rome." (true)) or emotional (delusion-relevant; e.g., "The German federal police uses approximately 3000 cameras for the purpose of video-based face-detection." (not true)) topics were presented as statements, which were either correct or incorrect. After one week, subjects were requested to take part in the second and final survey. Here, previously presented as well as novel statements had to be appraised according to their truth.
Results: As expected, an overall truth effect was found: statements that were repeated achieved higher subjective truth ratings than novel statements. Patients high on positive symptoms showed an excessive truth effect for emotional (delusion-relevant) items. The positive syndrome was correlated with the emotional truth effect in both healthy and schizophrenia participants.
Limitations: The sample was recruited via online forums and had probable but not externally validated diagnoses of schizophrenia. No psychiatric control group was tested.
Discussion: The truth effect for emotional items appears to be exaggerated in patients high on positive symptoms, which may play a role in delusion formation and maintenance. Several limitations of the study however render our conclusions preliminary. As patients with schizophrenia often dwell on and ruminate over selective and distorted pieces of information (e.g., conspiracy theories), the subjective authenticity of this information may be further elevated by means of the truth effect.

1. Introduction

The investigation of cognition has greatly deepened our understanding of the underpinnings of schizophrenia. While the complex cognitive infrastructure of schizophrenia is far from being fully understood, claims made by early investigators that psychosis is utter madness, not amenable to any psychological understanding, is no longer considered tenable (Moritz, Vitzthum, Randjbar, Veckenstedt, & Woodward, 2010; Moritz & Woodward, 2007). A number of cognitive biases have been put forward that may play a role in the formation and maintenance of psychotic symptoms (for reviews see Bell, Halligan, & Ellis, 2006; Fine, Gardner, Craigie, & Gold, 2007; Freeman, 2007; van der Gaag, 2006; Moritz et al., 2010). Unlike neuropsychological *deficits* primarily reflecting

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neural dysfunctions (e.g., deficits in the pre-frontal cortex resulting in executive dysfunctions), cognitive biases are cognitive *deviations* or styles pertaining to the collection, appraisal, interpretation, and processing of information. Biases are neither grave dysfunctions nor pathological per se. Importantly, attenuated forms of certain biases may even promote psychological well-being such as unrealistic optimism (i.e., the belief that positive events are more likely to happen to oneself than to others and vice versa for negative ones; see for example Sharot, Korn, & Dolan, 2011; Weinstein, 1984), the self-serving bias (i.e., positive events are rather attributed to oneself than to others and vice versa for negative events), or the "Polyanna" effect (i.e., preferred recollection of positive events from one's memory; Matlin, 2004). However, the aggravation of certain biases has been assumed in a number of psychological disorders. For example, over-estimation of threat is frequently implied in the pathogenesis of anxiety disorders including obsessive-compulsive disorder (Obsessive Compulsive Cognitions Working Group, 1997, 2001, 2003, 2005), whereas attentional biases toward trauma-relevant information is a well-replicated cognitive pattern in post-traumatic stress disorder (Moore, 2009). In schizophrenia, the following biases are prominent: jumping to conclusions (for a review see Fine et al., 2007; Garety, Hemsley, & Wessely, 1991; Huq, Garety, & Hemsley, 1988; Lincoln, Ziegler, Mehl, & Rief, 2010), bias against disconfirmatory evidence (Moritz & Woodward, 2005; Woodward, Buchy, Moritz, & Liotti, 2007; Woodward, Moritz, Cuttler, & Whitman, 2006; Woodward, Moritz, Menon, & Klinge, 2008), one-sided attributions (Randjbar, Veckenstedt, Vitzthum, Hottenrott, & Moritz, 2011) and over-confidence in errors (Gaweda, Moritz, & Kokoszka, 2012; Kircher, Koch, Stottmeister, & Durst, 2007; Köther et al., 2012; Moritz & Woodward, 2006; Moritz, Woodward, Jelinek, & Klinge, 2008; Peters et al., 2007; Warman, 2008). Some of these biases are often more pronounced during acute psychotic episodes but still detectable in remitted patients and in subclinical samples; these biases are typically found in both delusion-relevant and neutral scenarios, precluding tautological interpretations (Moritz et al., 2010).

1.1. The illusory truth effect

To the best of our knowledge, the so-called truth or validity effect, another prominent cognitive bias (Dechêne, Stahl, Hansen, & Wänke, 2010; Renner, 2004), has not yet been tested in schizophrenia patients. To investigate this mechanism, people are usually confronted with difficult items from valid but unfamiliar sources and required to evaluate whether statements are true or false. When asked to judge the truthfulness of such statements, people often use heuristic cues. In forming their judgment, they tend to take the perceived credibility of the statement's source into account, the context in which it is presented, or attributes of the information itself. The available evidence suggests that people tend to trust a statement to a higher degree if they have encountered it before (Dechêne et al., 2010). In other words, the re-exposure to difficult knowledge statements leads to an illusionary increase of their *subjective* truth. This illusory truth effect has been the subject of extended study and is well-established in healthy subjects (Alter & Oppenheimer, 2009; Arkes, Boehm, & Xu, 1991; Bacon, 1979; Begg, Anas, & Farinacci, 1992; Dechêne, Stahl, Hansen, & Wänke, 2009; Hasher, Goldstein, & Toppino, 1977; Hawkins & Hoch, 1992; Law, Hawkins, & Craik, 1998; Roggeveen & Johar, 2002; Unkelbach & Stahl, 2009).

From our point of view, the truth effect may be involved in the chain reaction of dysfunctional cognitive processing that ultimately leads to the formation of delusion beliefs. To illustrate, deluded patients often excessively search for and rely on information compatible with their delusional beliefs, reflecting a confirmation bias (Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002). As mentioned above, the illusory truth effect further enhances the subjective truth of such information and might explain why patients are not only preoccupied by "weird" ideas but also increasingly believe in them. We hypothesize that an increase of the illusory truth effect will be seen in schizophrenia patients, based on several pieces of evidence. First, we know that the illusory truth effect comes about because re-exposure to the same information enhances its familiarity. As patients with schizophrenia rely on shallow criteria when making judgments (Freeman et al., 2004; Glöckner & Moritz, 2009; So et al., 2012), and tend to mistake mere familiarity for knowledge (Moritz & Woodward, 2006; Moritz et al., 2008), patients may be more susceptible to the truth effect. Second, according to Kapur (2003) an increase of dopamine, a neurotransmitter implicated in the formation of positive symptoms, leads to an enhanced salience of internal and external stimuli: the current input is imparted with special meaning, particularly when the available evidence matches a held hypothesis about reality (Speechley, Whitman, & Woodward, 2010). Later exposure imparts these stimuli with more weight and authenticity than other events. The present study explored whether the truth effect is stronger in patients with schizophrenia. We presented emotional (i.e., delusion-relevant) and neutral statements to subjects that were either correct or incorrect. This procedure also allowed us to test whether paranoid patients are better at determining the truth status of delusion-relevant *true* information, while healthy subjects are perhaps even "under-paranoid" for such items.

2. Methods

2.1. Recruitment

The study was conducted as an anonymous Internet trial. We posted invitations for an online study on several German Internet self-help forums and information boards devoted to psychosis and schizophrenia, respectively. We refrained from posting the invitation on general sites to ensure that the call would be primarily read by people meeting diagnostic criteria of schizophrenia. The invitation was also sent to a mixed nonclinical subject pool. Additional subjects were recruited from online forums on topics unrelated to psychosis. Subjects were told beforehand that the study would involve difficult knowledge questions from different areas (example: "Nancy is the third biggest town in France."). Participants would be asked to appraise the truth of each statement ranging from "definitely false" to "definitely true". Initial inclusion criteria were liberal: a. subjects had to be willing to participate on two surveys that were one week apart, b. had to leave their email address at the end of the first survey to allow re-contact for the second and final survey and c. had to be between 18 and 65 years of age (for final inclusion criteria see below). No compensation was offered for study participation except for a disclosure form at the end of the second survey that revealed the correct responses and debriefed subjects about the purpose of the study and the nature of the truth effect. The survey was implemented using the software platform Unipark®. "Cookies" were utilized as a means of preventing multiple log-ons from the same computer. The software automatically collected data upon entry, but did not store IP addresses.

On the first page of the baseline survey, the invitation from the web-page was essentially repeated. The survey started with a brief socio-demographic section asking for gender, age, school education, and current occupational status. Subsequently, the knowledge statements were presented for the first time (pre-phase; see section "Assessment of the truth effect"). This section was followed by a section asking participants if they had ever suffered from any

psychological disorder (if affirmed, the specific disorder should be named) and if they ever sought help for it. Questions on the medical-psychiatric history followed (see Results section and Table 1). At the end of the survey the Community Assessment of Psychic Experiences (CAPE) was administered to all participants (see below). Finally, participants were required to enter their email address which was needed to invite them for the second part of the survey one week later. No other personal information such as telephone number or postal address was requested.

2.2. Re-assessment (1 week later)

One week after completion of the first survey, participants were re-contacted individually via email and requested to undergo the second and final survey.

Subjects were first asked to provide their email address again to allow merging of information obtained from both surveys. Then, gender and age had to be entered. This was followed by the final set of items for measuring the truth effect (see below). We did not reveal whether or not items were new. Finally, gratitude was expressed for study participation and subjects were invited to download a file containing all prior questions with the respective correct answers, were debriefed about the study purpose and familiarized with the truth effect.

2.3. Assessment of the truth effect

2.3.1. Pre-phase (initial assessment)

Subjects were initially shown the following instruction (translated from German):

"True or false? Please appraise spontaneously the truth or falsity of the statements below. For your judgment please use a scale ranging from 1 = "definitely false" to 6 = "definitely true". Please provide an assessment for each statement".

Response options denoted as 1, 2, 3, 4, 5 and 6 were displayed in the same size. Only options 1 and 6 contained anchor descriptions (see above). Unbeknownst to the subjects, two different versions of the questionnaire (version A vs. B) were set up, and participants were randomly allocated to either version A or version B. The following example describes items that were used for version A:

1. Neutral statements set A (18 items) that were either true or false (these statements were repeated at re-assessment)
2. Emotional (i.e., delusional-relevant) statements set A (8 items) that were either true or false (these statements were repeated at re-assessment)
3. Neutral statements sets C and D (12 items each) that were either true or false (these statements were *not* repeated at re-assessment)

For version B, a similar procedure was adopted with the main difference that items from set B (instead of items from set A) were displayed for conditions 1 and 2. Filler items (sets C and D; condition 3) remained the same for both parallel versions. Thus, the overall number of items was the same in both versions. The order of items was fully randomized.

2.3.2. Post-phase (re-assessment)

For the re-assessment, subjects were provided essentially the same instruction as before. This time, items were the same for all participants (i.e., from both versions A and B): The questionnaire contained all items from both sets A and B (in the prior phase, item set A *or* B was used), whereas item sets C and D were not presented again. Thus, participants were presented with repeated items (i.e., items from set A for participants who were initially allocated to version A; items from set B for participants who were initially allocated to version B) or novel items (i.e., items from the set that was not presented in the initial assessment). The order of items was randomized anew.

As introduced above, the truth effect denotes the phenomenon that repeated items (i.e., set A items when set A was shown initially; set B items when set B was shown initially) receive higher scores (i.e., more in direction "definitely true") than novel items (i.e., set B items when set A was shown initially; set A items when set B was shown initially; items presented in the pre-phase only), irrespective of their factual truth.

2.4. Community Assessment of Psychic Experiences (CAPE)

Subsequently, respondents had to complete the CAPE questionnaire (Stefanis et al., 2002), tapping psychosis-related phenomena. Its 42 items are derived from clinical rating scales but are worded in a manner comprehensible to both healthy and clinical populations. Items have to be endorsed on a four-point Likert scale (1 = never, 2 = sometimes, 3 = often, 4 = nearly always). The CAPE taps three syndromes: positive ($n = 20$, e.g., "Do you ever feel as if you are being persecuted in some way?"), negative ($n = 14$, e.g., "Do you ever feel that you experience few or no emotions at important events?") and depressive ($n = 8$, e.g., "Do you ever feel pessimistic about everything?"). The mean of the weighted subscores before standardization were computed and later compared to scores obtained in clinical (see Konings, Bak, Hanssen, van Os, & Krabbendam, 2006) and Internet samples (Moritz et al., 2009). Four items served as "lie" items (highly implausible positive symptoms) to assert the truth of the responses (see below).

2.5. Participants

Blind to experimental data, we deleted subjects with stereotypical responses on the truth effect section (i.e., the same value on all items), subjects entering the same value on all CAPE items, subjects with incompatible psychopathological responses (e.g., negated any psychiatric illness initially but later affirmed presence of a depressive disorder), and subjects scoring high on a psychopathological lie scale (i.e., subjects achieving more than 8 of 16 points on the psychosis lie scale, Moritz, in preparation), which taps broadly publicized but in fact rather rare or pseudo-psychotic symptoms: a. seeing tiny objects such as white mice; b. incidences of alien abduction; c. being a famous personality; d. experience of lapses during which one becomes another person.

Table 1
Background and psychopathological variables. Frequency (gender), means and standard deviations.

Variable	Healthy ($n = 40$)	Schizophrenia ($n = 36$)	Statistics
Gender (male/female)	27/13	18/18	$\chi^2(1) = 2.40$, $p > .1$
Age in years	35.25 (16.63)	36.00 (8.63)	$t(74) = .30$, $p > .7$
Formal school education in years	12.60 (1.08)	12.11 (1.60)	$t(74) = 1.54$, $p > .1$
Number of psychiatric admission	–	4.53 (2.05)	–
CAPE positive (weighted)	1.21 (.18)	1.95 (.51)	$t(74) = 8.21$, $p < .001$
CAPE negative (weighted)	1.74 (.39)	2.49 (.47)	$t(74) = 7.56$, $p < .001$
CAPE depressive (weighted)	1.78 (.46)	2.50 (.53)	$t(74) = 6.33$, $p < .001$

Application of these exclusion criteria reduced the baseline sample size to 89 participants that either had a likely diagnosis of schizophrenia/psychosis versus no psychiatric diagnoses. Thirteen subjects (i.e., 15%) were not willing to undergo the second assessment, leaving complete data of 40 nonclinical subjects and 36 participants with a probable diagnosis of schizophrenia. The clinical group was dichotomized according to the median CAPE positive score of 1.80 in two subgroups that were either high or low on positive symptoms.

3. Results

3.1. Background and psychopathological data

Table 1 shows that the healthy and schizophrenia group (full pre and post data on the truth effect) were indistinguishable with respect to background characteristics. As expected, the psychosis group achieved higher scores on all CAPE items, which are in the expected range for schizophrenia patients obtained in Internet (Moritz et al., 2009; positive score $M = 1.82$, $SD = .49$; negative score: $M = 2.30$, $SD = .47$; depression score: $M = 2.31$, $SD = .47$) or clinical trials (Myin-Germeys & Collip, unpublished data on 311 mainly remitted patients: positive score $M = 1.66$, $SD = .49$; negative score: $M = 1.98$, $SD = .54$; depression score: $M = 2.00$, $SD = .55$).

3.2. Truth effect

We calculated a mixed ANOVA with Item Type (pre, repeated post, novel post), Valence (emotional, neutral), and Truth (true, false) as within-subject factors, and Group (healthy, patients high versus low on CAPE positive symptoms) as between-subject factor. Initially, we added Version Type (Group A and B) as additional between-subject factor but subsequently dropped it as it did not yield significant main effects or interactions suggesting that the parallel versions were equivalent. The main effects of Item Type, $F(2,140) = 3.54$, $p = .03$, $\eta^2_{partial} = .048$, achieved significance: In line with our hypothesis, repeated items received higher truth ratings (i.e., more in the direction "entirely true" (= 6); $M = 3.84$) than when presented first ($M = 3.70$) and novel (unrepeated) ones presented at post ($M = 3.68$). Further, the interaction of Valence and Group was significant, $F(2,70) = 3.11$, $p = .05$, $\eta^2_{partial} = .082$; which was qualified by a three-way interaction of Item Type × Valence × Group, $F(2,70) = 4.22$, $p = .003$, $\eta^2_{partial} = .108$. As can be seen in Fig. 1, the group high on positive symptoms showed an excessive truth effect for emotional material relative to both other groups, which was confirmed by significant post-hoc t-tests (i.e., the comparison against healthy subjects and those low on positive symptoms revealed p-values of less than .05).

Further notable effects were a two-way interaction of Truth × Valence, $F(2,70) = 11.21$, $p = .001$, $\eta^2_{partial} = .138$, which, however, was not further qualified by Group indicating that patients were not more often incorrect on either item type. Interestingly, false emotional statements received higher truth scores than true ones ($M = 3.84$ vs. $M = 3.66$) relative to neutral ones ($M = 3.65$ vs. $M = 3.81$). This was qualified by a three-way interaction of Item Type × Truth × Valence, $F(2,70) = 10.57$, $p = .001$, $\eta^2_{partial} = .131$. Further exploration showed that the higher scores for false emotional statements relative to true ones emerged in fact only for the initial phase ($M = 3.89$ vs. $M = 3.66$) and the novel items ($M = 3.83$ vs. $M = 3.46$), but not for the repeated items ($M = 3.80$ vs. $M = 3.88$). For neutral items, true statements always achieved somewhat higher scores across all item types.

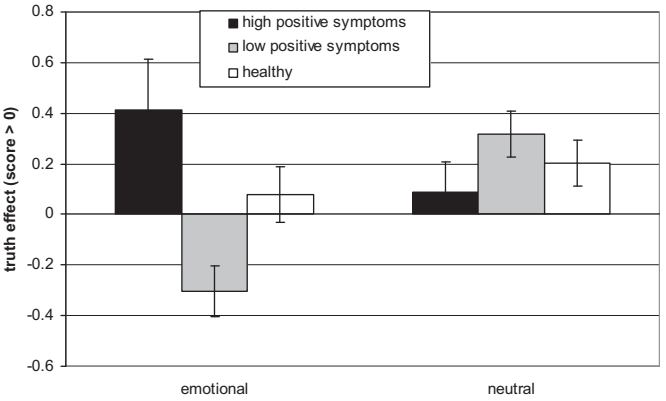

Fig. 1. Illusory truth effect, change scores (pre- vs. post-test). Mean and standard errors. The group high on positive symptoms showed an excessive truth effect for emotional (delusion-relevant) material, which was significantly different relative to the other two groups and which correlated with the CAPE positive syndrome.

3.3. Correlations

We correlated the magnitude of the truth effect (scores for repeated items minus scores for the same items in the pre-phase) with the CAPE scores. Significant correlations emerged for both patients with a probable diagnosis of schizophrenia ($r = .39$, $p = .02$) and healthy subjects ($r = .32$, $p = .05$) with respect to the emotional (i.e., delusion-relevant) condition for the CAPE positive syndrome. The emotional truth effect did not correlate with the other two CAPE subscales (both groups: $|r| < .23$; $p > .1$). The neutral truth effect did not correlate with any of the three subscales ($|r| < .17$, $p > .3$). Finally, for exploratory purposes, we composed three new subscales from the positive subscale tapping into delusions, hallucinations and beliefs about the permeability of ego boundaries (e.g., thought insertion, thought broadcasting). For the entire population, the delusion ($r = .32$, $p = .005$) and ego boundaries subscales ($r = .24$, $p = .03$) correlated significantly with the emotional truth effect, while for the hallucination subscale a trend was achieved ($r = .20$, $p = .09$). When the analysis was repeated for patients with a probable schizophrenia only, the delusion subscale was strongly correlated with the emotional truth effect ($r = .53$, $p = .001$), while the other two subscales only approached a trend level (both $r = .27$, $p = .11$).

4. Discussion

To the best of our knowledge, this is the first study that investigated the truth effect in schizophrenia. As expected, a significant overall truth effect emerged confirming the validity of our paradigm: The re-exposure to the same statement caused a reliable increment of its subjective truth, irrespective of its factual truth. Novel statements (i.e., items that were not presented in the first phase) received lower endorsements at post-test. In line with our expectation, patients with probable schizophrenia displaying high positive symptoms showed a significant response shift in direction to "entirely true" for emotional, delusion-relevant statements. We interpret this as a further support for the account that patients with schizophrenia display a disproportionately strong influence of recently encountered information (Moritz & Woodward, 2005; Woodward, Moritz, Arnold, et al., 2006; Woodward, Moritz, Cuttler, et al., 2006) and rely on shallow criteria such as familiarity and gist for their judgments (Moritz, Woodward, Cuttler, Whitman, & Watson, 2004; Moritz, Woodward, & Rodriguez-Raecke, 2006; Weiss, Dodson, Goff, Schacter, & Heckers, 2002). Importantly, the truth effect for emotional material was significantly correlated with

the CAPE positive syndrome subscore in both participants with probable schizophrenia and controls. Subsequent correlational analyses showed that the effect was more pronounced for delusional items.

Interestingly, while subjects high on positive symptoms were somewhat more affirmative to emotional and delusion-relevant statements, they were not more frequently wrong on emotional items than controls (as indicated by a non-significant three-way interaction of Valence × Truth × Group). In other words, healthy subjects were not better at distinguishing right from wrong when it came to delusional items. This is counterintuitive at first sight, as a core defining feature of delusions, being present in many patients, is that they represent fixed and especially false beliefs. However, our items may not have tapped into individual delusional beliefs so that patients have responded more rationally than one would expect if their core beliefs were tested. Being delusional apparently does not imply loss of reality for all delusion-relevant information. In future studies, one should test the degree to which patients were emotionally affected by the items and in how far the items captured the individual psychopathology, respectively.

In face of the limitations acknowledged in the next paragraph, we would like to refrain from bold claims. Independent replications with a clinical sample are clearly warranted to substantiate these results. However, if confirmed, the inflated truth effect found in patients for emotional material might represent a cognitive signature of a hyperdopaminergic state putatively underlying positive symptoms. According to Kapur (2003), hypersalience may falsely impart meaning and importance to neutral stimuli. Interestingly, participants high versus low on the CAPE positive syndrome did not differ on their judgments in the pre-phase, but dissociated only thereafter. Exposure to an item, particularly when it is emotional, enhances its salience, and for delusional people this process is sped up due to the hyperdopaminergic state. Importantly, the increase in truth judgments cannot be explained by a mere liberal response bias as this would predict higher ratings even for re-exposed neutral items. Instead, the increment was confined to twice-presented delusional items, while neutral items (both repeated and novel) and novel emotional items were comparable to the other groups at post-test.

The study faces several limitations, rendering its results preliminary. Firstly, while accessing a rather large sample, the recruitment was done over the Internet and therefore cannot externally verify diagnosis. Whereas several precautions raised the methodological quality of the study and the reliability of group allocation (e.g., CAPE results comparable to prior studies with clinical samples, study invitation was posted on specialized forums for psychotic patients), we cannot fully rule out that some participants in the schizophrenia group had conditions that would have led to exclusion in a conventional (i.e., clinical) research setting. Secondly, further research may delineate whether the enhanced truth effect was due to the emotional valence or the predominantly delusional content of the items. Thirdly, future studies should ask participants about the personal relevance/salience of the items, which, according to studies done in other psychopathological disorders (Crane, Barnhofer, Mark, & Williams, 2007; Moritz et al., 2011; Schlosser et al., 2011), may represent a further moderator. Finally, an unbalanced number of items was employed per condition. This design flaw should be addressed and removed for future research.

To conclude, this pilot study tentatively suggests that patients with probable schizophrenia high on positive symptoms show an inflated illusory truth effect for emotional items. In combination with the confirmation bias (patients select pieces of information in accordance with their hypotheses), the inflated truth effect may provide a clue as to why the strange ideas and interests that patients typically dwell on increasingly perpetuate into firm delusional beliefs. Interestingly, the inflated truth effect was elicited only for emotional information, which may partially explain why patients are not receptive of contradicting sober facts. Further research may elucidate a possible role of dopamine in the process.

Declaration of interest

None of the authors had a conflict of interest.

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