

# The Impact of Irrational Beliefs on Paranoid Thoughts

Radu Soflau

*The International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health,  
Babes-Bolyai University of Cluj-Napoca*

Daniel O. David

*Department of Clinical Psychology and Psychotherapy, Babes-Bolyai University of Cluj-Napoca and  
Icahn School of Medicine at Mount Sinai, New York*

**Background:** Although the ABC model proposed by cognitive behavioral theory has strong empirical support for a wide range of psychological problems, little is known about the role of irrational beliefs (IBs), a central concept of the ABC model, in the aetiology of paranoid thoughts, one of the most common psychotic symptoms. **Aims:** The present study aimed to investigate the impact of IBs on paranoid thoughts and people's perceptions of others. **Method:** Eighty-one non-clinical participants ( $m$  age = 21.21 years,  $SD$  = 2.72, range 18–33; 83.95% female) recruited for this study were randomly assigned to one of the two conditions: IBs or rational beliefs (RBs). In a role-play paradigm, subjects were asked to imagine holding a list of IBs or RBs, respectively, while being exposed to a neutral social context in a virtual reality environment. **Results:** In line with the ABC model, results indicate that IBs lead to significantly higher levels of state paranoid thoughts and more negative perceptions of others than RBs, even after controlling for participants' baseline irrationality and trait paranoia [ $F(5,68) = 11.23$ ,  $p < .001$ , Wilk's  $\lambda = .54$ , partial  $\eta^2 = .45$ ]. **Conclusions:** The findings of this paper suggest that IBs might play an aetiological role in the occurrence of paranoid thoughts. Practical and theoretical implications of these results are also considered.

*Keywords:* irrational beliefs, paranoid thoughts, ABC model, virtual reality

## Introduction

Considering the heterogeneity of psychotic disorders, the study of psychosis is currently focusing on specific behavioural or cognitive symptoms rather than on general disorders such as schizophrenia (Bentall et al., 1988, 2009; Verdoux and van Os, 2002). In this symptom-focused approach, paranoid delusions/thoughts are among the most frequently researched symptoms of psychotic disorders. The interest in paranoia is not surprising, given that paranoid thoughts were found to be the most common type of delusion in psychotic patients (Jørgensen and Jensen, 1994; Stompe et al., 1999), but were also observed in other psychiatric populations, such as

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Correspondence to Daniel David, Department of Clinical Psychology and Psychotherapy, Babes-Bolyai University, No. 37, Republicii Street 400015, Cluj-Napoca, Cluj, Romania. E-mail: [daniel.david@ubbcluj.ro](mailto:daniel.david@ubbcluj.ro)

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bipolar disorder (Goodwin and Jamison, 2007), post-traumatic stress disorder (PTSD) (Hamner et al., 1999), or dementia (Fischer et al., 2004; Flint, 1991; Rubin et al., 1988). Previous studies indicate that paranoid ideation is nearly as common as symptoms of depression and anxiety in the general population (Johns et al., 2004; van Os and Verdoux, 2003). Moreover, in light of the somewhat high rates of paranoid thoughts detected in non-clinical population samples (i.e. 15–20% of the general population have delusional ideation on a regular basis; Freeman, 2006) it has been argued that delusions in psychiatric patients represent the severe end of a phenomenon also present in the general population (i.e. on a continuum with the normal experience; Chapman and Chapman, 1980; van Os et al., 2009). There is some empirical support for this perspective (e.g. Bebbington et al., 2013; Elahi et al., 2017; Freeman et al., 2005a).

The continuum perspective has important implications, as the aetiological continuity perspective (Myin-Germeys et al., 2003) implies that similar factors should equally underlie both low-level psychotic-like (i.e. non-clinical) experiences and clinical symptoms (Freeman et al., 2010). This prediction is supported by findings from epidemiological studies that show similar associations between different social, demographic and clinical variables (e.g. single marital status, urban residence, depressive symptoms) and both clinical and non-clinical psychotic symptoms (van Os et al., 2000, 2009). Furthermore, there is evidence that non-clinical symptoms predict later development of psychosis (Chapman et al., 1994; Poulton et al., 2000). Thus, studies conducted on the general population could offer important insights concerning causal factors implied in paranoia. Moreover, given that delusional thoughts are associated with increased distress and significant functional impairment in the general population (Olfson et al., 2002), studying delusional ideation and underlying aetiological factors in non-clinical settings is of importance on its own.

### *CBT in psychosis*

Cognitive behavioural therapy (CBT) was proved to be effective in reducing positive symptoms and might facilitate recovery in psychotic individuals (Gould et al., 2001). However, although it is recommended by the National Institute for Clinical Excellence guidelines for psychosis (NICE, 2014), the effect sizes favouring CBT are small to medium (e.g.  $d = 0.40$ ; Wykes et al., 2008). Moreover, with regard to changes in delusions, CBT appears to be effective only compared with treatment as usual (and with a small effect size), but not superior to other interventions, according to a recent meta-analysis (Mehl et al., 2015). Nevertheless, the findings from this study (Mehl et al., 2015) indicate that newer studies evaluating interventions that specifically address causal factors of delusions (e.g. worry; see Freeman et al., 2015) obtained significantly larger effect sizes than the non-specific CBT interventions. However, the difference in mean effect sizes between the two types of interventions is still small ( $d = 0.33$ ). These results suggest the importance of further exploring potential causal factors for delusions that need to be targeted by future CBT interventions.

### *The ABC model for paranoia*

The number of empirical studies investigating different predictors of paranoia within the CBT framework is increasing (see Freeman, 2007). However, to date little attention has been paid to

testing the ABC trans-diagnostic model (Ellis, 1962, 1977, 1994) in paranoia, despite the fact that cognitive behavioural therapies are based on this model (David and Szentagotai, 2006).

A central hypothesis of the ABC model is that irrational beliefs (IBs) about activating events lead to psychological disturbance. According to the general ABC model, in the presence of an activating event (A), rational/irrational beliefs (B) will lead to functional/dysfunctional consequences (i.e. on the emotional, behavioural and/or cognitive level; C) (Dryden and David, 2008). The activating event could be external (e.g. an unfriendly audience) or internal (e.g. inferences, emotions). While rational beliefs (RBs) are pragmatic (i.e. consistent with one's goals), reality-based, logical (i.e. non-absolutistic), and/or flexible, IBs are non-pragmatic, non-reality-based, illogical (i.e. absolutistic), and/or rigid (David et al., 2010). There are four IBs stressed in the more recent developments of the rational emotive behavioural therapy (REBT; Ellis, 1994): a primary belief – demandingness (DEM) and three secondary IBs – catastrophizing/awfulizing (AWF), low frustration tolerance (LFT), and global evaluation (GE) (i.e. of self – SD, others – OD, and life – LD). The RBs corresponding to these IBs are: flexible thinking (including preferences, acceptance; PRE), non-catastrophizing/badness (BAD), frustration tolerance (FT), and unconditional acceptance (UA)/non-global evaluation (non-GE), respectively (David et al., 2010).

Although the ABC model has been previously proposed in paranoia, earlier attempts have predominantly conceptualized paranoid inferences as activating events (A) for IBs (B) that subsequently lead to dysfunctional consequences (C) (e.g. anxiety/depression, hostile behaviours, and other psychotic symptoms; see Trower, 2003). Thus, less attention has been paid to the REBT hypothesis that IBs also result in dysfunctional automatic thoughts/inferences (e.g. paranoid thoughts) in the CBT explanatory models of paranoia. Within the ABC model, paranoid inferences (e.g. 'Someone has it in for me') can also be conceptualized as dysfunctional cognitive consequences (C) of the IBs (e.g. 'I should show no sign of weakness in front of others. People are bad and hostile.') (B) that are activated by certain events (A; e.g. a social interaction). Even though the ABC model and REBT techniques have been used to elaborate clinical interventions for paranoia and other psychotic symptoms (Bennett and Pearson, 2015; Hansen, 2006; Trower, 2003), little is known about the aetiological role of IBs in the occurrence of paranoid thoughts. This is not very surprising considering that CBT research has been less focused on the causal links between IBs and other cognitive variables (e.g. inferences/automatic thoughts) and more concerned with the impact of IBs on the emotional level in other psychopathologies as well.

There are some empirical data in favour of applying the ABC model in paranoia. A few findings indicate that emotional and behavioural responses to psychotic experiences are mediated by people's beliefs about psychotic symptoms (e.g. voices; Birchwood and Chadwick, 1997; Chadwick and Birchwood, 1994).

Even though little is known about the role of IBs in the occurrence of paranoid automatic thoughts, there are some findings that indirectly support the hypothesis of a potential link between these variables. First, a series of studies conducted by Dryden, Bond and colleagues (Bond and Dryden, 1997; Dryden et al., 1989a,b; McDuff and Dryden, 1998) experimentally investigated the impact of beliefs' irrationality on the occurrence of dysfunctional automatic thoughts (inferences). The findings of these studies systematically showed that holding IBs led to more dysfunctional automatic thoughts than holding RBs.

Second, a recent meta-analysis synthesizing a series of both experimental and correlational studies reporting data for the relationship between IBs and dysfunctional automatic thoughts

(i.e. including inferences; Soflau and David, 2016) found a significant medium to high magnitude of the association. Although none of the studies included in this meta-analysis focused on paranoid inferences/thoughts, the consistency of this relationship across different psychological problems and populations might suggest that these findings could generalize to paranoid ideation as well.

Moreover, somewhat supporting the causal role of IBs in paranoia, it has been shown that negative beliefs about the self and others are associated with increased levels of paranoia, in both clinical (Fowler et al., 2006; Smith et al., 2006) and non-clinical samples (Freeman et al., 2003, 2005a). Furthermore, these beliefs discriminated between non-clinical subjects and patients with psychosis (Fowler et al., 2006).

A more direct support for the link between IBs and paranoia has been provided in a recent study (R. Soflau and D.O. David, unpublished observations) showing that different measures of beliefs' irrationality were consistently positively associated with measures of trait paranoia. Still, to the best of our knowledge, to date little experimental work has been done on IBs potentially lending vulnerability to paranoid psychosis or paranoid thoughts.

#### *Role-play procedures for inducing IBs/RBs*

Although correlational studies are important for investigating the role of IBs in psychopathology, it is difficult to draw conclusions about causal relationships based on these data. However, the induction of actual IBs in experimental settings is a sensitive issue, given that it might be both difficult and unethical. As a consequence, in the experimental studies of Dryden, Bond and colleagues (Bond and Dryden, 1997; Dryden et al., 1989a,b; McDuff and Dryden, 1998) the authors used a role-play paradigm, asking participants to imagine themselves holding either RBs or IBs while being in an imagined scenario. In order to check the success of the manipulation, subjects were asked to assess the extent to which they managed to hold the beliefs while imagining themselves in the given situation and only those reporting a score of seven or higher were considered eligible for analyses. Although it can be argued that this procedure is artificial, it has been maintained that role-play is realistic, as shown by studies implementing this procedure that managed to replicate the findings of studies conducted with classical (i.e. non-simulated) manipulation procedures (see McDuff and Dryden, 1998). Moreover, as role-play is often used in clinical settings by CBT practitioners (Dryden, 1995), it has been claimed that this procedure has certain ecological validity (McDuff and Dryden, 1998). Hence, the use of role-play procedures for inducing RBs/IBs has the advantage of enabling random allocation to different types of beliefs, thus favouring the formulation of causal inferences, without the ethical implications of inducing actual IBs.

#### *Virtual reality for assessing paranoid thoughts*

Although the use of role-play procedures for inducing RBs/IBs is arguable from an ethical perspective, a limit of the majority of experimental studies concerning the causal link between IBs and automatic thoughts (see Soflau and David, 2016) is that participants were also asked to imagine negative events, instead of being exposed to real events. This could be problematic, considering that IBs may not be triggered in *in vivo* (Ellis, 1994), a relatively safe context. Given that it would be difficult to expose all participants to the exact same experience in a real life setting, the use of a virtual reality (VR) system could tackle this limitation.

VR systems were already shown to be useful tools for assessing paranoid ideation. VR has the advantage of providing controlled neutral situations that realistically approximate the reality (i.e. identical activating events for all participants), thus ensuring that the paranoid thoughts triggered by these naturalistic scenarios are unfounded (Fornells-Ambrojo et al., 2008). It has been successfully used to investigate paranoid thinking in both general population (Freeman et al., 2008) and among people at risk of psychosis (Valmaggia et al., 2007), the occurrence of persecutory ideation in VR being associated with higher levels of trait paranoia. Moreover, the ecological validity of VR testing is suggested by studies showing that people presenting paranoid thoughts in VR settings are more likely to also report paranoid thoughts in real life situations (Freeman et al., 2008). Thus, VR could provide a feasible setting for studying paranoid thoughts.

### *Objectives*

This study aimed to evaluate the impact of IBs on paranoid thoughts and people's perceptions of others. Based on the REBT theory, we hypothesized that IBs would determine higher levels of paranoid inferences and more negative perceptions of others than RBs. In addition, we aimed to analyse whether participants' initial irrationality, paranoid traits or other variables that have been previously related to paranoid thoughts (i.e. positive and negative self/others evaluations; self-esteem and its alternative – unconditional self-acceptance; depression; and anxiety) (see Freeman, 2007) are associated with the study outcomes. We expected to find no or small associations between these variables if the manipulation was to be successful and the two types of beliefs were to have different effects on paranoid thoughts.

## **Method**

### *Participants*

Ninety-three individuals completed the online baseline measurements. Twelve of them were excluded for various reasons (i.e., provided incorrect contact information, did not attend the scheduled session, travelled during the experiment). Eighty-one participants ( $m$  age = 21.21 years;  $SD$  = 2.72; range = 18–33; 83.95% female) were randomly assigned to one of the two groups (see Fig. 1). Participants were recruited from a Faculty of Psychology, through internet-based outlets. Similar to the previous studies that investigated factors involved in paranoia in non-clinical individuals, no paranoia-related criteria were used for inclusion in this study. Participants had to be at least 18 years old and to have no neurological problem. All participants met these inclusion criteria. The 81 participants completed the entire protocol and received course credits for participation. No participant raised any complaints concerning cybersickness or related to the use of VR.

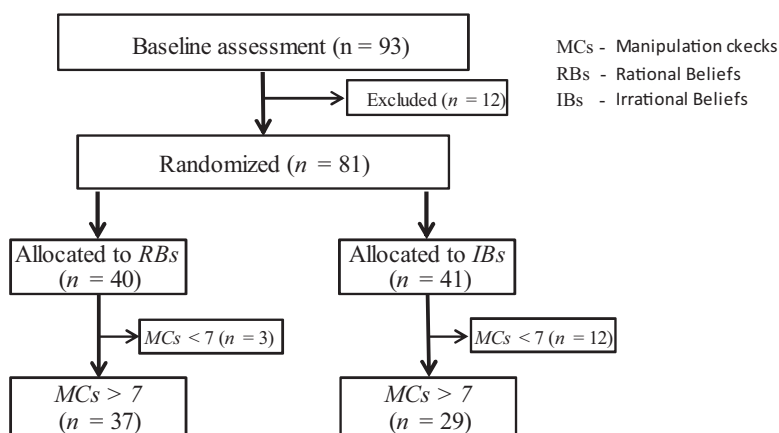
### *Measures*

The *Attitude and Beliefs Scale II* (ABS-II; DiGiuseppe et al., 1988) contains 72 items that evaluate IBs. The scale is focused on four cognitive processes (i.e. DEM, AWF, LFT and GE/SD). ABS-II has proved validity and reliability in assessing both rational and irrational beliefs (David et al., 2002; DiGiuseppe et al., 1988). See Table 1 for the internal consistency estimates obtained in the present study.

**Table 1.** Descriptive statistics and internal consistency estimates (Cronbach’s  $\alpha$ )

|           | ABS-II | RIBS  | G-PTS-SR | G-PTS-P | BCSS-NS | BCSS-NO | BCSS-PS | BCSS-PO | RSE   | UAQ    | DASS-D | DASS-A | SSPS  | PT-VAS |
|-----------|--------|-------|----------|---------|---------|---------|---------|---------|-------|--------|--------|--------|-------|--------|
| Mean      | 87.40  | 50.79 | 31.70    | 22.71   | 4.80    | 7.80    | 15.28   | 10.71   | 26.30 | 159.65 | 11.407 | 9.82   | 22.36 | 180.34 |
| <i>SD</i> | 48.15  | 7.91  | 12.17    | 9.58    | 4.80    | 5.08    | 5.51    | 4.29    | 2.59  | 30.25  | 8.70   | 8.17   | 10.53 | 155.74 |
| $\alpha$  | .97    | .87   | .91      | .93     | .76     | .89     | .91     | .89     | .88   | .88    | .81    | .78    | .95   | .93    |

ABS-II, Attitude and Beliefs Scale II (DiGiuseppe et al., 1988); RIBS, Paranoia Rational and Irrational Beliefs Scale; G-PTS-SR, Green Paranoia Thoughts Scale – Social Reference Subscale (Green et al., 2008); G-PTS-P, Green Paranoia Thoughts Scale – Persecution Subscale (Green et al., 2008); BCSS-NS, Brief Core Schema Scales – Negative Self (Fowler et al., 2006); BCSS-NO, Brief Core Schema Scales – Negative Others (Fowler et al., 2006); BCSS-PS, Brief Core Schema Scales – Positive Self (Fowler et al., 2006); BCSS-PO, Brief Core Schema Scales – Positive Others (Fowler et al., 2006); RSE, Rosenberg Self-Esteem Scale (Rosenberg, 1965); UAQ, Unconditional Acceptance Questionnaire (David et al., 2013); DASS-D, Depression Anxiety Stress Scales 21 – Depression Scale (Lovibond and Lovibond, 1995); DASS-A, Depression Anxiety Stress Scales 21 – Anxiety Scale (Lovibond and Lovibond, 1995); SSPS, State Social Paranoia Scale (Freeman et al., 2007); PT-VAS, Paranoid Thoughts Visual Analogue Scales.



**Figure 1.** Participant flowchart

The *Paranoia Rational and Irrational Beliefs Scale* (Paranoia-RIBS) was developed for this study, in order to measure RBs and IBs related to paranoia, on the basis of the general format (Montgomery et al., 2007). The statements of the Paranoia-RIBS were built to reflect IBs and RBs related to two domains (i.e. social rejection and vulnerability) that have been previously hypothesized to be central themes for delusional beliefs (Freeman et al., 2005b) and were found to predict the occurrence of paranoia. Thus, eight items were conceived for each domain (16 items for the entire scale), one for each IB (i.e. DEM, AWF, LFT, GE) and RB (i.e. PRE, BAD, FT, non-GE). Participants were asked to rate their level of agreement for each statement, on a scale from 1 ('strongly agree') to 4 ('strongly disagree'). The rational items were reverse coded, and a total score was computed by summing all the scores. Lower scores reflect higher levels of paranoia-specific irrationality.

The *Green Paranoia Thoughts Scale* (G-PTS; Green et al., 2008) is a measure of trait paranoia. It consists of two 16-item subscales: social reference and ideas of persecution. Higher scores indicate higher levels of paranoid thoughts. Both scales displayed good psychometric properties in clinical and non-clinical samples (Green et al., 2008).

The *Brief Core Schema Scales* (BCSS; Fowler et al., 2006) consists of 24 items developed to assess self- and other-evaluations. The items are grouped in four subscales: negative-self, negative-others, positive-self, and positive-others. The scale has been previously found to have good internal consistency and test-retest reliability (Fowler et al., 2006).

The *Rosenberg Self-Esteem Scale* (RSE; Rosenberg, 1965) consists of 10 statements assessing self-esteem through 10 positive and negative statements about self. The scale has good construct validity (Robins et al., 2001), reliability and concurrent validity (Schmitt and Allik, 2005).

The *Unconditional Acceptance Questionnaire* (UAQ; David et al., 2013) evaluates unconditional acceptance of self, others, and life. Adequate psychometric properties have been reported for this instrument (David et al., 2013).

*Depression Anxiety Stress Scales 21* (DASS-21). DASS-21 is the short form developed by Lovibond and Lovibond (1995) from their 42-items self-report measure of depression, anxiety

and stress (DASS). Only scores for the depression and anxiety scales were computed in the present study, higher scores indicating increased levels of depression/anxiety.

The *State Social Paranoia Scale* (SSPS; Freeman et al., 2007) is a 10-item scale that measures paranoid thinking in a social situation, higher scores indicating increased levels of persecutory thinking.

The *Paranoid Thoughts Visual Analogue Scales* (PT-VAS) were built to additionally assess paranoid thoughts. The six affirmations were initially designed to independently assess specific paranoid thoughts. However, given that an excellent internal consistency (see Table 1) was observed for the six items combined, we chose to merge the six VASs into a single scale, in order to reduce the number of dependent variables from the analyses. Each item was evaluated on a 10 cm line, with the left end being labelled '0', and the right end '100'. The total score was computed by summing all scores. Higher scores correspond to increased levels of paranoid inferences.

*Visual Analogue Scales for Perceptions* (P-VAS). Participants were asked to evaluate to what extent people present in the room were 'friendly', 'hostile' and 'neutral', on separate 10 cm lines. A '0' and a '100' were marked at the extremities of each line. Higher scores indicate greater levels of the associated characteristic.

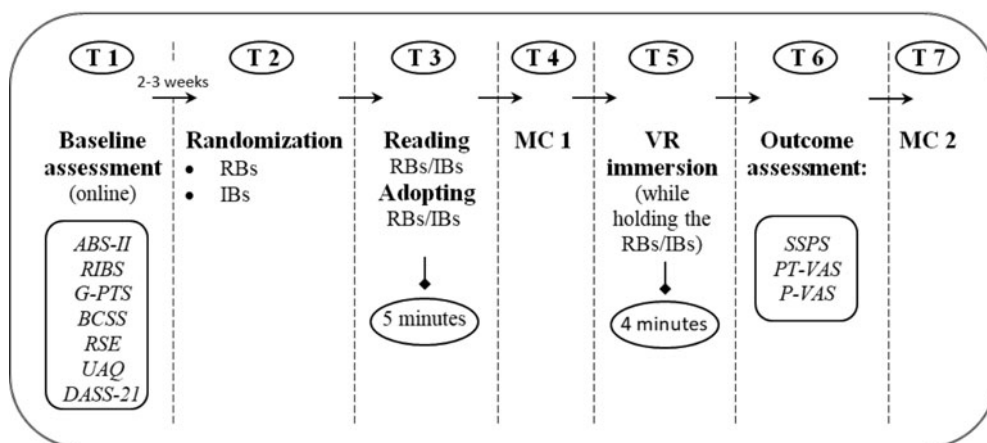
### *Experimental set-up*

The experimental sessions took place at a VR research platform. A head mounted display (HMD) system was used for VR immersion. The HMD was an eMagin Z800 3D Visor device (SVGA – 800×600 triad pixels per display; >16.7 million colours; brightness >50 cd/m<sup>2</sup>; contrast ratio >200:1; view angle of around 40 deg diagonal field of view), equipped with a head tracking device (360 deg horizontal, >60 deg vertical) that allowed natural movement. Thus, participants were able to explore the environment by turning their head, while sitting in a chair. No additional VR controller was used. The VR environment consisted of a social scenario developed by Virtually Better Inc. that was previously used in several studies targeting social anxiety (with various adjustments; e.g. Anderson et al., 2005; Wallach et al., 2009), as well as for the assessment of paranoia (R. Soflau and D.O. David, unpublished observations). The VR scenario depicted an indoor setting that was populated with human avatars (22 men and women) displaying neutral behaviours. The avatars were seated in front of the participants and were relatively static (i.e. realized only a few slight body movements and negligible changes in facial expressions, while remaining seated throughout the immersion).

### *Procedure*

This study conformed to the ethical guidelines of Babes-Bolyai University's Institutional Review Board and of the APA's Ethical Principles of Psychologists and Code of Conduct. Following consent, participants completed the battery of initial self-report measures approximately 2 weeks prior to participating in the experimental tasks (see Fig. 2). Participants who agreed to attend the experimental session were randomized in experimental groups using a random number generator. They were not informed that the study aimed to investigate paranoia until the end of the experiment.





**Figure 2.** Procedure timeline

The current study used a role-play methodology similar to that used by Bond and Dryden (1997). However, unlike these authors, we chose to immerse the participants in a VR generated scenario instead of asking them to imagine themselves in a certain scenario.

First, applying the role-play paradigm, the rationality of beliefs was manipulated by asking participants to imagine holding a list of RBs (DEM, OD, AWF and LFT) or IBs (PRE, non-GE, BAD and FT), depending on their group allocation (see Supplementary Information).

Second, participants were immersed in a VR environment and asked to explore the surroundings while imagining they are holding the beliefs they received. Next, as a first manipulation check (MC 1), subjects had to evaluate the extent to which they managed to imagine holding the beliefs they received during the VR exposure (0 – ‘not at all’; 9 – ‘to a great extent’). Then, participants had to complete outcome measures (see Fig. 2) referring to the thoughts they had during the VR immersion. Finally, participants were asked to estimate the extent to which they focused on the VR environment and managed to hold the beliefs they previously received while completing the questionnaires (MC 2).

All sessions were conducted by graduate students who were blind to the study hypotheses. The research assistants attended three training workshops for applying the manualized protocol and were supervised by the first author. All research assistants administered both conditions.

### Data analysis

A one-way MANOVA analysis was used to compare the two groups on baseline variables. Pearson correlations were computed between baseline and outcome variables. Two sets of statistical analyses were conducted to test the effects of the irrationality of beliefs. First, a one-way MANCOVA analysis using the scores from the two manipulation checks as covariates was carried out. In the second analysis, a one-way MANOVA that included only participants who reported a score of at least seven on both manipulation checks was run (i.e. applying the same cut-off point for inclusion as Bond and Dryden, 1997). In both types of analysis participants’ levels of irrationality and trait paranoia were included as covariates.

## Results

Results showed no significant differences between the two conditions on the baseline variables [ $F(12,68) = 0.57, p = .855$ , Wilk's  $\lambda = .91$ , partial  $\eta^2 = .09$ ; see Table 1 for descriptives], and none of the baseline variables was significantly related to the outcome variables (see Table 2).

MANCOVA revealed a significant effect of the irrationality of beliefs on the dependent variables, controlling for manipulation check scores ( $F(5,71) = 10.61, p < .001$ , Wilk's  $\lambda = .57$ , partial  $\eta^2 = .43$ ). IBs led to higher levels of state paranoia thoughts, as assessed by both SSPS ( $F(1,75) = 39.38; p < .001$ ; partial  $\eta^2 = .34$ ) and PT-VAS ( $F(1,75) = 36.58; p < .001$ ; partial  $\eta^2 = .33$ ). Furthermore, participants holding IBs perceived the people/avatars from the VR environment as more hostile ( $F(1,75) = 36.53; p < .001$ ; partial  $\eta^2 = .33$ ), less friendly ( $F(1,75) = 26.11; p < .001$ ; partial  $\eta^2 = .26$ ) and less neutral ( $F(1,75) = 7.63; p = .007$ ; partial  $\eta^2 = .09$ ) than those holding RBs (see Table 3). The results pattern was replicated after controlling for participants' levels of irrationality and trait paranoia ( $F(5,68) = 11.24, p < .001$ , Wilk's  $\lambda = .55$ , partial  $\eta^2 = .45$ ) (see Table 4).

Similar results were obtained after including in the analyses data exclusively from subjects scoring seven or higher on both manipulation checks ( $F(5,41) = 6.13, p < .001$ , Wilk's  $\lambda = .57$ , partial  $\eta^2 = .43$ ; see Table 4).

## Discussion

This is the first study to examine the impact of IBs and RBs on paranoid thoughts and people's perceptions of others, using an experimental design. As expected based on the REBT transdiagnostic model, IBs induced higher levels of paranoid thoughts and more negative perceptions of others than RBs. These findings are unlikely to be explained by people's irrationality or paranoia traits, as there was no difference between groups on these variables at baseline and none of these variables was significantly related to the study outcomes. Moreover, the differences between people holding IBs and those holding RBs matched the REBT model's hypothesis even after controlling for the aforementioned variables.

These results add further support to the REBT hypothesis (Ellis, 1977) concerning the relationship between beliefs and automatic thoughts, indicating that IBs might play a role in the occurrence of paranoid thoughts and matching the general REBT assumption that IBs determine the functionality of other cognitions, such as automatic thoughts (Dryden and David, 2008).

Of interest is the magnitude of the impact of IBs on paranoid thoughts, given that all the effect sizes from the present study are large (i.e. partial  $\eta^2 > 0.14$ ), while the meta-analysis of Soflau and David (2016) revealed only a medium to high mean effect size ( $r = .43$ ) for the relationship between IBs and automatic thoughts. Possible explanations for these dissimilarities might be related to methodological issues (e.g. unlike the present study, a significant number of studies included in the meta-analysis did not assess participants in the presence of an activating event and might have under-estimated the effect) or to potential particularities of paranoid thoughts (e.g. IBs might play a more important role in generating paranoid thoughts than in causing other automatic thoughts).

This study has certain limitations. It is possible for the results to be influenced by potential demand characteristic of the role-play paradigm (i.e. being instructed to hold certain beliefs, participants might guess that the experimenter expects more positive/negative ratings and

**Table 2.** Correlations between baseline and outcome variables

|          | G-SR  | G-P   | RIBS  | BSCS<br>NS | BSCS<br>PS | BSCS<br>NO | BSCS<br>PO | UAQ   | ABS II | SES  | DASS-<br>A | DASS-<br>D |
|----------|-------|-------|-------|------------|------------|------------|------------|-------|--------|------|------------|------------|
| SPSS     | -.006 | -.039 | -.064 | .064       | -.048      | .054       | .070       | -.021 | .051   | .018 | .153       | .101       |
| PT-VAS   | -.014 | -.037 | -.088 | .081       | -.039      | .136       | .081       | -.078 | .077   | .003 | .205       | .123       |
| Hostile  | .029  | -.067 | -.002 | .073       | -.107      | .143       | .054       | -.013 | -.029  | .056 | .184       | .145       |
| Friendly | .137  | .163  | .091  | -.022      | .070       | .138       | -.039      | .035  | -.137  | .072 | -.093      | -.063      |
| Neutral  | -.049 | -.030 | -.025 | .008       | .101       | .062       | -.013      | -.015 | -.115  | .062 | -.177      | -.124      |

G-SR, Green Social Reference (Green et al., 2008); G-P, Green Persecution; RIBS, Paranoia Rational and Irrational Beliefs Scale; BSCS, Brief Core Schema Scales (Fowler et al., 2006); NS, Negative Self; PS, Positive Self; NO, Negative Others; PO, Positive Others; UAQ, Unconditional Acceptance Questionnaire (David et al., 2013); ABS II, Attitude and Beliefs Scale II (DiGiuseppe et al., 1988); SES, Rosenberg Self-Esteem Scale (Rosenberg, 1965); DASS-A, Depression Anxiety Stress Scales 21 – Anxiety Scale (Lovibond and Lovibond, 1995); DASS-D, Depression Anxiety Stress Scales 21 – Depression Scale (Lovibond and Lovibond, 1995); SPSS, State Social Paranoia Scale (Freeman et al., 2007); PT-VAS, Paranoid Thoughts Visual Analogue Scales.

**Table 3.** Outcomes by group: descriptive statistics

|            |           | SPSS  | PT-VAS | VAS hostile | VAS friendly | VAS neutral |
|------------|-----------|-------|--------|-------------|--------------|-------------|
| Rational   | Mean      | 16.57 | 92.38  | 23.92       | 46.90        | 52.37       |
|            | <i>SD</i> | 6.38  | 98.30  | 24.30       | 27.99        | 27.43       |
| Irrational | Mean      | 28.53 | 264.66 | 54.54       | 22.16        | 36.37       |
|            | <i>SD</i> | 10.29 | 150.63 | 22.76       | 15.87        | 26.24       |

SPSS, State Social Paranoia Scale (Freeman et al., 2007); PT-VAS, Paranoid Thoughts – Visual Analogue Scales; VAS, Visual Analogue Scale.

**Table 4.** Comparisons between groups

|  |  | Outcome      | <i>F</i> (1,72) | <i>p</i> | Partial $\eta^2$ |
|--|--|--------------|-----------------|----------|------------------|
| Controlling for irrationality and trait paranoia |  | SSPS         | 38.83           | <.001    | .35              |
|  |  | PT-VAS       | 36.72           | <.001    | .33              |
|  |  | VAS hostile  | 40.83           | <.001    | .36              |
|  |  | VAS friendly | 28.51           | <.001    | .28              |
|  |  | VAS neutral  | 7.97            | .006     | .10              |
| Applying the cut-offs                            |  | SSPS         | 25.78           | <.001    | .35              |
|  |  | PT-VAS       | 25.38           | <.001    | .36              |
|  |  | VAS hostile  | 26.81           | <.001    | .37              |
|  |  | VAS friendly | 9.41            | .004     | .17              |
|  |  | VAS neutral  | 3.95            | .053     | .08              |

SPSS, State Social Paranoia Scale (Freeman et al., 2007); PT-VAS, Paranoid Thoughts – Visual Analogue Scales; VAS, Visual Analogue Scale.

respond accordingly; see Davies, 2008). However, given that in the meta-analysis of Soflau and David (2016) no difference between the experimental (i.e. of which, the vast majority also used a role-play paradigm) and the correlational studies was found, this hypothesis is less plausible. Nevertheless, future studies are needed in order to develop and test alternative procedures for manipulating the irrationality of beliefs in a less demanding manner.

Moreover, given that in this study participants received all four types of IBs/RBs to suit the purpose of the current study, it is unclear which, if any, of the IBs (i.e. DEM, SD/OD, AWF, LFT) might play a more important role in generating paranoid thoughts. Future studies should address this research question. Some studies have already shown that negative beliefs about the self and others are linked to paranoia (Fowler et al., 2006; Smith et al., 2006). However, virtually no empirical data exist concerning the impact of each of the other three IBs (i.e. DEM, AWF, LFT) from the REBT model on paranoid thoughts.

Although no actual IBs/RBs have been induced due to ethical issues, the occurrence of some priming effects following the role-play procedure cannot be entirely excluded. Still, if such effects were to occur, these would be likely to manifest in the short-term only. Even though participants were not specifically informed about possible priming effects, they were thoroughly informed about the detrimental effects of IBs (i.e. on the emotional, behavioural and cognitive levels) at the end of the experiment. Moreover, participants from the IBs condition were presented with a list of the alternative RBs and it was explained to them how the RBs could lead to more functional outcomes.

If confirmed in future studies, the results of this paper could have both practical and theoretical implications. From a practical point of view, identifying IBs as an aetiological factor for paranoid ideation might stimulate the development of interventions for paranoia that specifically target IBs. This could be of importance, given that previous empirical findings (Mehl et al., 2015) suggest that the implementation of more targeted CBT interventions in psychosis might result in an increased efficacy. Moreover, as it has been previously argued (Bennett and Pearson, 2015), tackling IBs instead of directly targeting paranoid inferences might offer a number of advantages. First, the process of restructuring IBs may be less threatening for the therapeutic relationship than the direct challenge of the patient's interpretations (paranoid thoughts). Second, focusing on IBs might be particularly beneficial in cases where (some) inferences could be true. Next, as it is very plausible for patients with high levels of IBs to have faulty inferences in a wide range of situations, the process of disputing specific paranoid inferences might be more time consuming than restructuring the more general IBs, given that inferential change could be less stable.

From a theoretical point of view, these findings might open future lines of study, not exclusively limited to paranoia. For example, it would be useful to assess the relationship between people's level of irrationality of beliefs and the dysfunctionality of (non-paranoid) automatic thoughts in correlational studies that use stressful VR scenarios to activate IBs prior to evaluating automatic thoughts, given that previous correlational studies conducted in the absence of an activating event might have under-estimated the magnitude of this relationship (i.e. such studies might not properly activate IBs; see Ellis, 1994). Furthermore, future studies should experimentally assess possible bidirectional links between IBs and paranoid thoughts. Also, it might be necessary to explore the interplay between IBs and other cognitive biases that have been linked to psychosis (e.g. jumping to conclusions, attributional bias, bias against disconfirmatory evidence; see Buchy et al., 2007) in the aetiology of paranoia.

In summary, the present study is the first to experimentally investigate the impact of IBs on paranoid thoughts, in a non-clinical sample. Results show that the people holding IBs reported significantly higher levels of paranoid thinking and more negative perceptions of others than those holding RBs. Future studies are required to replicate these findings, in both non-clinical and clinical samples.

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*Ethical statements:* This study conformed to the ethical guidelines of Babes-Bolyai University's Institutional Review Board and of the APA's Ethical Principles of Psychologists and Code of Conduct. The present research was part of the first author's PhD Program and the Institution's regulation asserts that the ethical approval is automatically granted once the Scientific Coordinator consents upon the research procedure. As the Scientific Coordinator and the members of the doctoral program committee approved the procedure based on the Institution's ethical guideline, no reference number was assigned.

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## Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1017/S1352465818000565>

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