



## Shorter communication

## Rumination, reflection, intrusive thoughts, and hallucination-proneness: Towards a new model

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## ABSTRACT

Although rumination has been proposed to play an important role in the creation of hallucinations, direct empirical tests of this proposal have not yet been performed. Employing a distinction between ruminative and reflective self-consciousness, we set out to test a new model of the relations among rumination, reflection, intrusive thoughts, thought suppression, social anxiety, and hallucination-proneness. This model proposed that rumination would be related to hallucination-proneness through the mediating variable of intrusive thoughts, but that reflection would not be related to hallucination-proneness. The model was tested in a student population ( $N = 296$ ) using path analyses. A modified version of the model was found to be a good fit to the data, once a direct path from reflection to hallucination-proneness had been added. As hypothesized, rumination was related to hallucination-proneness only indirectly, through the mediating variable of intrusive thoughts. Implications for interventions and future directions for research are considered.

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## Introduction

The cognitive mechanisms underlying auditory verbal hallucinations (AVHs) are still not well understood. Many contemporary accounts of AVHs propose that such experiences have their roots in the voice-hearer's own inner speech (e.g., Leudar, Thomas, McNally, & Glinski, 1997). One problem for such theories arises from the observation that, in both clinical and non-clinical samples, AVHs are typically perceived as the voice of another person (Nayani & David, 1996). One approach to this problem is to ask why voice-hearers would be generating other people's voices in their inner speech (Jones & Fernyhough, 2007). We have previously argued, employing a Vygotskian approach, that inner speech should naturally take a dialogic form, i.e., be in the form of a dialogue rather than a first person monologue (Jones & Fernyhough, 2006a, 2007). If dialogic inner speech is the norm, then it raises the question of what factors may be relevant to the experiencing of such internalized voices as AVHs (Fernyhough, 2004).

Fowler et al. (2006) have proposed that inner speech may be experienced as alien if it involves the recreation of a voice associated with a stressful event in one's past. Based on observations that early trauma, such as sexual and physical abuse, often precede

onset of AVHs (e.g., Read, van Os, Morrison, & Ross, 2005), they suggest that *rumination* or inner dialogues about interactions with the people in these situations could form the raw material of some AVHs. For example, "rumination or inner dialogue about self in relationship to what a shaming and insulting abuser might say about one's current actions" (Fowler et al., 2006, p. 113) may explain why AVHs commonly take the form of commentaries on present actions. This proposal is also in line with the finding that a significant number of AVHs have similar themes and content to earlier abuse experiences (Hardy et al., 2005).

Although the relation between rumination and hallucinations has not yet been studied, the relation between hallucinations and a construct related to rumination, the metacognitive trait of cognitive self-consciousness, defined by Cartwright-Hatton and Wells (1997) as "the tendency to focus attention on thought processes" (p. 387), has been examined. For example, Baker and Morrison (1998) found that levels of cognitive self-consciousness were higher in patients with schizophrenia with auditory hallucinations than in patients with schizophrenia with delusions but no auditory hallucinations.

Rumination may also be related to hallucinations in other modalities, such as the visual. Allen, Coyne, and Console's (1997) argument that stressful or traumatic events may leave individuals "vulnerable to... [their] inner world" (p. 332) allows for an inner experience consisting of reconstructed visual images as well as auditory experiences. Indeed, indirect evidence suggests that rumination will be associated with hallucinations in general, rather

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than specifically with hallucinations of the auditory verbal type. For example, cognitive self-consciousness has been found to be positively related to a general measure of hallucination-proneness, the Launay–Slade Hallucination Scale (Launay & Slade, 1981), in student populations (Morrison, Wells, & Northard, 2000; Sterling, Barkus, & Lewis, 2007). This led Sterling et al. (2007) to conclude that hallucinations are related to a “relatively stable trait-like form of ‘ruminative thinking’” (p. 1407).

Nevertheless, as the studies discussed above utilized a general measure of cognitive self-consciousness rather than dedicated measures of rumination, there is as yet no evidence for a specific relation between rumination and hallucinatory experiences. Trapnell and Campbell (1999) have argued that self-consciousness of one’s thoughts should be divided into two distinct forms, based on the individual’s motivation. They note that one reason why individuals may pay attention to their thoughts is because they are “motivated by curiosity or epistemic interest in the self” (p. 297). This form of self-consciousness is termed reflection, and is proposed to be associated with adaptive self-knowledge and generally positive effects. In contrast, individuals may also focus on their own thoughts for reasons of negative affect and anxiety. Trapnell and Campbell term this rumination, or “self-attentiveness motivated by perceived threats, losses, or injustices to the self” (p. 297).

Given Fowler et al.’s (2006) contention that it is recreating imagined interactions with significant individuals associated with negative affect or anxiety that form the raw material of some hallucinations, rumination as conceptualized by Trapnell and Campbell (1999) would appear to be likely to relate strongly to hallucinations. The first aim of the present study was hence to investigate the relations among rumination, reflection and hallucination-proneness. We hypothesized that rumination, but not reflection, would be related to hallucination-proneness.

We proposed that this relation would occur because of rumination’s tendency to cause cognitive intrusions. Cognitive intrusions have been linked to hallucinations in both clinical and non-clinical populations. Morrison, Haddock, and Tarrier (1995) proposed that intrusive thoughts may form the raw material for auditory hallucinations, with intrusive imagery being the raw material of visual hallucinations. This has received support from studies showing that patients with schizophrenia with auditory hallucinations report more cognitive intrusions than psychiatric and healthy controls (Morrison & Baker, 2000). In a student population Jones and Fernyhough (2006b) have also found a relation between intrusive thoughts and hallucination-proneness. As rumination has been found to increase both the number and intensity of cognitive intrusions (e.g., Guastella & Moulds, 2007), we proposed that rumination would relate to hallucination-proneness through its tendency to promote cognitive intrusions. As there is no evidence that the other element of self-consciousness identified by Trapnell and Campbell (1999), reflection, is related to intrusions, we predicted no relation between and hallucination-proneness.

We were also interested in examining other variables potentially related to rumination, cognitive intrusions and hallucinations. Thought suppression, “the intentional conscious removal of a thought from subsequent conscious attention” (Wegner, 1992, p. 194), is known to encourage both intrusive thoughts and rumination. Attempting thought suppression has been found to cause suppressed thoughts to intrude into consciousness in an unexpected manner (Wegner, 1992). Furthermore, like rumination, thought suppression has been found to increase the intensity of intrusive memories (Yoshizumi & Murase, 2007). Indeed, there is evidence that thought suppression may be related to hallucinations due to its tendency to encourage intrusive thoughts (Jones & Fernyhough, 2006b). Rumination is also associated with greater levels

of thought suppression (Erskine, Kvavilashvili, & Kornbrot, 2007). Thus, we proposed that rumination may be linked to hallucination-proneness through its direct and indirect (via thought suppression) encouragement of cognitive intrusions.

The final factor of interest was social anxiety. Trapnell and Campbell (1999) proposed that rumination, but not reflection, should be related to anxiety. In support of this proposal, social anxiety has been found to be associated with higher levels of ruminative thought (Kocovski & Rector, 2007). Individuals with high levels of social anxiety have also been shown to attempt more thought suppression (Magee & Zinbarg, 2007), and to do so less successfully, experiencing more intrusions and unwanted thoughts than controls (Fehm & Margraf, 2002; Magee & Zinbarg, 2007). This led us to propose that social anxiety may relate to hallucinations through its tendency to promote cognitive intrusions via the mediating variables of rumination and thought suppression.

In summary, the findings and arguments set out above led us to propose a model of relations between hallucination-proneness, rumination, reflection, intrusive thoughts, thought suppression, and social anxiety, as shown in Fig. 1. The key points of this model are as follows. Rumination is understood as having an indirect effect on hallucination-proneness through acting as the generative force behind the thoughts that intrude into consciousness. Reflection does not relate to hallucination-proneness in the model, either directly or indirectly.

It is now well established both that hallucinations exist on a continuum with normal experiences, and stretch into the general population (Johns & van Os, 2001). It has also been argued that the mechanisms underlying sub-clinical (i.e., experienced by non-patients in the general populous) and clinical hallucinations may be the same. For example, based on the finding that risk factors for hallucinations are the same for those with sub-clinical and clinical hallucinations, Aleman and Larøi (2008) have argued for “a developmental mechanism in non-clinical participants that is similar to the one reported in schizophrenia” (p. 82). We hence proposed to perform an initial test of this model, using path analyses, in an analogue study using data obtained from a sample drawn from a student population.

## Method

### Participants

Undergraduate and postgraduate students ( $N = 296$ , 198 women) at a UK university, with a mean age of 21.3 years ( $SD = 2.83$ , range = 18–29), completed on-line questionnaires. Participants were recruited through e-mail invitation and there was no financial incentive to participate; the likelihood of repeated participation was thus considered negligible. Response rates were approximately 20%, and comparable to previous studies employing on-line questionnaires of similar length (e.g., Kaplowitz, Hadlock, & Levine, 2004). Answers were given anonymously, with only the age and gender of the participants being recorded. Thought suppression and hallucination-proneness data reported here overlaps with that reported in Jones, Fernyhough, and Meads (2009).

### Measures

*White Bear Suppression Inventory* (WBSI; Wegner & Zanakos, 1994) is a 15-item self-report measure of tendency to suppress thoughts. Each item is scored on a five-point Likert scale ranging from “strongly agree” (5) to “strongly disagree” (1). Higher scores indicate a greater tendency to suppress thoughts. Muris, Merckelbach, and Horstelenberg (1996) have argued that the WBSI taps intrusive thoughts as well as thought suppression, and devised a “corrected WBSI” (p. 505) which removed all items relating to intrusion (items 2, 3, 4, 5, and 9).

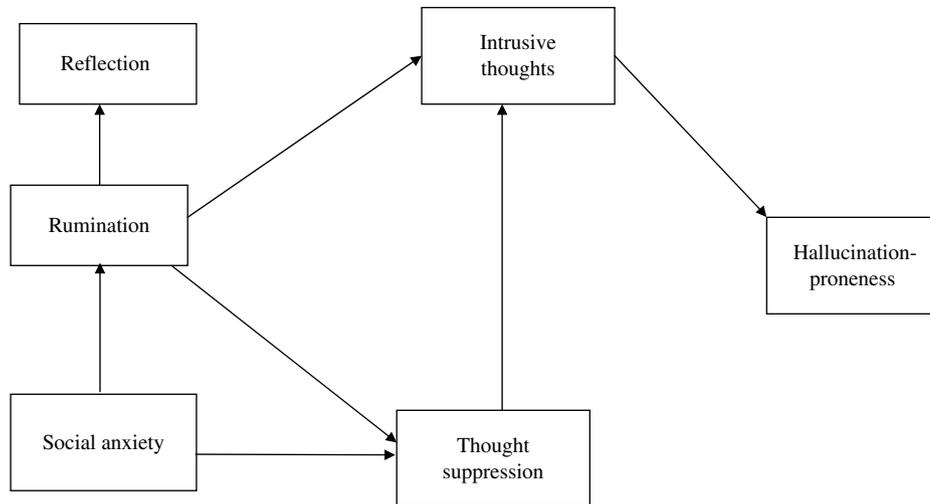


Fig. 1. Model of hallucinations to be tested.

The resultant scale, which we term  $WBSI_{sup}$ , was found to have satisfactory internal reliability and test–retest reliability, and was used in the present study as a measure of self-reported thought suppression. Following Muris et al. (1996), numerous factor analyses have confirmed that the full version of the WBSI measures both thought suppression and intrusive thoughts (e.g., Rassin, 2003) and all such studies have found the core items Muris et al. (1996) identified as the ‘intrusion items’ on the WBSI (items 2, 3, 4, 5 and 9) to load onto this factor. Thus, we used items 2, 3, 4, 5, and 9 of the WBSI as a separate measure of self-reported intrusiveness of unwanted thoughts ( $WBSI_{intru}$ ).

**Hallucination-proneness.** This was assessed using the revised Launay–Slade Hallucination Scale (LSHS-R; Bentall & Slade, 1985), a 12-item instrument designed to measure predisposition to hallucination-like experiences. Items are scored on a five-point Likert scale ranging from “certainly does not apply to me” (0) to “certainly applies to me” (4). Examples of items include “In the past, I have often had the experience of hearing a person’s voice and then found that no-one was there”, and “I have been troubled by hearing voices in my head”. This scale also contains one item directly related to unwanted intrusive thoughts (“No matter how hard I try to concentrate, unrelated thoughts always creep into my mind”). We hence removed this item from the scale in order to avoid inflating the correlation between the LSHS-R and our measure of intrusive thoughts ( $WBSI_{intru}$ ). The resulting 11-item scale had a total score that could range from 0 to 44. Higher scores indicate a greater predisposition to hallucination-like experiences.

**Rumination and Reflection.** This was assessed using the Rumination and Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999), a 24-item self-report measure of individuals’ dispositions to engage in ruminative and reflective private self-consciousness. The scale is scored as two separate 12-item ruminative and reflective subscales, derived by factor analysis. Examples of ruminative and reflective items include “I always seem to be ‘re-hashing’ in my mind recent things I’ve said or done” and “I’m very self-inquisitive by nature” respectively. Items are scored on a 5-point Likert scale ranging from “strongly agree” (5) to “strongly disagree” (1). Total scores on each subscale are divided by twelve to give a mean item score, hence subscale scores may range from 1 to 5. This instrument has been shown to have good psychometric properties (Trapnell & Campbell, 1999).

**Social Anxiety.** This was assessed by the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), a 24-item self-report measure in

which participants first rate the amount of fear a social situation causes them. This is scored on a four-point Likert scale ranging from “none” (0) to “severe” (3). Participants then rate how much they avoid such situations, and respond on a 4-point Likert scale ranging from “never” (0) to “usually” (3). An overall total score is often calculated by summing the total fear and total avoidance scores. The LSAS has been shown to be a valid and reliable tool (Baker, Heinrichs, Kim, & Hofmann, 2002).

## Results

Descriptive statistics are presented in Table 1. Rumination and reflection scores on the RRQ were in line with those found by Trapnell and Campbell (1999) in the general population.  $WBSI_{sup}$  and  $WBSI_{intru}$  scores were in line with previous studies assessing these variables in student populations (e.g., Jones & Fernyhough, 2006b). Scores on our 11-item version of the LSHS-R were in line with pro-rated scores of students taken from previously published data on the 12-item version of this scale (e.g., Waters, Badcock, & Maybery, 2003). Cronbach’s alphas on all scales employed were satisfactory. Partial correlations (controlling for age and gender) between the variables are presented in Table 2. Due to the number of correlations performed (15), a Bonferroni correction was employed and significance set at  $\alpha = 0.05/15 = 0.003$ .

The model shown in Fig. 1 was subjected to path analysis using AMOS 6.0. The sample size was deemed appropriate for reliable performance of such analysis as it met the criterion of  $N > 200$  proposed by Barrett (2007). Due to data non-normality, analysis

Table 1  
Descriptive statistics for variables under investigation ( $N = 296$ ).

	Mean (SD, range)	Cronbach’s alpha
LSHS-R	15.11 (8.77, 0–38)	0.84
Rumination	3.85 (0.70, 1.17–5.00)	0.91
Reflection	3.33 (0.77, 1.25–5.00)	0.85
$WBSI_{intru}$	18.34 (4.12, 6–25)	0.80
$WBSI_{sup}$	34.29 (8.42, 10–50)	0.87
SocAnx	45.64 (27.61, 2–144)	0.94

Note. LSHS-R = Revised Launay–Slade Hallucination Scale,  $WBSI_{intru}$  = Intrusive thoughts subscale of the White Bear Suppression Inventory,  $WBSI_{sup}$  = Thought suppression subscale of the White Bear Suppression Inventory, SocAnx = Liebowitz Social Anxiety Scale.

**Table 2**  
Partial correlations between variables (controlling for age and gender).

	LSHS-R	Rumination	Reflection	WBSI <sub>intru</sub>	WBSI <sub>sup</sub>	SocAnx
LSHS-R	1	0.39*	0.30*	0.46*	0.31*	0.19*
Rumination	–	1	0.24*	0.57*	0.42*	0.33*
Reflection	–	–	1	0.15	0.04	0.05
WBSI <sub>intru</sub>	–	–	–	1	0.64*	0.27*
WBSI <sub>sup</sub>	–	–	–	–	1	0.32*
SocAnx	–	–	–	–	–	1

\* $p < 0.003$ .

was performed using Bentler and Yuan's (1999)  $T_F$  statistic, which has been shown to be reliable with non-normal data (Bentler & Yuan's, 1999). The model in Fig. 1 was found to differ significantly to the data,  $T_F(8, 288) = 3.39$ ,  $p < 0.01$ ,  $GFI = 0.97$ ,  $AGFI = 0.92$ ,  $CFI = 0.96$ ,  $RMSEA = 0.09$ . Modification indices indicated that the model fit could only be significantly improved by addition of a direct path from Reflection to LSHS-R. This model was found to be an excellent fit to the data,  $T_F(7, 289) = 1.48$ , n.s.,  $GFI = 0.99$ ,  $AGFI = 0.97$ ,  $CFI = 0.99$ ,  $RMSEA = 0.04$ . Standardized estimates of the strength of the relations between the variables for this revised model are shown in Fig. 2.

Modification indices indicated that adding further additional paths between variables (such as a direct path between Rumination and LSHS-R) would not improve the fit of the model.

## Discussion

The present study aimed to provide a test of the model of hallucination-proneness set out in Fig. 1. Path analyses indicated that the model was a poor fit to the data. After examination of modification indices, our original model was revised to include a direct path from reflection to hallucination-proneness. This amended model (Fig. 2) was found to be an excellent fit.

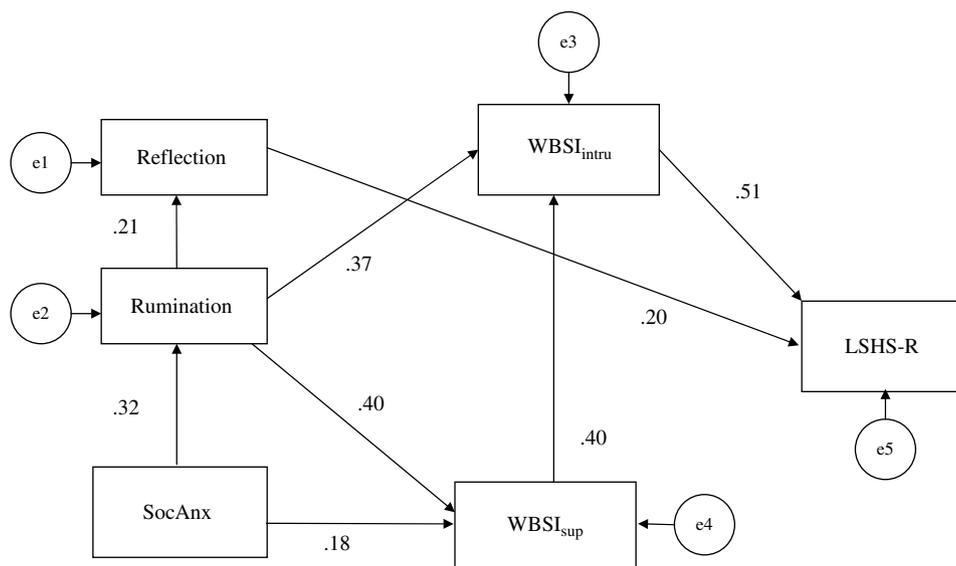
A number of features of this model are worthy of discussion. Firstly, although correlation analyses indicated a strong relation between rumination and hallucination-proneness, the path analysis, as predicted, demonstrated that this relation was not direct, but rather mediated by intrusive thoughts. Furthermore, as predicted, rumination was found to be associated with

intrusive thoughts directly, as well as indirectly through the mediating variable of thought suppression. This is consistent with a model of hallucination-proneness that sees intrusive thoughts playing a key role, with levels of intrusive thoughts being influenced by ruminative and thought suppression processes.

As noted above, reflection was found, contrary to our prediction, to be directly related to levels of hallucination-proneness. It is possible that this relation may have obtained due to the increased tendency of reflective individuals to notice their thoughts, and hence to notice dissonance between their metacognitive beliefs and the actual occurrence of thoughts. Morrison et al. (1995) have proposed that such dissonance may result in individuals making attributions of such thoughts to another, resulting in hallucination formation. Finally, in line with previous research, social anxiety was found to relate to rumination and thought suppression, but these relations, although statistically significant, were weak. This suggests that, although social anxiety may influence rumination and suppression, it may not be a key causal factor in the creation of hallucinations.

One possible objection to the argument that intrusive thoughts are the raw material of hallucinations is that those with hallucinations should report fewer, rather than more, intrusive thoughts, as any such intrusions would be experienced as hallucinations. It is not clear, however, that all intrusive thoughts will automatically be experienced in this way. For example, in the case of AVHs, the factors affecting whether a verbal intrusion is experienced as a hallucination include individual differences in source monitoring abilities (Bentall, 1990). It has been proposed that source monitoring deficits may be particularly associated with verbal imagery of non-self speakers rather than one's ordinary inner speech (Hoffman, Varanko, Gilmore, & Mishara, 2008). Based on a review of neuroimaging studies in this area, we too have advocated the position that the raw material for AVHs is inner speech involving non-self speakers (Jones & Fernyhough, 2007).

A number of limitations of our study must be acknowledged. Firstly, it is not able to establish the direction of causation among the variables under investigation. It is possible that a more complicated pattern of relations could exist. For example, rumination and thought suppression could be seen as



**Fig. 2.** Standardized estimates of path strengths. Note.  $p < 0.001$  for all standardized co-efficients.

maladaptive strategies to cope with intrusive thoughts (rather than agents acting in the genesis of them) that work in a feedback circuit to amplify the effects of cognitive intrusions (Ehlers & Steil, 1995).

Secondly, given that the LSHS-R is heavily weighted towards AVHs, and that the theoretical and empirical arguments for a relation between the variables discussed here are strongest for AVHs, it may be that our model is more appropriate for AVHs than visual hallucinations. Future studies may wish to examine whether this model holds equally well for AVHs and visual hallucinations. Thirdly, the present study lacked a sufficient sample size (Barrett, 2007) to examine whether the model held equally for males and females. It is hoped that future studies with larger samples may address this issue. Fourthly, metacognitive beliefs not examined here, such as beliefs about the uncontrollability and danger of thoughts, are also related to hallucination-proneness (Jones & Fernyhough, 2006b; Morrison et al., 1995). Future work may wish to investigate the relations of such factors to the present variables. A fifth limitation was the self-report nature of the study, which future research might overcome through the employment of behavioural measures. For example, cognitive intrusions or the tendency to ruminate could be assessed by experience sampling techniques such as have been used effectively in research into delusions (Thewissen, Bentall, Lecomte, van Os, & Myin-Germeys, 2008). Finally, another limitation of the present study was its failure to control for levels of depression in participants, which is associated with rumination (Spasojevic & Alloy, 2001).

Looking forward, it is worth considering how our model may be extended to account for a) the causes of ruminative and reflective thinking, b) the factors causing intrusions to be experienced as not authored by the self, and c) whether it is likely to be applicable to hallucinations in populations such as patients with schizophrenia. Firstly, in terms of accounting for the causes of ruminative thinking, traumatic stress may play a key role in generating such ruminative thinking (Gold & Wegner, 1995). Secondly, our model needs extending to include other factors such as individuals' appraisals of, and responses to, cognitive intrusions (Morrison, Frame, & Larkin, 2003), as well as other factors that may be involved in causing self-generated cognitions to feel non-self generated. These may include disrupted source monitoring abilities (Bentall, 1990), and corollary discharge mechanisms (Jones & Fernyhough, 2006a). Such factors are termed 'Disrupted agency mechanisms' in our extended

hypothesized model, presented in Fig. 3. As we have suggested our model may be most appropriate to AVHs, we have focused on these experiences in this model.

In terms of the applicability of this model to clinically relevant AVHs, such as in patients with schizophrenia, a number of arguments suggest that this model may be valid, although this must ultimately be tested by future research. Firstly, as we noted in **Introduction**, common mechanisms may indeed underlie hallucination-proneness and clinical hallucinations. For example, abuse and trauma have been found to be associated with hallucinations (especially AVHs) in both clinical (Read et al., 2005) and non-clinical (Morrison & Petersen, 2003) populations. Similarly, it has been argued that it is the content and distress associated with clinical AVHs, such as the distressing abusive content found particularly in clinical populations (Nayani & David, 1996), and not their form or pragmatics, that separates AVHs in psychiatric and non-psychiatric populations. We would hence call for this model to be tested, in both clinical and non-clinical samples, by replicating the present study whilst also taking appropriate measures of exposure to trauma and stressful events. Such studies may also wish to use more detailed measures of the tendency to experience intrusive thoughts, such as the Intrusive Thoughts Questionnaire (Reynolds & Salkovskis, 1992). Similarly, when assessing the tendency to ruminate, existing measures could be adapted to assess the extent to which imagined responses from other individuals are created in inner speech or produced in visual imagery.

Finally, if the model can be validated in future studies, it may inform interventions with those distressed by hallucinatory experiences, or those at high risk for such experiences. Firstly, strategies that can help reduce the frequency of cognitive intrusions may be beneficial. One such strategy may be for individuals to be encouraged to openly express stressful or traumatic experiences. As Sparrow and Wegner (2006) have found that intrusive thoughts may be deactivated by merely expressing them, such a strategy may profitably impact upon the frequency of hallucinations. Furthermore, interventions that attempt to directly reduce rumination on and around traumatic events may also be likely to prove beneficial. For example, self-affirmation has been found to be successful at reducing rumination on negative events (Koole, Smeets, Van Knippenberg, & Dijksterhuis, 1999). That said, more work requires to be performed to validate the model presented here, before clear recommendations on cognitive-behavioural interventions can be made.

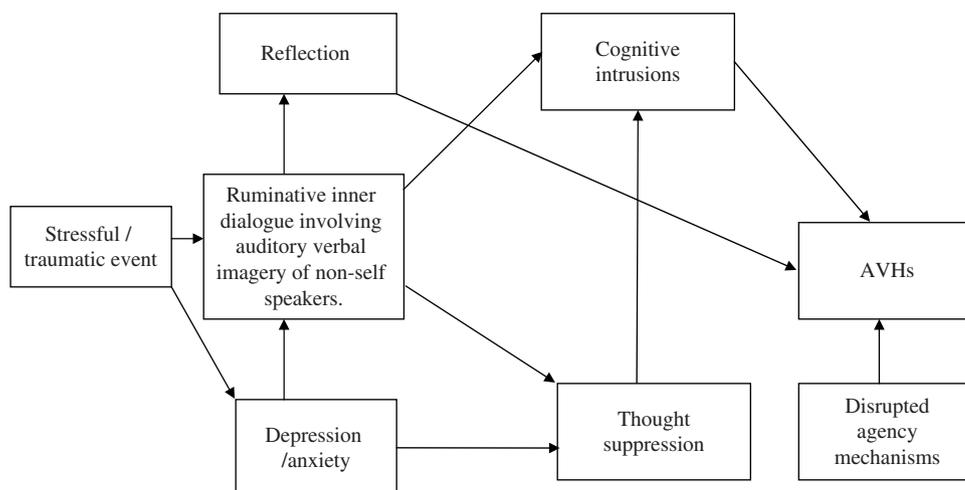


Fig. 3. Extended proposed model of cognitive mechanisms behind hallucinations.

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