Mindfulness training and false perception in individuals with high unusual experiences

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Abstract

The present study explored the impact of mindfulness training on the relationship between false perceptions (hallucinations) and high levels of unusual experiences. 130 participants completed the O-LIFE(B) scale and a visual-detection task in which they had to identify fast-moving words in a visual display. Each participant completed a version of the visual-detection task twice, once after a 10min mindfulness induction session, and once after a 10min unfocused attention control session. Participants scoring high on the unusual experiences sub-scale of the O-LIFE reported seeing more words that were not there than those scoring low on this scale. However, this difference between high and low unusual experience scorers was not pronounced or statistically significant in the mindfulness condition. These data suggest that mindfulness can reduce the number of hallucination-like experiences in individuals with high levels of self-reported schizotypy.

Key words: mindfulness, schizotypy, unusual experiences, visual search

1. **Introduction**

Hallucinations are regarded as a severe psychopathology (Bentall, 1990; Waters et al., 2012), and can be defined as perceptual experiences that occur in the absence of any appropriate external perceptual stimuli (Slade & Bentall, 1988). Hallucinations can occur in any sensory modality, but are most often experienced in the auditory and visual modalities, and are associated with a range of disorders (Cella et al., 2008). Hallucinations are most often noted in individuals with schizophrenia (Bauer et al., 2011; Waters et al., 2012); 16-72% of schizophrenic patients reporting regular visual hallucinations, and 50-70% reporting regular auditory hallucinations (Bauer et al., 2011; Mueser et al., 1990). However, at leats one hallucinatory experiences has been noted by up to 70% of the nonclinical population (Barret & Etheridge, 1992; Pechey & Halligan, 2012; Posey & Losch, 1983; Slade & Bentall, 1988).

One theory of the etiology of false perceptions (hallucinations) is that they are associated with a cognitive bias, and hallucination-prone individuals tend to believe that a stimulus is present when it is absent because an information-processing bias causes them to attribute their own internally-generated experiences to external sources (Brebion et al., 1998; Garety et al., 2001). Evidence for a reality-monitoring deficit has been obtained in a number of studies. Heilbrun and Blum (1984) found that patients suffering from hallucinations tended to make incorrect and overconfident judgments regarding ambiguous words compared to non-hallucinating controls. Brebion et al. (1998) asked schizophrenic and control participants to recall words previously generated by themselves or the experimenter, and noted that schizophrenic individuals had a greater tendency to recall items that had not actually been present, and to believe that these items had been present. They also had a greater tendency to wrongly believe that the experimenter had generated items that they had actually generated themselves (see also Bentall et al., 1985; Young et al., 1987).

Individuals in the non-clinical population who score highly on schizotypal traits (Claridge & Brooks, 1984) also report high levels of hallucinations relative to those scoring low on this trait (Cella et al., 2007; Chapman et al., 1994; Tsakanikos & Reed 2005a, 2005b; Winkel et al., 2008). Schizotypal traits are taken to be normally distributed among the general population (Boyle, 1998; Claridge et al., 1984; Raine, 1991), and to have a multidimensional structure corresponding to the structure of schizophrenic symptoms involving both positive and negative symptom dimensions (Loughland & Williams, 1997), with factor analytic studies suggesting four main schizotypal domains (Bentall et al., 1989; Claridge & Brooks, 1984; Mason et al., 1995). Tsakanikos and Reed (2005a, 2005b) noted that individuals who scored highly on the unusual experiences scale of a schizotypy questionnaire also reported more false visual perceptions when detecting fast moving words (see also Bentall & Slade, 1985; Rankin & O'Carroll, 1995). Similar studies have demonstrated how this bias may be mediated by the ambiguity of the perceptual information, and by violations of expectancies of stimulus presentation (Cella et al., 2007; Reed et al., 2008).

In the last decade, research has investigated the effectiveness of mindfulness as part of a psychological intervention (Kabat-Zinn, 2003; Khong, 2001). Mindfulness can be described as: "an enhanced attention to and awareness of current experience or present reality" (Brown & Ryan, 2003). A wide range of literature supports the idea that mindfulness-based therapies can help in treatment for many psychiatric disorders, such as depression, eating disorders, anxiety, and borderline personality disorder (Baer, 2003; Mason & Hargreaves, 2001). There is some, albeit limited, evidence that mindfulness can be effective for psychosis, particularly where positive symptoms, such as hallucinations, are concerned (Abba et al., 2008; Bach & Hayes, 2002; Gaudino & Herbert, 2006; Khoury et al., 2013; Newman–Taylor et al., 2009). In a meta-analyses, Khoury et al. (2013) noted that

mindfulness-based interventions are moderately effective for psychosis. For example, Bach and Hayes (2002; Gaudino & Herbert, 2006) investigated whether Acceptance and Commitment Therapy (ACT) involving mindfulness would result in lower re-hospitalization rates for patients with a variety of diagnoses who reported hallucinations and delusions. Patients receiving ACT reported lower levels of believability and distress associated with their hallucinations, and the re-hospitalization rates of the control group were twice as high as the ACT group. The mechanisms whereby a mindfulness/ACT intervention could benefit those with psychotic experiences are, at present, unclear, but these could include mindfulness: increasing attention to environmental cues, and reducing the impact of automatic biases to external events by allowing better discrimination between internal and external cues; reducing levels of stress associated with psychosis-proneness; and reducing fatigue and anxiety, which may be critical in affecting information processing ability.

The present study aimed to extend the investigation of the impact of mindfulness on the experience of false perceptions to a nonclinical sample scoring differentially on a schizotypy scale. Erisman (2010) demonstrated that several emotional and affective difficulties displayed by high schizotypal individuals could be improved through a very brief single mindfulness session. These findings suggest that even a brief mindfulness intervention can alter the emotions and cognitions predisposed in schizotypal individuals, suggesting the cognitive biases associated with hallucinatory experiences in schizotypal individuals may also be susceptible to mindfulness interventions. Given this, the present study examined the impact of a brief mindfulness session (Arch & Craske, 2006; McHugh et al., 2010) on experimentally-detected false perceptual experiences (Tsakanikos & Reed, 2005a; 2005b), using non-clinical participants who were assessed for their level of schizotypy. It was hypothesized that positive schizotypal participants would report more non-existent words during the word detection task than lower-scoring individuals, and that this effect would be

most strongly observed for the unusual experiences scale of the O-LIFE. Moreover, it was predicted that a brief mindfulness induction session presented immediately before a word-detection task would reduce the number of non-existent words positive schizotypal subjects reported seeing during the task. It was thought that this effect may be especially pronounced among those scoring highly on the unusual experiences scale of the O-LIFE, which has previously been shown to be associated with the report of false experiences to a greater extent than the other scales (Tsakanikos & Reed, 2005a).

2. **Method**

2.1 **Participants**

140 participants (87 females and 53 males), aged 18–64 (M=22.82, SD=7.02), volunteered to take part in the study, and none received aby compensation for their participation. All participants were recruited from the general population through advertisements, all had normal or corrected-to-normal vision, and all were native English speakers. None of the participants reported any history of psychiatric disorder.

2.2 **Questionnaires**

2.2.1 **Oxford Liverpool Inventory of Feelings and Experiences - Brief Version** (OLIFE-B: Mason et al., 2005) is a 43 item scale consisting of four subscales (unusual experiences, cognitive disorganization, introverted anhedonia, and impulsive non-conformity) designed to measure schizotypy in the normal population. The scale has an internal reliability (Cronbach α) of between 0.72 and 0.89.

2.2.2 **Beck's Depression Inventory** (BDI; Beck et al., 1961) is a 21-item questionnaire that assesses the clinical symptoms of depression through asking about feelings over the past

week. The score is a sum of the positive answers, ranging from 0 to 63. The internal reliability (Cronbach α) is 0.93. This measure was used as a control, as depression has been noted to be associated with schizotypy and with hallucinations.

2.2.3 **Spielberger Trait Anxiety Inventory** (STAI-T; Spielberger, 1983) rates the affective, cognitive, and physiological manifestations of anxiety in terms of long-standing patterns (i.e., trait anxiety). Scores for each question range from 1 = never, to 4 = almost always), and the total score can range from 20 to 80. The internal reliability (Cronbach α) is 0.93. This measure was used as a control, as anxiety has been noted to be associated with schizotypy and with hallucinations.

2.3 **Attention Induction**

Participants were informed that they were to complete two separate 10min exercises – an unfocused attention induction and a focused attention induction (mindfulness induction), based on exercises used by McHugh et al. (2010; Arch & Craske, 2006). The participants received both sessions separated by a period of 2 hours. The instructions for the two exercises were initially read aloud to each participant once before they began each exercise. The instructions were read by a female investigator in person, and were repeated if the participant had any questions. The exercise was completed alone by the participant while sitting in a dimly lit small room.

2.3.1 **Mindfulness (Focused Attention) Induction**: The instructions for the mindfulness induction were: "*Focus your attention on your breathing. Notice the sensation of breathing air in. Notice the sensation of breathing air out. As you breathe air into your body, fill your mind with the thought 'just this one breath'. As you breathe air out of your body, fill your*

mind with the thought 'just this one exhale"". Whenever any other thoughts came into the participants' minds, they were instructed to try and push them aside, and continue to focus only on their breathing patterns.

2.3.2 **Unfocused Attention Induction:** The participant instructions for the unfocused attention exercise were: "*Let your mind wander freely amongst thoughts about past and present events. Start by allowing your mind to roam. Don't try to focus on your thoughts; just let them drift without hesitation. There is no need to focus on anything in particular. Allow yourself to think freely. Try not to focus on any one thing. Just let your mind wander.*"

2.4 **Word Detection Task**

The task consisted of a computer-based presentation (Super Lab), which presented a series of word-recognition trials. Each presentation (trial) comprised four, 5-letter strings, each string set in an oval shape, presented in the four corners of the screen. The 5-letter strings were either non-words, and or 5-letter words one standard deviation above or below average frequency, using a logarithmic combine measure of the English frequency vocabulary (Zeno et al., 1995). Each trial was presented for 500ms, with a 2s blank screen between each trial. Some of the letter strings on each trial corresponded to words, and some were non-words. The participants had to respond "*Yes*", if one of the oval shapes contained a word letter string. There were 48 such trials (24 containing a word and 24 containing no words, presented in a random order).

Prior to the experimental task, the participants received instructions presented on the screen: *"You will be shown a series of slides each with four discs containing 5 letters. On some slides these letters will make up a word on others no words will be present. Could you*

please state (saying "YES") if you saw a word for each of the slides. There will be a short gap between each slide".

Each participant was free to read the instructions for as long as they needed, and after reading proceed by pressing a keyboard button.

2.5 **Procedure**

Participants were tested individually in a small experimental room. They were initially asked to complete three questionnaires (O-LIFE, BDI, STAI). The participants were instructed that they would take part in a two 10min exercises, each followed immediately by a word detection task. The two sessions were 2 hours apart, and were presented in a counterbalanced order across participants. During the word detection task, the participant's responses were recorded by the experimenter on a recording sheet.

3. **Results**

Table 1 shows the means and inter-correlations between the subscales of the O-LIFE(B) schizotypy questionnaire, and the depression (BDI) and trait anxiety (STAI) scores.

Table 1 about here

Participants were divided into high and low UE, CD, IA and INC groups based on a mean split. This method has previously been used by Randell et al. (2009), and is employed in preference to regression partly due to sampling size, and also as it is thought to be more conservative (see Osborne et al., 2008), and because it was not known whether the impact of the subscales on false perceptions would have a linear or step function (Osborne et al., 2008).

The sample was split into high and low scoring groups for each of the subscales of the O-LIFE(B) according to a mean split. For the UE scale, the lower scoring group (*n*=81) had a mean UE score of .77 (± .78, range = 0–2), and the higher scoring group (*n*=59) had a mean UE score of 5.02 (± 2.57, range = 3–12). For the CD scale, the lower scoring group (*n*=78) had a mean CD score of 1.91 (± 1.27, range = 0–4), and the higher scoring group (*n*=62) had a mean CD score of 7.00 (± 1.66, range = 5–11). For the IA scale, the lower scoring group (*n*=83) had a mean IA score of .52 (± .50, range = 0–1), and the higher scoring group (*n*=57) had a mean IA score of 3.02 (± 1.29, range = 2–9). For the IN scale, the lower scoring group (*n*=63) had a mean IN score of 1.41 (± .73, range = 0–2), and the higher scoring group (*n*=77) had a mean IN score of 4.26 (± 1.61, range = 3–10).

Figure 1 about here

The mean number of false positive responses (reporting a word in the absence of a word) made by the two groups for each subscale in both the mindfulness and unfocused attention conditions are displayed in the top panel of Figure 1. Inspection of these data reveals that, for the UE subscale, higher scorers emitted more false positives than lower scorers in the control condition, but this difference was much less pronounced in the mindfulness condition. For the other subscales, these differences between high and low scorers were not great, although participants in the mindfulness condition emitted numerically fewer false positive responses than they did in the control (unfocused attention) condition.

A two-factor mixed-model analysis of covariance (ANCOVA) with group (lower versus higher) as a between-subject factor, and condition (mindfulness versus control) as a within-subject factor, and depression (BDI) and anxiety (STAI) as covariates to control for

the potential effects of these traits on false perceptions was conducted on these data from the UE groups. This analysis revealed a significant main effect of group, $F(1,136)=31.53, p<.001$, *partial eta*^{2}=.188, no main effect of condition, $F<1$, *partial eta* =.006, but a significant interaction between the two factors, $F(1,136)=7.30$, $p<.001$, *partial eta*^{2}=.051. Simple effect analyses conducted for group at each condition, revealed a significant difference between the groups in the control condition, $F(1,136)=4.54$, $p<.05$, *partial eta*^{2}=.032, but not in the mindfulness condition, $F(1,136)=1.19$, $p>.20$, *partial eta*^{2}=.009.

This ANCOVA conducted for the CD groups revealed a significant main effect of group, $F(1,136)=5.39$, $p<.05$, *partial eta*^{2}=.045, but no main effect of condition, $F<1$, *partial eta*^{2}=.003, or interaction, $F(1,136)=1.02$, $p>.30$, *partial eta*^{2}=.007. For the IA groups the ANCOVA revealed no significant main effects of group, $F<1$, *partial eta*^{2}=.001, or condition, $F<1$, *partial eta*^{2}=.001, and no interaction, $F<1$, *partial eta*^{2}=.001. The ANCOVA conducted for the IN groups revealed no significant main effects of group, $F(1,136)=1.56$, $p>.20$, *partial eta*^{2}=.011, or condition, $F<1$, *partial eta*^{2}=.001, and no significant interaction between the two factors, $F<1$, *partial eta*^{2}=.001.

The bottom panel of Figure 1 shows the number of correct words identified as a function of condition and sub-scale group. There was little difference between high and low scorers for any sub-scale, but participants tended to reported numerically more words correctly in the mindfulness than control condition. An ANCOVA (group x condition) with BDI and STAI as covariates was conducted for the UE groups revealed no significant main effects of group, $F(1,136)=2.91$, $p>.09$, *partial eta*^{2}=.021, or condition, $F<1$, *partial eta*^{2}=.003, or interaction, $F<1$, *partial eta*^{2}=.005. The ANCOVA for the CD groups revealed no significant main effect of group, $F(1,136)=1.27$, $p>.20$, *partial eta*^{2}=.009, no main effect of condition, $F < 1$, *partial eta*^{2} = .001, and no interaction, $F(1,136)=1.44$, $p>.20$, *partial*

eta^2=.010. For the IA groups, the ANCOVA revealed no significant main effects or interaction, all *F*s<1, all *partial eta*^{2}s=.001. Similarly, the ANCOVA conducted for the IN groups revealed no significant main effects or interaction, all *p*s>.20, all *partial eta*^{2}s<.012.

Table 2 about here

To further examine the relationship between schizotypy sub-scales and false perceptions, separate stepwise regressions were conducted on the control and mindfulness conditions. In both cases, depression (BDI) and anxiety (STAI) were added into the first step of the regression, and the four schiotypy subscales were then added into step 2. The left of Table 2 shows the results of step 2 of the model for the control condition, and reveals a significant regression, $F(6,133)=3.86$, $p<.001$, $R^2=.148$, with only the UE experiences sub-scale significantly predicting numbers of false perceptions. The right of Table 2 shows the results of step 2 of the model for the mindfulness condition, and reveals a significant regression, $F(6,133)=2.76$, $p<.05$, $R^2=.111$, with only the UE experiences sub-scale significantly predicted numbers of false perceptions for the control condition.

4. **Discussion**

The present study investigated the impact of mindfulness on false perceptions reported by individuals soring highly on various aspects of schizotypy. Participants scoring highly in unusual experiences reported more false perceptions than those scoring lower in unusual experiences, but there were no differences in the numbers of words correctly recognized. These data replicate previous findings (Cella et al., 2007; Reed et al, 2008; Tsakanikos, 2005a, 2005b) , and provide further support for the idea that hallucinations can be studied in non-clinical populations in laboratory settings (Feelgood & Rantzen, 1994).

Moreover, the data suggest that the impact of high unusual experiences on false perceptions was reduced after a brief mindfulness induction session (Bach & Hayes, 2002; Erisman, 2012; Gaudino & Herbert, 2006), but not after an unfocused attention induction (see Asch & Clark, 2008).

That the effect relating to false perceptions was limited to the unusual experiences sub-scale of the O-LIFE is in line with previous findings (Tsakanikos & Reed, 2005a; 2005b). One explanation of hallucinations suggests that they occur due to deficits in metacognitive skills such as reality monitoring (Bentall, 1990; Bentall & Slade, 1985), which have been found to be affected in those with high unusual experience scores (Tsakanikos & Reed, 2005a). The three other schizotypal domains measured using the O-LIFE did not impact on false perceptions. However, it might be noted that cognitive disorganization approached statistical significance, potentially suggesting that levels of cognitive disorganization may have an effect on the occurrence of false perceptual experiences. However, the four schizotypal domains measured by the O-LIFE are not orthogonal (Mason et al., 1995), and when the independent impact of cognitive disorganization was studied in the absence of its association with unusual experiences, its relationship to false perceptions was not significant.

The present study noted that brief mindfulness training reduced the number of false perceptions (and also numerically increased the number of correct words identified) relative to an unfocused attention control, especially for high unusual experience scorers. This finding adds to the literature suggesting that the level and impact of hallucinations can be reduced through such approaches. For example, previous studies have noted that mindfulness training reduces the believability of hallucinatory experiences (Bach & Hayes, 2002; Chadwick et al, 2007; Gaudino & Herbert, 2006). Of note was that a relatively brief mindfulness session (10min) reduced the number of false perceptions. This finding provides

support for previous research suggesting that even a brief, single session of mindfulness practice is enough to provide some of the benefits that have been found to occur from participation in much lengthier, multiple sessions of mindfulness practice (Arch et al., 2006; Erisman, 2010; McHugh et al., 2010). This is encouraging considering that many mindfulness-based treatment approaches (e.g. mindfulness-based stress reduction, mindfulness-based cognitive therapy, dialectical behavior therapy, and ACT), are considerably more time consuming and costly. The finding that even brief sessions of mindfulness impact on phenomenon akin to hallucinations in an analogue study is also encouraging given the evidence that long periods of meditation can provoke psychotic experiences in schizophrenic individuals (Garcio-Trujillo, 1992; Walsh & Roche, 1979).

There are a number of possible mechanisms underlying the impact of mindfulness on false perceptual experiences. It could have been that mindfulness-induced increased awareness of environmental stimuli enabled positive schizotypal subjects to be less susceptible to their automatic biases responsible for the attribution of internal experiences to external events. As mindfulness is believed to increase sustained attention and awareness of present events and experiences (Brown and Ryan, 2003), producing greater awareness of sensations may allow better discrimination between internal and external cues (Baumeister et al., 1994). For longer mindfulness programs, levels of stress may be reduced (Neff, 2003; Shapiro et al., 2005), which is significant in that chronic stress is associated with a transition of psychosis-proneness to fully-fledged psychosis (Winkel et al., 2008). Finally, mindfulness may reduce fatigue and anxiety, which may be critical in affecting information processing ability (Zeidan et al., 2010). Although such a nonspecific effect might also have been expected in the uncontrolled-attention induction (McHugh et al., 2010). However, the exact mechanism by which mindfulness is able to reduce hallucinatory experiences needs to be further explored through future research.

The finding that mindfulness impacted differentially on positive schizotypal subjects may relate to findings that schizotypy is significantly negatively correlated with trait mindfulness (Erisman, 2010). It could be that there is an underlying mediating relationship between levels of mindfulness and the occurrence of hallucinatory experiences; low levels of mindfulness could be a general feature of positive schizotypy, which would explain the disassociated states of mind that result in discontinuities of conscious awareness leading to the occurrence of hallucinations. Lower levels of trait mindfulness in positive schizotypal individuals would explain why the effect of a brief focusing exercise was greater on false perceptions reported by subjects scoring high in unusual experiences.

There are a number of limitations of this research that need to be acknowledged. Clearly, more research is needed before mindfulness training can be deemed a successful intervention outside the experimental laboratory. It is also not known how long the effect of a brief mindfulness induction lasts. Given this, it would be informative for future research to replicate the present study, using a delayed word-detection task following mindfulness induction. It might also be noted that there was some similarity between the present 'unfocused attention' condition and open-monitoring meditation. Such similarities highlight the difficulty in precisely defining mindfulness interventions, and sometimes the interventions overlap. Previous studies, such as Arch and Craske (2006), have included additional controls that might help to detangle the mechanisms of mindfulness. It would also be interesting to see how mindfulness interacts with factors that have been found to increase the number of false perceptual experiences in positive schizotypal individuals, such as greater speed of stimulus presentation and violations of expectancies regarding stimulus presentation (Reed et al., 2008).

Despite these limitations, the present study should be viewed as a basis for much needed future research, as it has demonstrated novel findings regarding mindfulness as a

potential intervention for hallucinatory experiences in normal individuals with positive schizotypal traits, which no known previous research to date has investigated.

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Table 1: Means (standard deviations) for the O-LIFE(B) subscales – UE = unusual experiences, CD = cognitive disorganization; IA = introverted anhedonia; IN = impulsive nonconformity; BDI = Beck's Depression Inventory; Speilberger State-Trait Anxiety Inventory (trait), as well as the Pearson correlations between the variables.

			CD	IA	IN	BDI	STAI
UE	2.55	(2.75)	.430***	.281***	.617***	.500***	.409***
CD	4.16	(2.92)		.318***	.460***	.361***	.477***
IA	1.54	(1.53)			.242**	.358***	.237**
IN	2.98	(1.92)				.416***	.377***
BDI	7.13	(8.51)					.773***
STAI	37.94	(11.49)					

Table 2: Results from stepwise regressions prediction false perceptions from the four subscales of the O-LIFE(B) = UE = unusual experiences, CD = cognitive disorganization; IA = introverted anhedonia; IN = impulsive nonconformity – and depression (BDI) and anxiety (STAI), in the control and mindfulness conditions.

Control	Beta	t	p	Mindfulness	Beta	t	p
UE	.356	3.77	.001	UE	.192	3.00	.003
CD	.110	1.34	.184	CD	.112	2.02	.055
IA	.041	0.30	.765	IA	-.009	0.09	.927
IN	-.107	0.82	.416	IN	-.148	1.66	.098
BDI	-.036	0.92	.152	BDI	-.001	0.05	.964
STAI	-.009	0.34	.745	STAI	-.018	0.95	.345

Figure 1. Mean numbers of words falsely (top panel) and correctly (bottom) panel identified by lower and higher scorers for UE = unusual experiences, CD = cognitive disorganization; IA = introverted anhedonia; IN = impulsive nonconformity in the mindfulness and control (unfocused attention) conditions).