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Cognitive, metacognitive and dissociative factors underlying psychotic hallucinations and nonclinical hallucination-proneness

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Cognitive, metacognitive and dissociative factors underlying psychotic hallucinations and nonclinical hallucination-proneness

by

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ABSTRACT

Research in clinical and nonclinical samples has linked hallucination-proneness to dissociative tendencies (possibly reflecting a consequence of traumatic experiences), maladaptive metacognitive beliefs, and a perturbed capacity to discriminate between internal and external cognitive events (i.e. reality discrimination). The studies included in this doctoral dissertation used a number of research methods (experimental, questionnaire, meta-analytic and experience sampling methodologies) to expand this research and resolve a number of methodological limitations of previous studies in this area. Part of this dissertation examined the specificity of the associations between hallucinations, dissociation, metacognitive beliefs and perturbed reality discrimination when controlling for the confounding effect of symptom dimensions that frequently covary with hallucination-proneness (e.g. paranoid ideation). In addition, this PhD thesis aimed to examine the alleged mediational role of dissociation in the relationship between childhood trauma and hallucinations, and to investigate the interplay between dissociation and the cognitive mechanisms believed to underlie hallucinatory experiences.

The findings of the current studies suggest that hallucination-proneness is specifically related to reality discrimination abnormalities and dissociative tendencies, but not to maladaptive metacognitive beliefs when the impact of comorbid symptoms is taken into account. In addition, the present findings support recent accounts in suggesting that the apparent association between childhood trauma and hallucinatory experiences may be explained in terms of dissociative processes. These finding have implications for the continued investigation of the psychological underpinnings of hallucinatory experiences, and may inform the development and implementation of specific psychological interventions for the treatment of auditory hallucinations.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1:

Introduction

1.1 Hallucinations in psychiatric and non-psychiatric populations

Hallucinations have been defined as percept-like experiences which occur in absence of appropriate stimuli, have the full force of the corresponding actual (real) perceptions, and which are usually unamenable to direct and voluntary control (Slade & Bentall, 1988). Although hallucinatory experiences can occur in any sensory modality, auditory hallucinations remain the most extensively investigated hallucinatory phenomena in psychiatric research. Since their inclusions among the Schneiderian first-rank symptoms (Schneider, 1959), hallucinations have often been regarded by mainstream psychiatry as pathognomonic for schizophrenia. Consistent with this view, numerous studies have shown that hallucinations are experienced by a large proportion of patients with diagnoses in the schizophrenia-spectrum (e.g. Baethge, et al., 2005; Sartorious, Jablensky, & Korten, 1986; Tarrier, et al., 2004). However, hallucinatory experiences are also reported by patients with other psychiatric diagnoses, including bipolar disorder (Baethge, et al., 2005; Goodwin & Jamison, 1990; Hammersley, et al., 2003), unipolar depression (e.g. Baethge, et al., 2005; Coryell, 1996; Lattuada, Serretti, Cusin, Gasperini, & Smeraldi, 1999), post-traumatic stress disorder (Butler, Mueser, Sprock, & Braff, 1996), dissociative disorders (e.g. Allen & Coyne, 1995; Moskowitz & Corstens, 2007; Ross, et al., 1990) and obsessive compulsive disorder (e.g. Fontenelle, et al., 2008).

It is increasingly recognised that hallucinations are not a prerogative of individuals suffering from mental health difficulties. Several epidemiological studies have indicated that hallucinations are experienced by a sizable minority of individuals with no history of psychiatric illness. The earliest evidence suggesting that hallucinations might be regarded as a relatively common phenomena in the general

population emerged from the first "Census on Hallucinations" conducted by the Society for Psychical Research in the late 19th century, in which 17.000 individuals completed a standardised interview assessing the occurrence of visual, auditory and tactile hallucinatory experiences (Sidgewick, 1894). Recent reanalyses of these data (adjusted to account for experiences which would not be classified as hallucinations according to modern criteria) estimated the life-time prevalence of hallucinations in this study at 6.9% (Tien, 1991). These early findings have been largely replicated by recent epidemiological investigations. In the Epidemiological Catchment Area Study, in which 18.572 individuals drawn at random from the US population were interviewed about psychiatric symptoms, the lifetime prevalence of hallucinations was estimated at 13% (Tien, 1991). Similarly, the prevalence rate of hallucinations in a recent study investigating the prevalence of positive psychotic symptoms in a representative sample of 7076 Dutch citizens was approximately 7.9% after excluding abnormal experiences caused by substance abuse or organic illness (Bijl, Ravelli, & Van Zessen, 1998; Bijl, Van Zessen, & Ravelli, 1998). Finally, it has been estimated that approximately 8.5% of the 8000 individuals who took part to the recent US National Comorbidity Study had experienced auditory hallucinations (M. Shevlin, M. Dorahy, & G. Adamson, 2007). As the lifetime risk of psychotic disorders has been estimated at approximately 0.4% (e.g. Jablensky, et al., 1992; McGrath, 2005), these findings suggest that hallucinatory experiences are much more prevalent than documented clinical cases of psychosis in the general population.

These epidemiological findings are complemented by a large number of cross-sectional studies which investigated hallucination-proneness (as measured by self-report questionnaires such as the Launay-Slade Hallucinations Scale (Launay & Slade, 1981) in non-clinical samples. In a recent review, Aleman and Larøi (Aleman

& Larøi, 2008) estimated that between 11% and 37% of the participants tested in these studies responded affirmatively to items such as "I often hear a voice speaking my thoughts aloud", or "I sometimes hear my thoughts aloud. I actually hear them spoken outside my head when no one really said anything".

Overall, these findings suggest that hallucinations cannot be ascribed to specific psychiatric diagnoses, and are consistent with the notion that psychotic experiences lie on a continuum with normal functioning rather than representing a distinct category of pathological complaints exclusively experienced by a minority of individuals (van Os, Hanssen, Bijl, & Ravelli, 2000; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). This dimensional approach implies that hallucinatory experiences similar to those reported by psychiatric patients can be reliably measured in non-clinical individuals, and that the cognitive underpinnings of hallucinatory experiences can be regarded as a legitimate object of investigation in their own right, regardless of the diagnostic categories which have frequently been associated with them.

1.2 The reality discrimination account of hallucinatory experiences

Interest over the cognitive underpinnings of hallucinatory experiences has considerably expanded over the past two decades. Although the processes which might ultimately account for the genesis of hallucinations are still debated, there has been an emerging consensus that they are the consequence of the misattribution of internally generated cognitive events to external sources (e.g. Bentall, 1990; Frith, 1992; Frank Larøi & Woodward, 2007; Waters, Badcock, Michie, & Maybery, 2006).

Several cognitive accounts have assumed that specific metacognitive dysfunctions may underlie this process of misattribution. In this context, the term

metacognition refers both to processes that individuals use to monitor and control their own thoughts, as well as to beliefs about cognition (i.e. metacognitive beliefs) that might influence these control processes (Flavell, 1979). Bentall (1990) proposed that the origin of hallucinatory experiences can be explained in terms of reality discrimination, a metacognitive process used to discriminate between internal and external perceptions and make attributions about the origin of mental experiences. According to this account, hallucination-prone individuals are impaired in their capacity to discriminate between internally and externally generated cognitive events, and present a cognitive bias towards the misattribution of internal cognitive events to external sources.

The reality discrimination model of hallucinatory experiences has received empirical support from investigations which compared hallucination-prone (i.e. hallucinating patients or non-clinical participants with high scores on hallucination-proneness measures) and non-prone sample using various experimental procedures, including signal detection (e.g. Bentall & Slade, 1995), self-monitoring (e.g. Johns, et al., 2001) and source monitoring (e.g. Bentall, Baker, & Havers, 1991) paradigms. Signal detection paradigms are commonly used to investigate the capacity of individuals to detect stimuli in situations of uncertainty, such as detecting specific auditory signals (e.g. voices) against background noise. The studies which employ this experimental procedure generally require participants to listen to recordings of white noise. A pre-recorded voice is presented in the white noise at different points during the experiment, and participants are required to indicate when they believed they had detected the voice. According to signal detection theory, the performance in these tasks is influenced by two parameters which can be estimated from the participants' observed pattern of responding: perceptual sensitivity and response bias .

Perceptual sensitivity (d') corresponds to the capacity to accurately detect a signal when it is present. Conversely response bias (β) indicates the individual's willingness to assume that a signal is present under conditions of uncertainty. If d' is optimum, stimuli will be correctly detected signals with relatively few false alarms. Greater response bias, by contrast, will lead to an increase in hits but only at the cost of an increase in false alarms. The studies which employed this kind of paradigm generally revealed that hallucination-proneness is associated with greater response bias, but not to perceptual sensitivity deficits, a finding which has been interpreted as consistent with the notion that hallucinations may results from a cognitive bias towards the misattribution of self-generated cognitive events (e.g. Barkus et al., 2007; Bentall & Slade, 1985). Other paradigms used to investigate the cognitive underpinnings of hallucinatory experiences (i.e. the self-monitoring and the source monitoring paradigms) require participants to make attributions regarding the source of self-generated material. The self-monitoring paradigm is an experimental procedure involving the direct measurement of the on-line monitoring of self-generated speech (Johns & McGuire, 1999; Johns et al., 2001). In a typical experiment, participants are asked to pronounce out loud a list of words into a microphone. Certain auditory features of the participants' speech, for example pitch, are then manipulated, and the speech is played back to the participants. At various points in the experiment, the participants are presented with someone else's pre- recorded voice pronouncing the same word. After each trial, participants are requested to identify the source of the auditory feedback. Finally, the source monitoring paradigm, differs from the signal detection and self-monitoring approaches, because participants are asked to distinguish between *memories* of self-generated material (e.g. words) and memories of externally-generated stimuli (Johnson, Hashtroudi, & Lindsay, 1993). In the typical

source monitoring task, participants are provided with a list of cue words read out loud by the experimenter. For each word, participants are required to generate a word associated with the cue. After a delay, participants are asked to complete a word recognition task including the words generated by the participant, the words presented by the experimenter and new words. Participants are therefore requested to indicate whether the word presented is old or new, and whether it was self-generated or was read out by the experimenter.

Recent narrative and systematic reviews of the studies which used the aforementioned tasks have generally supported the reality discrimination model of hallucinatory experiences. In a recent meta-analysis of studies investigating self-recognition judgements in psychosis (including studies which employed source memory and self-monitoring procedures) Waters et al. (2010) showed that auditory hallucinations in patients with diagnosis of schizophrenia are associated with deficits in the capacity to recognise thoughts and mental events as self-generated, a finding which is consistent with the predictions of this cognitive model (as well as with other misattribution accounts of hallucinatory experiences e.g. Frith, 1992; Waters et al., 2006). In addition, there is consensus across narrative reviews of experimental studies employing source monitoring, self-monitoring and signal detection tasks (e.g. Aleman & Larøi, 2008; Ditman & Kuperberg, 2005; Frank Larøi & Woodward, 2007) that hallucinations and non-clinical hallucination-proneness may be associated with a bias towards the attribution of internally generated cognitive events to an external source. Despite these consistent findings, the available evidence is marked by a number of methodological pitfalls which make it difficult to ascertain whether perturbed reality discrimination is specifically related to hallucinatory experiences. For example, several studies compared patients currently experiencing multiple positive symptoms

to non-symptomatic patients (Brébion, et al., 2000; Keefe, Arnold, Bayen, & Harvey, 1999), making it impossible to ascribe reality discrimination abnormalities to hallucinations rather than to other concurrent symptoms. A related methodological limitation concerns the confounding effect of symptom dimensions which covary with hallucination-proneness in clinical as well as non-clinical samples, such as delusional ideation (e.g. Kimhy, Goetz, Yale, Corcoran, & Malaspina, 2005; Shevlin, Murphy, Dorahy, & Adamson, 2007; Smeets, et al., 2010) and intrusive cognitions (Jones & Fernyhough, 2006; Lobban, Haddock, Kinderman, & Wells, 2002; Morrison & Baker, 2000). It has been proposed that a fully satisfactory account of the psychological mechanisms underlying specific symptoms of psychosis can be achieved only by taking into account such covariation between different symptoms (Bentall, 2003). Future studies should therefore attempt to investigate the association between the vulnerability to hallucinations and reality discrimination while implementing the necessary methodological and statistical control for the covariation between hallucinations and comorbid symptom dimensions.

1.3 The metacognitive beliefs account of hallucinatory experiences

Whereas the reality discrimination model is primarily concerned with the metacognitive process underlying the misattribution of internally generated cognitive events to external sources, other models of hallucinations have stressed the role of metacognitive beliefs on this process of misattribution. Morrison, Haddock and Tarrier (1995) proposed that hallucinations are generated when intrusive thoughts are erroneously attributed to an external source, and that this process of misattribution is mediated by dysfunctional metacognitive beliefs that are incompatible with the experience of cognitions of this kind. Intrusive cognitions are

generally defined as thoughts, images or impulses that are unwanted or unintended, perceived as uncontrollable, egodystonic and capable of interrupting ongoing activity (Clark & Purdon, 1995; Clark & Rhyno, 2005; Rachman, 1981). The experience of cognitive intrusions is generally associated with elevated levels of negative affect, and with implementation of thought control strategies aimed to manage or suppress cognitions of this kind (Clark, 2005; Clark & Rhyno, 2005). Morrison et al. proposed that hallucinations are generated by the attempts to reduce the negative arousal resulting from the concomitant presence of intrusive cognitions and maladaptive metacognitive beliefs about the importance of thought consistency and the need to control thoughts. When intrusive thoughts are experienced, the inconsistency between these metacognitive beliefs and the experience of uncontrollable mental events leads to cognitive dissonance (Festinger, 1957), a state of negative arousal that individuals are motivated to escape. From this perspective, hallucination-prone individuals are therefore motivated to attribute their intrusive thoughts to an external source in the attempt to prevent cognitive dissonance from occurring.

The metacognitive beliefs account has received apparent support from studies which have investigated the association between maladaptive metacognitive beliefs and hallucination-proneness in nonclinical and clinical samples. With a few notable exceptions (e.g. Linney & Peters, 2007), the majority of these studies assessed the presence of maladaptive metacognitive beliefs using the Metacognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997), a self-report questionnaire assessing five metacognitive factors: (i) positive beliefs about worry (beliefs that worry helps to solve problems and avoid unpleasant events); (ii) negative beliefs about the uncontrollability of thoughts and corresponding danger (beliefs that thoughts are uncontrollable and beliefs about the importance of controlling thought

process in order to function effectively as a person); (iii) cognitive confidence (beliefs about one's own cognitive functioning, in particular in the domains of memory and attentional); (iv) negative beliefs about thoughts in general (beliefs about potential negative consequences of having uncontrollable/worring thoughts); and (v) cognitive self-consciousness (the predisposition to monitor or focus upon one's own thought processes).

Consistent with the prediction of this model, several non-clinical studies published in the past decade have generally supported the hypothesised association between hallucination-proneness and the metacognitive factors assessed by the MCQ (e.g. F. Larøi, van der Linden, & Marczewski, 2004; Morrison, Wells, & Nothard, 2000, 2002; Stirling, Barkus, & Lewis, 2007). Similarly, different clinical studies have shown that hallucinating patients score significantly higher than non-hallucinating patients on dysfunctional metacognitive beliefs and also report a higher frequency of intrusive cognitions (Baker & Morrison, 1998; Lobban, et al., 2002; Morrison & Baker, 2000; Morrison & Wells, 2003), findings which have been generally interpreted as consistent with the metacognitive beliefs account of hallucinatory experiences. More recently, however, a number of studies were unable to replicate these findings (Brett, Johns, Peters, & McGuire, 2009; García-Montes, Pérez-Álvarez, Balbuena, Garcelán, & Cangas, 2006; Linney & Peters, 2007). To complicate matters, there is increasing evidence suggesting that metacognitive beliefs are associated with proneness to psychotic symptoms other than hallucinations, including delusion-proneness (F. Larøi & Van der Linden, 2005), paranoid ideation (Fraser, Morrison, & Wells, 2006; García-Montes, Cangas, Pérez-Álvarez, Hidalgo, & Gutiérrez, 2005), and symptoms of thought interference (Linney & Peters, 2007). Furthermore, metacognitive beliefs have been related to a number of non-psychotic

symptoms, such as anxiety (Cartwright-Hatton, et al., 2004; Cartwright-Hatton & Wells, 1997; Davies & Valentiner, 2000) depression (e.g. Wells & Carter, 2001) and obsessive-compulsive symptoms (Gwilliam, Wells, & Cartwright-Hatton, 2004; Irak & Tosun, 2008; Moritz, Peters, Larøi, & Lincoln, 2010; Myers & Wells, 2005).

Overall, these findings raise doubts about the specific contribution of metacognitive beliefs to hallucinations and hallucination-proneness, and suggest that the effect of comorbid symptoms which have been linked to dysfunctional metacognitive beliefs in previous research might represent an important confound in the relationship between hallucination-proneness and metacognitive beliefs. More research is therefore required to examine the consistency and specificity of the alleged associations between metacognitive beliefs and hallucinations when the effect of comorbid symptoms is taken into account.

1.4 The trauma-dissociation-hallucinations link

Recent research has also witnessed a growing interest in the potential contribution of traumatic events, and in particular childhood trauma, to the development of hallucinatory experiences. A link between childhood trauma and hallucinations has been documented in several cross-sectional studies with psychotic (Read, Agar, Argyle, & Aderhold, 2003), bipolar (Hammersley, et al., 2003) and dissociative identity disorder patients (Dorahy, et al., 2009). Similarly, the results of recent large population-based studies suggest that the childhood trauma is a powerful predictor of subsequent hallucinatory experiences in the general population (Cardena & Spiegel, 1993; Shevlin, Dorahy, & Adamson, 2007; Whitfield, Dube, Felitti, & Anda, 2005). The results of several studies have also suggested that childhood trauma might be more robustly associated with vulnerability to hallucinations rather than

psychotic symptoms in general. For example, Read et al. (2003) found that child sexual abuse was not significantly associated with delusions, thought disorder or negative symptoms. Similarly, other studies which documented an association between hallucinations and child trauma were not able to identify any significant association between early traumatic experiences and delusions (Famularo, Kinschererff, & Fenton, 1992; Hammersley, et al., 2003; Sansonnet-Hayden, Haley, Marriage, & Fine, 1987).

It has been proposed that the apparent association between childhood trauma and hallucinations might be explained by dissociative processes (e.g. Moskowitz & Corstens, 2007; Moskowitz, Read, Farrelly, Rudegeair, & Williams, 2009). Different conceptualizations of the construct of dissociation have been used to describe a variety of clinical and non-clinical psychological phenomena (Brown, 2002, 2006; Holmes, et al., 2005). Dissociation has been defined as the "lack of normal integration of thoughts, feelings and experiences into the stream of consciousness and memory" (Bernstein & Putnam, 1986, p. 727) and represents the core component of DSM-IV diagnosis of dissociative disorders. A widely accepted unitary conceptualization of dissociation assumes that dissociative experiences lie on a continuum ranging from the relatively benign forms of absorption frequently experienced in non-clinical populations (Glicksohn & Barrett, 2003; Mayer & Farmer, 2003), to pathological symptoms of depersonalisation and derealisation, to identity alteration and dissociative amnesia observed in dissociative disorders (Waller, Putman, & Carlson, 1996; Waller & Ross, 1997). Although dissociative states can be experienced in the absence of antecedent trauma (Mayer & Farmer, 2003; Merckelbach & Muris, 2001), dissociation is generally regarded as a psychological sequela of traumatic events in non-psychotic samples (van Ijzendoorn & Schuengel, 1996). Consistent with this

view, numerous investigations suggest that psychotic patients exposed to traumatic life experiences score higher on measures of dissociative tendencies compared to patients with no history of trauma (Dorahy, et al., 2009; Goff, Brotman, Kindlon, Waites, & Amico, 1991; Holowka, King, Saheb, Pukall, & Brunet, 2003; Offen, Waller, & Thomas, 2003; Perona-Garcelán, et al., 2010).

Increasing evidence suggests that dissociation may be specifically related to hallucinations. The existence of a specific connection between dissociation and hallucinatory experiences is supported by the findings of several cross-sectional studies. Dissociative tendencies have been found to be strongly associated with self-report measures of hallucination-proneness in adult non-clinical samples (Glicksohn & Barrett, 2003; Morrison & Petersen, 2003) and sexual abuse survivors (Kilcommons, Morrison, Knight, & Lobban, 2008). In addition, elevated dissociation has also been linked to hallucinatory experiences in several studies with psychotic patients (Perona-Garcelán, et al., 2008; Perona-Garcelán, et al., 2010), PTSD patients (Anketell, et al., 2010) and non-psychotic adolescents (Altman, Collins, & Mundy, 1997; Escher, Romme, Buiks, Delespaul, & Van Os, 2002a, 2002b). Several studies also suggest that dissociation might be specifically related to hallucinatory experiences rather than other psychotic complaints. Altman et al. (1997) found that dissociation was significantly related to auditory hallucinations in non-psychotic adolescents after controlling for depression and schizotypal symptomatology. Conversely, no association was observed between dissociation and delusional symptoms. Escher et al. (2002a, 2002b) found that dissociation was significantly associated with hallucinations persistence, but not paranoid ideation, in a 3-year longitudinal study of non-psychotic adolescents with auditory verbal hallucinations. Finally, dissociation was related to severity of hallucinations but not delusions in two

recent studies with psychotic patients (Kilcommons & Morrison, 2005; Perona-Garcelán, et al., 2010).

Despite these consistent findings, further evidence is required to clarify the role played by dissociation in the aetiology of hallucinatory experiences. The accumulating evidence for an association between childhood trauma, dissociative tendencies and hallucinations has lead to speculation that dissociation may mediate the effect of childhood trauma on hallucination-proneness (Anketell, et al., 2010; Moskowitz & Corstens, 2007). This hypothesis, however, has not been directly tested to date. In addition, although the results of previous studies have been frequently interpreted in terms of dissociation representing a predisposing factor towards hallucinations, no empirical study has yet attempted to examine the association between dissociative tendencies and the psychological mechanism underling hallucinatory experiences. Allen et al. (1997) proposed that dissociation might promote psychotic symptoms in virtue of its capacity of "loosening the moorings in inner and outer reality" (p. 327), therefore making individuals vulnerable to psychotic states by impairing reality testing. This hypothesis implicitly assumes that dissociative tendencies might directly interfere with discrimination between internally and externally generated events. Further research is therefore required to test whether dissociative tendencies might account for the reality discrimination difficulties observed in hallucination-prone individuals. Finally, the available evidence for an association between hallucinations and dissociative experiences has relied exclusively on measures of trait rather than state dissociation. Hence, these studies are only indicative that hallucination-prone individuals are also prone to experience dissociative phenomena. The implementation of momentary assessment methods, such as the Experience Sampling Method (Delespaul, 1995), might therefore help to

clarify the nature of the relationship between dissociation and hallucinatory experiences and provide further corroborating evidence for a direct association between dissociative states and hallucinatory experiences.

1.5 Aims and outline of the present thesis

The general aims of the present thesis are twofold. Part of this doctoral dissertation examined the specificity of the associations between hallucinations, metacognitive beliefs and perturbed reality discrimination when controlling for the effect of comorbid symptoms. In addition, this PhD thesis aimed to expand the findings of previous studies which linked hallucinations to dissociative experiences, examine the alleged mediational role of dissociation in the relationship between childhood trauma and hallucinations, and investigate the interplay between dissociation and the cognitive mechanisms believed to underlie hallucinatory experiences. Each of the following chapters consists of recently published papers, including one manuscript recently submitted for publication (i.e. Chapter 5).

In Chapter 2, the specificity of the associations between hallucination-proneness, metacognitive beliefs, reality discrimination and dissociation-like experiences is investigated in a non-clinical sample of university students. The objective of the study described in this chapter was to test whether hallucination-proneness is specifically associated with dysfunctional metacognitive beliefs, dissociation and perturbed reality discrimination when the effect of other symptom dimensions frequently associated with hallucinatory predisposition are controlled for.

The study presented in Chapter 3 used meta-analytic methods to summarise the research findings of studies which examined the empirical predictions of the

metacognitive model of Morrison et al. (1995). In addition, separate meta-analyses were carried out for studies which controlled for comorbid symptoms in order to establish the consistency of the associations between metacognitive beliefs and hallucinatory experiences when the effect of these covariates is accounted for.

The clinical study presented in Chapter 4 further explores the relationship between dissociation and auditory hallucinations using the Experience Sampling Method (ESM), a structured diary technique used to investigate psychotic symptoms in the context of daily life. This research method was used to test whether auditory hallucinations are directly predicted by increased dissociative detachment in the daily life of patients. As in Chapters 2 and 3, the specificity of this association was also examined when controlling for the effect of comorbid symptoms (i.e. concurrent paranoia).

The clinical study presented in Chapter 5 considers whether the apparent relationship between childhood trauma and hallucinations might be explained by dissociative processes. In this study, mediation analysis was employed to test whether the association between childhood trauma and hallucination-proneness is mediated by dissociative tendencies. In addition, this study examined the impact of pathological dissociative symptoms on reality discrimination, in an attempt to explain the dissociation-hallucination link in terms of cognitive mechanisms believed to underlie hallucinatory experiences.

In Chapter 6, an integrative summary of the results of the studies will be given, alongside a general discussion of the theoretical, methodological and clinical implications of these findings.

References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Allen, J. G., & Coyne, L. (1995). Dissociation and vulnerability to psychotioc experience. *Journal of Nervous and Mental Disease, 183*(10), 615-622.

Allen, J. G., Coyne, L., & Console, D. A. (1997). Dissociative detachment relates to psychotic symptoms and personality decompensation. *Comprehensive Psychiatry, 38*(6), 327-334.

Altman, H., Collins, M., & Mundy, P. (1997). Subclinical hallucinations and delusions in nonpsychotic adolescents. *Journal of Child Psychology and Psychiatry, 38*(4), 413-420.

Anketell, C., Dorahy, M. J., Shannon, M., Elder, R., Hamilton, G., Corry, M., et al. (2010). An exploratory analysis of voice hearing in chronic PTSD: Potential associated mechanisms. *Journal of Trauma and Dissociation, 11*(1), 93-107. doi: 10.1080/15299730903143600

Baethge, C., Baldessarini, R. J., Freudenthal, K., Streeruwitz, A., Bauer, M., & Bschor, T. (2005). Hallucinations in bipolar disorder: Characteristics and comparison to unipolar depression and schizophrenia. *Bipolar Disorders, 7*(2), 136-145. doi: 10.1111/j.1399-5618.2004.00175.x

Baker, C. A., & Morrison, A. P. (1998). Cognitive processes in auditory hallucinations: Attributional bias and metacognition. *Psychological Medicine, 28*(5), 1199-1208.

Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucinations. *Psychological Bulletin, 107*(1), 82-95.

Bentall, R. P. (2003). *Madness explained: Psychosis and the human nature*. London: Penguin Books Ltd.

Bentall, R. P., Baker, G. A., & Havers, S. (1991). Reality monitoring and psychotic hallucinations. *British Journal of Clinical Psychology, 30*, 213-220.

Bentall, R. P., & Slade, P. (1985). Reality testing and auditory hallucinations: A signal detection analysis. *British Journal of Clinical Psychology, 24*(3), 159-169.

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability and validity of a dissociation scale. *Journal of Nervous and Mental Disease, 174*(12), 727-735.

Bijl, R. V., Ravelli, A., & Van Zessen, G. (1998). Prevalence of psychiatric disorders in the general population: Results from the Netherlands Mental Health Survey and Incidence Study. *Social Psychiatry and Psychiatric Epidemiology, 33*, 587-596.

Bijl, R. V., Van Zessen, G., & Ravelli, A. (1998). The Netherlands Mental Health Survey and Incidence Study (NEMESIS): Objectives and design. *Social Psychiatry and Psychiatric Epidemiology, 33*, 581-587.

Brébion, G., Amador, X., David, A. S., Malaspina, D., Sharif, Z., & Gorman, J. M. (2000). Positive symptomatology and source-monitoring failure in schizophrenia - an analysis of symptom-specific effects. *Psychiatry Research, 95*, 119-131.

Brett, C. M. C., Johns, L. C., Peters, E. P., & McGuire, P. K. (2009). The role of metacognitive beliefs in determining the impact of anomalous experiences: A

comparison of help-seeking and non-help-seeking groups of people experiencing psychotic-like anomalies. *Psychological Medicine, 39*, 939-950.

Brown, R. J. (2002). The cognitive psychology of dissociative states. *Cognitive Neuropsychiatry, 7*(3), 221-235. doi: 10.1080/13546800244000085

Brown, R. J. (2006). Different types of "dissociation" have different psychological mechanism. *Journal of Trauma and Dissociation, 7*(4), 7-28. doi: 0.1300/J229v07n04_02

Butler, R. W., Mueser, K. T., Sprock, J., & Braff, D. L. (1996). Positive symptoms of psychosis in posttraumatic stress disorder. *Biological Psychiatry, 39*(10), 839-844.

Cardena, E., & Spiegel, D. (1993). Dissociative reactions to the San Francisco Bay Area earthquake of 1989. *Am J Psychiatry, 150*(3), 474-478.

Cartwright-Hatton, S., Mather, A., Illingworth, V., Brocki, J., Harrington, R., & Wells, A. (2004). Development and preliminary validation of the Meta-cognitions Questionnaire--Adolescent Version. *Journal of Anxiety Disorders, 18*(3), 411-422.

Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The meta-cognitions questionnaire and its correlates. *Journal of Anxiety Disorders, 11*(3), 279-296.

Clark, D. A. (2005). *Intrusive thoughts in clinical disorders*. London: The Guilford Press.

Clark, D. A., & Purdon, C. (1995). The assessment of unwanted intrusive thoughts: A review and critique of the literature. *Behaviour Research and Therapy, 33*(8), 967-976.

Clark, D. A., & Rhyno, S. (2005). Unwanted intrusive thoughts in nonclinical individuals: Implications for clinical disorders. In D. A. Clark (Ed.), *Intrusive thoughts in clinical disorders: Theory, research and treatment* (pp. 1-29). London: The Guilford Press.

Coryell, W. (1996). Psychotic depression. *Journal of Clinical Psychiatry, 57*(supp 3), 27-31.

Davies, R. N., & Valentiner, D. P. (2000). Does meta-cognitive theory enhance our understanding of pathological worry and anxiety? *Personality and Individual Differences, 29*(3), 513-526. doi: 10.1016/S0191-8869(99)00211-1

Delespaul, P. (1995). *Assessing schizophrenia in daily life: The Experience Sampling Method.* Maastricht, the Netherlands: Universitaire Pers Maastricht.

Ditman, T., & Kuperberg, G. R. (2005). A source-monitoring account of auditory verbal hallucinations in patients with schizophrenia. *Harvard Review of Psychiatry, 13*(5), 280-299.

Dorahy, M. J., Shannon, C., Seagar, L., Corr, M., Stewart, K., Hanna, D., et al. (2009). Auditory hallucinations in dissociative identity disorder and schizophrenia with and without a childhood trauma history. *Journal of Nervous and Mental Disease, 197*(12), 892-898.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002a). Formation of delusional ideation in adolescents hearing voices: A prospective study. *American Journal of Medical Genetics (Neuropsychiatric Genetics), 114*, 913-920.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002b). Independent course of childhood auditory hallucinations: A sequential 3-year follow up study. *British Journal of Psychiatry, 181*(suppl 43), s10-s18.

Famularo, R., Kinschererff, R., & Fenton, T. (1992). Psychiatric diagnoses of maltreated children: Preliminary findings. *Journal of the American Academy of Child and Adolescent Psychiatry, 31*, 863-867.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Stanford: SUP.

Flavell, J. H. (1979). Metacognition and cognitive monitoring. *American Psychologist, 34*(10), 906-911.

Fontenelle, L. F., Lopes, A. P., Borges, M. C., Pacheco, P. G., Nascimento, A. L., & Versiani, M. (2008). Auditory, visual, tactile, olfactory, and bodily hallucinations in patients with obsessive-compulsive disorder. [Article]. *Cns Spectrums, 13*(2), 125-130.

Fraser, J., Morrison, A. P., & Wells, A. (2006). Cognitive processes, reasoning biases and persecutory delusions: A comparative study. *Behavioural and Cognitive Psychotherapy, 34*(4), 421-435.

Frith, C. (1992). *The cognitive neuropsychiatry of schizophrenia*. Hov, UK: Lawrence Erlbaum.

García-Montes, J. M., Cangas, A., Pérez-Álvarez, M., Hidalgo, Á. M., & Gutiérrez, O. (2005). Influence of metacognitive variables on paranoid ideation. *International Journal of Clinical and Health Psychology, 5*(3), 463-469.

García-Montes, J. M., Pérez-Álvarez, M., Balbuena, C. S., Garcelán, S. P., & Cangas, A. (2006). Metacognitions in patients with hallucinations and obsessive-compulsive disorder: The superstition factor. *Behaviour Research and Therapy, 44*(8), 1091-1104.

Glicksohn, J., & Barrett, T. R. (2003). Absorption and hallucinatory experience. *Applied Cognitive Psychology, 17*(7), 833-849.

Goff, D. C., Brotman, A. W., Kindlon, D., Waites, M., & Amico, E. (1991). Self-report of childhood abuse in chronically psychotic patients. *Psychiatry Research, 37*(1), 73-80. doi: 10.1016/0165-1781(91)90107-Z

Goodwin, D. W., & Jamison, K. R. (1990). *Manic depressive illness*. New York: Oxford University Press.

Gwilliam, P., Wells, A., & Cartwright-Hatton, S. (2004). Dose meta-cognition or responsibility predict obsessive-compulsive symptoms: a test of the metacognitive model. *Clinical Psychology & Psychotherapy, 11*(2), 137-144.

Hammersley, P., Dias, A., Todd, G., Bowen-Jones, K., Reilly, B., & Bentall, R. P. (2003). Childhood trauma and hallucinations in bipolar affective disorder: preliminary investigation. *British Journal of Psychiatry, 182*(6), 543-547.

Holmes, E. A., Brown, R. J., Mansell, W., Pasco Fearon, R., Hunter, E. C. M., Frasquilho, F., et al. (2005). Are there two qualitatively distinct froms of dissociation? A review and some clinical implications. *Clinical Psychology Review, 25*(1), 1-23. doi: 10.1016/j.cpr.2004.08.006

Holowka, D. W., King, S., Saheb, D., Pukall, M., & Brunet, A. (2003). Childhood abuse and dissociative symptoms in adult schizophrenia. *Schizophrenia Research, 60*(1), 87-90.

Irak, M., & Tosun, A. (2008). Exploring the role of metacognition in obsessive-compulsive and anxiety symptoms. *Journal of Anxiety Disorders, 22*(8), 1316-1325. doi: 10.1016/j.janxdis.2008.01.012

Jablensky, A., Sartorius, N., Ernberg, G., Anker, M., Korten, A., Cooper, J. E., et al. (1992). Schizophrenia: manifestations, incidence and course in different cultures A World Health Organization Ten-Country Study. *Psychological Medicine. Monograph Supplement, 20*, 1-97

Johns, L. C., & McGuire, P. K. (1999). Verbal self-monitoring and auditory hallucinations in schizophrenia. *Lancet, 353*, 469-470.

Johns, L. C., Rossell, S., Frith, C., Ahmad, F., Hemsley, D., Kuipers, E., et al. (2001). Verbal self-monitoring and auditory verbal hallucinations in patients with schizophrenia. *Psychological Medicine, 31*, 705-715.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114*(1), 3-28.

Jones, S. R., & Fernyhough, C. (2006). The role of thought suppression and metacognitive beliefs in proneness to auditory verbal hallucinations in a non-clinical sample. *Personality and Individual Differences, 41*(8), 1421-1432.

Keefe, R. S. E., Arnold, M. C., Bayen, U. J., & Harvey, P. D. (1999). Source monitoring deficits in patients with schizoprenia; a multinomial modelling analysis. *Psychological Medicine, 29*, 903-914.

Kilcommons, A. M., & Morrison, A. P. (2005). Relationships between trauma and psychosis: An exploration of cognitive and dissociative factors. *Acta Psychiatrica Scandinavica, 112*(5), 351-359.

Kilcommons, A. M., Morrison, A. P., Knight, A., & Lobban, F. (2008). Psychotic experiences in people who have been sexually assaulted. *Social Psychiatry and Psychiatric Epidemiology, 43*(8), 602-611.

Kimhy, D., Goetz, R., Yale, S., Corcoran, C., & Malaspina, D. (2005). Delusions in individuals with schizophrenia: Factor structure, clinical correlates and putative neurobiology. *Psychopathology, 38*, 338-344. doi: 10.1159/000089455

Larøi, F., & Van der Linden, M. (2005). Metacognitions and proneness towards hallucinations and delusions. *Behaviour Research and Therapy, 43*(11), 1425-1441.

Larøi, F., van der Linden, M., & Marczewski, P. (2004). The effects of emotional salience, cognitive effort and meta-cognitive beliefs on a reality monitoring task in hallucination-prone subjects. *British Journal of Clinical Psychology, 43*(3), 221-233.

Larøi, F., & Woodward, T. S. (2007). Hallucinations from a cognitive perspective. *Harvard Review of Psychiatry, 15*(3), 109-117.

Lattuada, E., Serretti, A., Cusin, C., Gasperini, M., & Smeraldi, E. (1999). Symptomatologic analysis of psychotic and non-psychotic depression. *Journal of Affective Disorders, 54*, 183-187.

Launay, G., & Slade, P. (1981). The measurement of hallucinatory predisposition in male and female prisoners. *Personality and Individual Differences, 2*, 221-234.

Linney, Y. M., & Peters, E. R. (2007). The psychological processes underlying symptoms of thought interference in psychosis. *Behaviour Research and Therapy, 45*, 2726-2741.

Lobban, F., Haddock, G., Kinderman, P., & Wells, A. (2002). The role of metacognitive beliefs in auditory hallucinations. *Personality and Individual Differences, 32*(8), 1351-1363.

Mayer, J. L., & Farmer, R. F. (2003). The development and psychometric evaluation of a new measure of dissociative activities. *Journal of Personality Assessment, 80*(2), 185-196.

McGrath, J. J. (2005). Myths and plain truths about schizophrenia epidemiology – the NAPE lecture 2004. *Acta Psychiatrica Scandinavica, 111*(1), 4-11. doi: 10.1111/j.1600-0447.2004.00467.x

Merckelbach, H., & Muris, P. (2001). The causal link between self-reported trauma and dissociation: A critical review. *Behaviour Research and Therapy, 39*(3), 245-254. doi: 10.1016/S0005-7967(99)00181-3

Moritz, S., Peters, M. J. V., Larøi, F., & Lincoln, T. M. (2010). Metacognitive beliefs in obsessive-compulsive patients: Comparison with healthy and schizophrenia participants. *Cognitive Neuropsychiatry, 15*(6), 531-548. doi: 10.1080/13546801003783508

Morrison, A. P., & Baker, C. A. (2000). Intrusive thoughts and auditory hallucinations: A comparative study of intrusions in psychosis. *Behaviour Research and Therapy, 38*(11), 1097-1106.

Morrison, A. P., Haddock, G., & Tarrier, N. (1995). Intrusive thoughts and auditory hallucinations: A cognitive approach. *Behavioural and Cognitive Psychotherapy, 23*(3), 265-280.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Morrison, A. P., & Wells, A. (2003). A comparison of metacognition in patients with hallucinations, delusions, panic disorder, and non-patients controls. *Behaviour Research and Therapy, 41*(2), 251-256.

Morrison, A. P., Wells, A., & Nothard, S. (2000). Cognitive factors in predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 39*(1), 67-78.

Morrison, A. P., Wells, A., & Nothard, S. (2002). Cognitive and emotional predictors of predisposition to hallucinations in non-patients. *British Journal of Clinical Psychology, 41*(3), 259-270.

Moskowitz, A., & Corstens, D. (2007). Auditory hallucinations: Psychotic symptom or dissociative experience. *The Journal of Psychological Trauma, 6*(2), 35-63.

Moskowitz, A., Read, J., Farrelly, S., Rudegeair, T., & Williams, O. (2009). Are psychotic syptoms traumatic in origin and dissociative in kind? In P. Dell & J. O'Neil (Eds.), *Dissociation and dissociative disorders: DSM-V and beyond.* New York: Routledge.

Myers, S. G., & Wells, A. (2005). Obsessive-compulsive symptoms: The contributions of metacognition and responsability. *Journal of Anxiety Disorders, 19*(7), 806-817. doi: 10.1016/j.janxdis.2004.09.004

Offen, L., Waller, G., & Thomas, G. (2003). Is reported childhood abuse associated with the psychopathological characteristics of patients who experience auditory hallucinations? *Child Abuse and Neglect, 27*, 919-927.

Perona-Garcelán, S. P., Cuevas-Yust, C., García-Montes, J. M., Pérez-Alvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2008). Relationship between self-focused attention and dissociation in patients with and without auditory hallucinations. *Journal of Nervous and Mental Disease, 196*(3), 190-197.

Perona-Garcelán, S. P., García-Montes, J. M., Cuevas-Yust, C., Pérez-Álvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2010). A preliminary exploration of trauma, dissociation and positive psychotic symptoms in a Spanish sample. *Journal of Trauma and Dissociation, 11*(3), 284-292. doi: 10.1080/15299731003786462

Rachman, S. J. (1981). Unwanted intrusive cognitions. *Advances in Behaviour Research and Therapy, 3*, 89-99.

Read, J., Agar, K., Argyle, N., & Aderhold, V. (2003). Sexual and physical abuse during childhood and adulthood as predictors of hallucinations, delusions and thought disorder. *Psychology and Psychotherapy: Theory, Research and Practice, 76*, 1-22.

Ross, C. A., Miller, S. D., Reagor, P., Bjornson, L., Fraser, G. A., & Anderson, G. (1990). Schneiderian symptoms in multiple personality disorder and schizophrenia. *Comprehensive Psychiatry, 31*(2), 111-118.

Sansonnet-Hayden, H., Haley, G., Marriage, K., & Fine, S. (1987). Sexual abuse and psychopathology in hospitalized adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 26*(5), 753-757.

Sartorious, N., Jablensky, A., & Korten, A. (1986). Early manifestation and first contact incidence of schizophrenia in different cultures. *Psychological Medicine, 16*, 909-928.

Schneider, K. (1959). *Clinical Psychopathology*. New York: Grune & Stratton.

Shevlin, M., Dorahy, M., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*, 222-228.

Shevlin, M., Dorahy, M. J., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*(3-4), 222-228.

Shevlin, M., Murphy, J., Dorahy, M. J., & Adamson, G. (2007). The distribution of positive psychosis-like symptoms in the population: A latent class analysis of

the National Comorbidity Survey. *Schizophrenia Research, 89*(1-3), 101-109. doi: 10.1016/j.schres.2006.09.014

Sidgewick, H. A. (1894). Report of the census on hallucinations. *Proceedings of the Society for Psychical Research, 26*(259-394).

Slade, P., & Bentall, R. P. (1988). *Sensory deception: a scientific analysis of hallucination*. London: Croom Helm.

Smeets, F., Lataster, T., Dominguez, M.-d.-G., Hommes, J., Lieb, R., Wittchen, H.-U., et al. (2010). Evidence That Onset of Psychosis in the Population Reflects Early Hallucinatory Experiences That Through Environmental Risks and Affective Dysregulation Become Complicated by Delusions. *Schizophrenia Bulletin*. doi: 10.1093/schbul/sbq117

Stirling, J., Barkus, E., & Lewis, S. (2007). Hallucination proneness, schizotypy and meta-cognition. *Behaviour Research and Therapy, 45*(6), 1401-1408.

Tarrier, N., Lewis, S., Haddock, G., Bentall, R. P., Drake, R., Kinderman, P., et al. (2004). Cognitive-behavioural therapy in first-episode and early schizophrenia: Eighteen-month follow-up of a randomised controlled trial. *British Journal of Psychiatry, 184*, 231-239.

Tien, A. Y. (1991). Distribution of hallucinations in the population. *Social Psychiatry and Psychiatric Epidemiology, 26*, 287-292.

van Ijzendoorn, M. H., & Schuengel, C. (1996). The measurement of dissociation in normal and clinical populations: Meta-analytic validation of the Dissociative Experiences Scale (DES). *Clinical Psychology Review, 16*(5), 365-382.

van Os, J., Hanssen, M., Bijl, R. V., & Ravelli, A. (2000). Strauss (1969) revisited: A psychosis continuum in the normal population? *Schizophrenia Research, 45*, 11-20.

van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis-proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine, 39*(2), 179-195. doi: 10.1017/S0033291708003814

Waller, N. G., Putman, F. W., & Carlson, E. B. (1996). Types of dissociation and dissociative types: A taxometric analysis of dissociative experiences. *Psychological Methods, 1*(3), 300-321.

Waller, N. G., & Ross, C. A. (1997). The prevalence and biometric structure of pathological dissociation in the general population: Taxometric and behavior genetic findings *Journal of Abnormal Psychology, 106*(4), 499-510.

Waters, F. A. V., Badcock, J. C., Michie, P. T., & Maybery, M. T. (2006). Auditory hallucinations: Intrusive thoughts and forgotten memories. *Cognitive Neuropsychiatry, 11*(1), 65-83.

Waters, F. A. V., Woodward, T. S., Allen, P., Aleman, A., & Sommer, I. (2010). Self-recognition Deficits in Schizophrenia Patients With Auditory Hallucinations: A Meta-analysis of the Literature. *Schizophrenia Bulletin*. doi: 10.1093/schbul/sbq144

Wells, A., & Carter, C. S. (2001). Further tests of a cognitive model of generalised anxiety disorder: Metacognitions and worry in GAD, panic disorder, social phobia, depression and nonpatients. *Behavior Therapy, 32*, 85-102.

Whitfield, C. L., Dube, S. R., Felitti, V. J., & Anda, R. F. (2005). Adverse childhood experiences and hallucinations. *Child Abuse and Neglect, 29*, 797-810.

Chapter 2

Dissociative and metacognitive factors in hallucination-proneness when controlling for comorbid symptoms

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2.1 Abstract

Introduction: Recent studies have linked hallucination-proneness to dysfunctional metacognitive beliefs, dissociation and disrupted capacity to discriminate between internal and external cognitive events (reality discrimination). This study addressed a number of methodological limitations of previous research by investigating the relationship between hallucination-proneness and the aforementioned variables while controlling for comorbid symptoms.

Method: A large sample of non-clinical participants was screened on measures of hallucination-proneness, cognitive intrusions, paranoid ideation, metacognitive beliefs and dispositional mindfulness (including measures of dissociation-like experiences). In addition, a signal detection task was used to investigate reality discrimination in four sub-groups of participants selected on the basis of their scores on hallucination-proneness and intrusions.

Results: Regression analyses for the self-report data were conducted to investigate the predictors of hallucination-proneness and paranoia when controlling for comorbid symptoms. Also, between-group differences on the behavioural data were tested to determine whether perturbed reality discrimination is specifically associated with hallucination-proneness rather than cognitive intrusions. Results revealed that metacognitive beliefs are more strongly associated with intrusions and paranoia than hallucination-proneness, whereas hallucination-proneness is related to perturbed reality discrimination and dissociation.

Conclusions: These results clarify previous research on metacognitive dysfunction in hallucination-proneness, and highlight the importance of controlling for the

covariation among symptoms when investigating the cognitive processes underlying psychotic experiences.

2.2 Introduction

Recent cognitive models have assumed that auditory hallucinations are related to specific metacognitive dysfunctions. In this context, the term metacognition (the capacity of "thinking about thinking" or "cognition about cognition") refers both to processes used by the individuals to monitor and control their own thoughts, and also to certain beliefs about cognition that might in turn influence these control processes (Flavell, 1979). In an account proposed by Bentall (1990) hallucinatory experiences were explained in terms of reality discrimination, a specific metacognitive skill involving the discrimination between internal and external cognitive events. From this perspective, hallucination-prone individuals might be considered impaired in their ability to discriminate between imagined and real events, resulting in a specific bias towards misattributing internally generated cognitive events to an external source. In the past two decades, the reality discrimination model of hallucinatory experiences has received strong empirical support from numerous investigations which have used various experimental paradigms (Aleman & Larøi, 2008; Ditman & Kuperberg, 2005).

Signal detection theory (SDT) is one methodology that has been used to study reality discrimination with respect to hallucination-proneness. This framework allows the measurement of perceptual sensitivity (the capacity to detect a presented signal from background noise) and response bias (the extent to which an individual is more or less likely to report the presence of a signal in background noise). Bentall and Slade (1985a) used an auditory SDT task to investigate reality discrimination both in non-clinical subjects scoring high and low in measures of hallucinatory predisposition, and in hallucinating and non-hallucinating psychotic patients. The

hallucinating patients showed a greater bias towards detecting signals when compared to non-hallucinating patients, but showed no difference in perceptual sensitivity. The same pattern of results was found when comparing hallucination-prone students to students scoring low in hallucinatory predisposition, suggesting that hallucination-proneness is indeed associated with a cognitive bias towards the misattribution of internally generated cognitive events to an external source. These results have been replicated by other studies in both clinical and non-clinical samples adopting similar methodologies (Barkus, Stirling, Hopkins, McKie, & Lewis, 2007; Rankin & O'Carroll, 1995; Vercammen, De Haan, & Aleman, 2008).

Whilst the reality discrimination model is primarily concerned with the metacognitive process underlying the attribution of internally generated cognitive events to an external source, other models of auditory hallucinations have stressed the role of metacognitive beliefs on this misattribution. Morrison, Haddock and Tarrier (1995) developed a model of auditory hallucinations in which hallucinatory experiences are conceptualized as cognitive intrusions mediated by dysfunctional metacognitive beliefs. Even if the definition of what constitutes a cognitive intrusion, and the features distinguishing these from other cognitive events, is still debated in the literature, intrusions are traditionally conceptualized as repetitive thoughts, images or impulses which (i) are unacceptable, unwanted or unintended (ii), interfere with current flow of thought and ongoing activity, (iii) and are difficult control (Clark & Purdon, 1995). According to Morrison et al. (1995), auditory hallucinations arise from externalization of intrusive thoughts in an attempt to reduce cognitive dissonance (Festinger, 1957) resulting from the concomitance of intrusive cognitions and metacognitive beliefs about the importance of thought consistency and the need to control thoughts. According to this theory, when individuals with dysfunctional

metacognitive beliefs experience intrusive thoughts, they will find themselves in a state of negative arousal that can be reduced through the externalization of these thoughts to some source other than the self.

The metacognitive beliefs model of hallucinations has received apparent support both from studies investigating the association between hallucinatory experiences and intrusive thoughts, as well as from studies investigating the prevalence of dysfunctional metacognitive beliefs in hallucinating patients and hallucination-prone individuals. Concerning the predicted association between cognitive intrusions and hallucinations, Baker and Morrison (2000) found that hallucinating patients with diagnosis of schizophrenia scored higher on measures of frequency of intrusive thoughts than both psychiatric (patients with diagnosis of schizophrenia without hallucinations) and healthy controls. Similarly, hallucination-proneness has been found to be robustly associated with intrusive thoughts in non-clinical samples (Jones & Fernyhough, 2006, 2009). A number of studies have also tried to identify metacognitive beliefs associated with hallucinations and hallucination-proneness using the Metacognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997) or modified versions of the instrument (e.g. Lobban, Haddock, Kinderman, & Wells, 2002; Stirling, Barkus, & Lewis, 2007). The MCQ is designed to assess a discrete number of dysfunctional metacognitive beliefs and thought monitoring strategies assumed to be involved in the development and maintenance of psychopathological symptoms. The questionnaire comprises subscales assessing a set a positive and negative metacognitive beliefs (positive beliefs about the importance of worry; negative beliefs about the uncontrollability of thoughts; negative beliefs about thoughts, consequences of thoughts and the need to control thoughts) as well as

measures of cognitive self-consciousness and lack of cognitive confidence (the lack of confidence in one's own cognitive efficiency).

Studies with both clinical (e.g. Baker & Morrison, 1998; García-Montes, Pérez-Álvarez, Balbuena, Garcelán, & Cangas, 2006; Morrison & Wells, 2003) and non-clinical samples (e.g. García-Montes, Cangas, Pérez-Álvarez, Fidalgo, & Gutiérrez, 2006; Larøi & Van der Linden, 2005; Larøi, van der Linden, & Marczewski, 2004; Morrison, Wells, & Nothard, 2000, 2002) have found evidence supporting an association between hallucinations and dysfunctional metacognitive beliefs. However, the MCQ was originally designed to investigate metacognitive factors associated with the development and maintenance of worry and cognitive intrusions (Cartwright-Hatton & Wells, 1997). As hallucination-prone subjects have been found to be particularly vulnerable to experience frequent intrusive thoughts, it is possible that the dysfunctional metacognitive factors that correlate with hallucination-proneness may represent merely a response to frequent intrusive thoughts rather than a specific vulnerability to hallucinatory experiences. This interpretation is indirectly supported by the findings of a recent clinical study which found no significant differences on MCQ scores between hallucinating psychotic patients and non-hallucinating patients with diagnosis of Obsessive Compulsive Disorder, a patient-group characterized by frequent cognitive intrusions (García-Montes, Pérez-Álvarez et al., 2006). Furthermore, higher scores on the metacognitive factors assessed by the MCQ seem to be associated both with emotional and psychological disturbance in general, as well as with proneness to psychotic experiences other than hallucinations, such as delusion proneness (Larøi & Van der Linden, 2005) and clinical and non-clinical paranoia (Fraser, Morrison, & Wells, 2006; García-Montes, Cangas, Pérez-Álvarez, Hidalgo, & Gutiérrez, 2005). Previous studies which have investigated the

association between metacognitive beliefs and hallucination-proneness might therefore lack validity if they have failed to control for important covariates including intrusive thoughts and other psychological symptoms. A primary objective of the present study was to test whether the metacognitive factors of the MCQ are indeed specifically associated with hallucination-proneness once the effect of intrusive thoughts and proneness to other psychotic symptoms (paranoia) has been considered.

In addition, this study also aimed to test whether hallucination-proneness is associated with other variables related to the monitoring and control of mental events. In a recent unpublished pilot study carried out by our research group, we found evidence for a large association ($r(109) = .56, p < .01$) between hallucination-proneness and the acting with awareness subscale of the Five Factors Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietmeyer, & Toney, 2006) in a relatively small sample of undergraduate students. The acting with awareness subscale of the FFMQ is essentially a measure assessing acting on "automatic pilot" and a disposition towards experiencing a degree of attentional disengagement from ongoing experiences (Baer et al., 2006; Baer et al., 2008; Carriere, Cheyne, & Smilek, 2008; Cheyne, Carriere, & Smilek, 2006). The characteristics of automaticity, absorption and attentional disruption intrinsic to this construct suggest that acting with awareness might overlap with certain features of dissociation (e.g. Mayer & Farmer, 2003) as suggested by the robust associations observed between this construct and other dissociative experiences measures in non-clinical samples (Baer et al., 2006; Michal et al., 2007). In turn, dissociation has been suggested to represent a vulnerability towards psychotic experiences in general (e.g. Allen, Coyne, & Console, 1997) and towards auditory hallucinations more specifically (Moskowitz & Corstens, 2007). Altman et al. (1997) found that dissociation significantly predicted hallucinatory

experiences in a small sample of adolescents with no history of psychotic disorders. A large relationship between absorption, dissociations and hallucination-proneness has been reported in non-clinical samples (Glicksohn & Barrett, 2003; Morrison & Petersen, 2003). Dissociative symptoms were also found to be robustly associated with the predisposition to auditory and visual hallucinations in PTSD patients and sexual assault survivors (Kilcommons & Morrison, 2005; Kilcommons, Morrison, Knight, & Lobban, 2008). Similarly, Perona-Garcelán et al. (2008) found a strong association between dissociation and hallucinations severity in a sample of psychotic patients.

The objective of the present study is therefore twofold. Firstly, we aimed to replicate and extend the results of our previous exploratory investigation into the relationship between acting with awareness and hallucination-proneness. Secondly, this study aimed to test whether hallucination-proneness is specifically associated with dysfunctional metacognitive beliefs and perturbed reality discrimination when the effect of comorbid symptoms is also taken into account. A two-phase design was adopted. In Phase 1, we screened a large sample of university student using measures of hallucination-proneness, frequency of cognitive intrusions, metacognitive beliefs, dispositional mindfulness (including measures of dissociation-like experiences) and paranoid ideation. In Phase 2, a factorial design was used to determined whether between-group differences in metacognitive variables (metacognitive beliefs and dispositional mindfulness) and reality discrimination performance (as assessed by a SDT task) could be uniquely attributed either to hallucination-proneness or to cognitive intrusions.

2.3 Method

Participants

In Phase 1, 388 students from Bangor University (122 males; M_{age} = 22.93, *SD* = 7.01) were screened on a battery of web-based questionnaires including: the revised Launay-Slade Hallucination Scale (LSHS-R; Bentall & Slade, 1985b), a measure of hallucination-proneness; the frequency subscale of the Distressing Thoughts Questionnaire (DTQ-F; Clark & de Silva, 1985), a measure of frequency of cognitive intrusions; and measures of paranoid ideation, metacognitive beliefs and dispositional mindfulness. From this larger sample, 67 participants (28 males M_{age} = 21.63, *SD* = 5.35) in four different groups were recruited for Phase 2, selected on the basis of their scores on the LSHS-R and DTQ-F. Group 1 (hallucination-prone individuals experiencing infrequent intrusive thoughts) included participants scoring in the upper tertile of the distribution of the LSHS-R and lower tertile of the distribution of DTQ-F scores (*n* = 11; 7 males; LSHS-R range = 34-48; DTQ-F range = 23-40). Group 2 (hallucination-prone individuals who frequently experience intrusive thoughts) included participants scoring in the upper tertiles of the distributions of both LSHS-R and DTQ-F scores (*n* = 23; 11 males; LSHS-R range = 37-51; DTQ-F range = 47-91). Group 3 (participants not prone to hallucinations experiencing frequent intrusive thoughts) included participants scoring in the lower tertile of the LSHS-R scores and upper tertile of DTQ-F scores (*n* = 13; 7 males; LSHS-R range = 14-24; DTQ-F range = 57-83). Group 4 (participants not prone to hallucinations who rarely experience intrusive thoughts) included participants scoring in the lower tertiles of both LSHS-R and DTQ-F scores (*n* = 20; 5 males; LSHS-R range = 12-21; DTQ-F range =12-36).

Table 2.1
Untransformed means and standard deviations for the self-reported measures (hallucination-proneness, intrusions, paranoid ideation, MCQ-30 and FFMQ subscales) and behavioural measures (perceptual sensitivity and response bias scores) of Phase 2.

	High hallucination proneness		Low hallucination proneness	
	low intrusions	high intrusions	low intrusions	high intrusions
Age	20.50 (3.87)	21.96 (7.08)	22.25 (3.06)	21.08 (2.98)
LSHS-R	38.64 (4.58)	41.87 (3.72)	17.10 (2.82)	19.76 (2.71)
DTQ-F	32.00 (4.82)	69.48 (11.45)	25.55 (5.72)	70.46 (9.24)
PADS-P	20.00 (7.38)	29.48 (8.41)	14.39 (3.52)	26.92 (8,73)
MCQ-UDT	8.36 (2.42)	13.09 (3.85)	8.70 (1.95)	13.42 (4.38)
MCQ-NCT	9.82 (4.42)	14.73 (4.94)	7.45 (1.43)	15.31 (5.15)
MCQ-CC	11.78 (3.52)	12.52 (4.13)	7.68 (2.13)	11.85 (6.48)
MCQ-CSC	14.36 (3.61)	17.22 (4.08)	10.95 (2.68)	14.62 (4.33)
MCQ-PB	10.33 (5.87)	11.19 (4.47)	9.32 (2.38)	12.15 (5.47)
FFMQ-O	28.64 (5.04)	28.59 (5.05)	23.00 (6.32)	23.38 (6.75)
FFMQ-A	27.67 (3.77)	28.96 (6.37)	17.55 (3.91)	22.55 (4.88)
FFMQ-D	28.45 (9.38)	20.87 (8.17)	27.75 (6.54)	20.08 (8.24)
FFMQ-NR	24.45 (4.51)	20.48 (4.38)	21.58 (4.61)	18.38 (4.33)
FFMQ-NJ	17.00 (7.21)	26.17 (6.18)	14.53 (5.59)	26.92 (7.73)
d' 1	1.17 (0.36)	1.08 (0.47)	1.12 (0.47)	1.22 (0.52)
d' 2	1.25 (0.41)	1.21 (0.51)	1.21 (0.52)	1.44 (0.37)
β 1	.07 (.44)	.18 (.30)	.16 (.35)	.32 (.41)
β 2	.10 (.43)	.08 (.32)	.36 (.31)	.41 (.34)

Note. d' 1 = perceptual sensitivity for the first run of the task; d' 2 = perceptual sensitivity for the second run of the task; β 1 = response bias for the first run of the task; β 2 = response bias for the second run of the task

All participants recruited for Phase 2 reported no hearing problem at the time of testing.

Descriptive statistics for these groups are displayed in Table 2.1. There were no significant group differences for age, $F(3, 63) = 0.33$, $p > .05$. Although group membership had a significant main effect on hallucination-proneness scores, $F(3, 63) = 243.07$, $p < .001$, there were no significant differences in LSHS-R scores between the two high hallucination-proneness groups (Tukey HSD = 2.67, $p > .05$) and between the two low hallucination-proneness groups (Tukey HSD = 3.23, $p > .05$).

Similarly, there was a significant main effect of group membership of cognitive intrusions frequency scores, $F(3, 63) = 127.36$, $p < .001$. However, no significant differences in DTQ-F scores were found between the two high frequency groups (Tukey HSD = 0.98, $p > .05$), and between the two low frequency groups (Tukey HSD = 6.45, $p > .05$). Seven participants (one from Group 1, four from Group 2, two from Group 3 and one from Group 4) reported to have used mental health services in the past.

Measures

The revised Launay-Slade Hallucination Scale (LSHS-R; Bentall & Slade, 1985b) is a widely used self-report scale of hallucination-proneness comprising 12 statements describing clinical as well as sub-clinical forms of auditory and visual hallucinations (e.g. "I have been troubled by hearing voices in my head"; "In my daydreams I can hear the sound of a tune almost as clearly as I was listening to it"). Participants are asked to rate the degree to which the content of each item applies to themselves on a 5-point Likert scale (1 = certainly does not apply; 5 = certainly applies). In this study, the LSHS-R had good internal consistency (Cronbach's α = .82).

The Frequency subscale of the Distressing Thoughts Questionnaire (DTQ-F; Clark & de Silva, 1985) is a self-report measure of frequency of intrusive thoughts with anxious and depressive content. The scale describes 12 types of intrusive thoughts (e.g. "Thoughts or images that something is, or may in the future, be wrong with my health"; "Thoughts or images that my future is bleak") which are rated according their frequency ("How often does this thought or image enter your mind?") on a 9-point Likert scale (1 = never; 9 = daily). The DTQ-F has been used to assess

intrusive thoughts in both clinical (i.e. psychiatric patients; Morrison & Baker, 2000) and non-clinical samples (i.e. undergraduate students; Clark & de Silva, 1985). The scale had good internal consistency in this sample (Cronbach's $\alpha = .86$)

The Persecution and Deservedness Scale (PADS; Melo, Corcoran, Shryane, & Bentall, 2009) is a self-report measure of paranoid ideation and deservedness of persecution comprising two 10-item subscales. The persecution subscale includes statements with persecutory content (e.g., "There are times when I worry that others might be plotting against me") which participants are required to rate on a 5-point Likert scale (0 = certainly false; 4 = certainly true). If participants score ≥ 2 on any persecution item, they are invited to rate on a 5-point Likert scale 10 associated items assessing deservedness of persecution (e.g. "Do you feel like you deserve others to plot against you?"). Separate total scores are calculated for the two subscales. Only the persecution subscale of the PADS was used in the present analysis. The Cronbach's α of the scale was .87 in this sample.

The short form of the Metacognitions Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004) assesses inter-individual differences in metacognitive beliefs and monitoring strategies and comprises a list of 30 statements, which participants are asked to rate on a 4-point Likert scale (1 = do not agree; 4 = agree very much). The items are grouped into five separate subscales: cognitive self-consciousness (MCQ-CSC; e.g. "I constantly examine my thoughts"); positive beliefs about worry (MCQ-PB; e.g. "Worry helps me to solve problems"); negative beliefs about the uncontrollability and danger of thoughts (MCQ-UDT; e.g. "I cannot ignore my worrying thoughts"); lack of cognitive confidence (MCQ-CC; e.g. "I do not trust my memory") and need to control one's own thought (MCQ-NCT; e.g. "Not being

able to control my thoughts is a sign of weakness"). All the subscales had acceptable internal consistency in this sample (Cronbach's αs ranging from .72 to .87).

The Five Factors Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item self-report questionnaire used to assess five different facets of mindful awareness: non-reactivity to inner experience (FFMQ-NR; e.g. "I perceive my feelings and emotions without having to react to them"), observing (FFMQ-O; e.g. "I pay attention to how my emotions affect my thoughts and behaviour"), acting-with-awareness (FFMQ-A; e.g. "I find it difficult to stay focused on what's happening in the present"), describing (FFMQ-D; e.g. "I am good at finding the words to describe my feelings") and non-judging of experience (FFMQ-NJ; e.g. "I tell myself I shouldn't be thinking the way I am thinking"). Participants are asked to rate the items using a 5-point Likert scale (1= never or very rarely true; 5 = very often or always true). The five subscales of the FFMQ demonstrated adequate to good internal consistency in this sample, with α coefficients ranging from .77 to .92.

The signal detection task developed by Barkus et al. (2007) was used as a measure of reality discrimination. The task consisted of two 8-min blocks, each comprising sixty 8-second epochs. Each epoch consisted of one 5-second bursts of white noise and 3 seconds of silence. During 60% of the bursts of white noise, a 1-second androgynous voice was presented in the middle second. A third of the time the voice was clearly audible to participants, whilst in the remaining epochs the voice was presented at auditory thresholds. Auditory thresholds were estimated by prior testing using 10 pilot participants in the same age-range of the experimental participants. Stimuli were presented through standard stereo headphones. After each burst of white noise, participants were requested to indicate whether they perceived a voice by pressing mouse buttons labelled "Yes" or "No" using their preferred hand. Four

measures were obtained: hits (positive responses given when the voice was present), false alarms (positive responses given when the voice was absent), misses (negative responses when the voice was present) and correct rejections (negative responses when the voice was absent). From the relationship between hits and false alarms, measures of perceptual sensitivity (d') and response bias (β) were calculated. Within the framework of SDT, a d' value of zero indicates complete inability to discriminate between signals and background noise, whereas higher d' scores indicate better capacity to readily detect true signals. Conversely, any β score lower than 1 suggests a bias towards the detection of signals when no signal is present, whereas scores equal to 1 indicate no response bias. The computational methods used to estimate d' and β in the present study are described in detail by Barkus et al. (2007).

Procedure

In Phase 1, an e-mail invitation to complete a web-based survey was sent to the student population of Bangor University. The survey comprised a battery of questionnaires including a brief demographic questionnaire, the three symptoms measures (LSHS-R, PADS and DTQ-F) and the two metacognitive questionnaires used in this study (MCQ-30 and FFMQ). In addition, the respondents were invited to disclose their contact details so that they could be invited to take part to in a paid follow-up study if eligible. In Phase 2, students who met the inclusion criteria and who agreed to be contacted for further testing were approached. Participants were tested individually in a quiet room in the Bangor University School of Psychology. After giving informed consent, they were asked to read a set of standardised instructions and complete the SDT task. The task was described as a simple hearing test. Afterwards, they were fully debriefed and received either £6 or course credits for their participation.

2.4 Results

Prior to the analysis, the Phase 1 data were examined for fit between their distribution and the assumptions of parametric analysis. No severe deviation from normality was found for any of the FFMQ subscales. However, inspection of the distribution histograms revealed that the LSHS-R, DTQ-F, PADS and MCQ-30 subscales scores were positively skewed. After square root transformation, DTQ-F and PADS were found to be normally distributed and were therefore used in subsequent analyses. Several data transformation for positively skewed data were carried out to attempt to normalise LSHS-R and MCQ-30 scores, but these did not lead to any improvement in the scores distribution. These variables were therefore retained untransformed for subsequent analyses[1].

2.4.1 Correlational analysis and multiple regressions for self-reported measure of Phase 1

The global associations between hallucination-proneness, frequency of cognitive intrusions, paranoid ideation, MCQ-30 subscales and FFMQ subscales were explored using Spearman's r_s (see Table 2.2). In addition, partial correlations were also conducted using the Kendall's τ_p partial coefficient for rank correlation (Gibbons

[1] To establish the impact of the contemporary inclusion of transformed as well as non-transformed variables, hierarchical regression analyses were also carried out including only non-transformed measures. This had no substantial effect on the pattern of the results reported.

Table 2.2

Non-parametric correlations between the self-report measures

	PADS sqrt	DTQ-F sqrt	MCQ UDT	MCQ NCT	MCQ CSC	MSQ CC	MCQ PB	FFMQ O	FFMQ A	FFMQ D	FFMQ NR	FFMQ NJ
LSHS-R	.40**	.43**	.38**	.27**	37**	.32**	.08	.32**	.46**	-.15**	-.07	.33**
PADSsqrt		.60**	.56**	.41**	.34**	.36**	.30**	.01	.33**	-.30**	-.25**	.52**
DTQ-Fsqrt			.56**	.38**	.38**	.33**	.18**	.15**	.40**	-.28**	-.22	.57**
MCQ-UDT				.40**	.41**	.34**	.29**	.13**	.30**	-.19**	-37**	.58**
MCQ-NCT					.32**	.29**	.23**	.05	.12*	-.11*	-.09	.52**
MCQ-CSC						.21**	.22**	.39**	.19**	.01	.02	.35**
MCQ-CC							.21**	-.05	.38**	-.29**	-.06	.29**
MCQ-PB								-.01	.03	-.06	.08	.13*
FFMQ-O									.09	.14**	.21**	.16**
FFMQ-A										-.30**	-.12*	.27**
FFMQ-D											.23**	-.26**
FFMQ-NR												-.20**

Notes. * $p < .05$, ** $p < .01$; PADSsqrt = square-root transformed scores of the persecution subscale of the PADS; DTQ-Fsqrt = square-root transformed DTQ-F scores (frequency of intrusive thoughts); The number of observations on which correlation coefficients have been calculated varied between 326 and 370 because of missing data.

& Chakraborti, 2003; Johnson & Wichern, 2002) to investigate the association between hallucination-proneness and frequency of cognitive intrusions when controlling for the paranoia scores, and between paranoia and intrusions when controlling for hallucinatory predisposition.

Hallucination-proneness was found to be significantly associated with both cognitive intrusions and paranoid ideation. However, the strength of the association between hallucination-proneness and frequency of intrusions was relatively small when compared to the association between intrusions and paranoia. The results revealed that when controlling for hallucination-proneness, paranoid ideation was still moderately associated with cognitive intrusions, τ_p (315) = .31, $p < .001$. Conversely, when the effect of paranoid ideation was controlled for, only a small-sized association between hallucination-proneness and cognitive intrusions was observed, τ_p (315) = .11, $p < .001$. Overall, these results suggest that anxious-depressive intrusive cognitions might be more associated with paranoid ideation than hallucination-proneness.

As shown in Table 2.2, hallucination-proneness was found to be significantly associated with all the other self-reported measures, except positive beliefs about worry and non-reactivity to inner experience. Hierarchical multiple regression was used to further investigate whether these apparent associations are symptom-specific. Specifically, sequential regression was carried out to test whether the factors of the MCQ-30 and the subscales of the FFMQ improved prediction of hallucination-proneness scores after statistically controlling for the other symptoms measures. Only variables that were significantly associated with LSHS-R scores in the correlational analysis reported above were selected as predictors. A residuals analysis using graphical methods was conducted to test the assumptions of multivariate normality,

linearity and homoscedasticity between predicted values and errors of prediction. Although several predictors were not normally distributed, the residuals scatterplot and normality-plot revealed that the assumption of linearity and multivariate normality had been met. The scatterplot also showed no evidence of serious heteroscedasticity despite the presence of skewed variables amongst the selected predictors. Screening of the standardized residuals found no evidence of suspected outliers in the dataset.

After step 1, with square-root transformed paranoia and frequency of intrusions scores entered in the equation, $R^2 = .23$, $F\,(2, 281) = 41.01$, $p < .001$, indicating that these symptom measures accounted for 23% of the variance in hallucination-proneness. After step 2, with all the MCQ-30 subscales but positive beliefs about worry in the equation, $R^2 = .25$, $F\,(4, 277) = 2.25$, $p = .063$, indicating that the addition of the MCQ-30 scales did not improve reliably the prediction of hallucination-proneness scores. Finally, after the inclusion all the subscales of the FFMQ except non-reactivity to inner experience, $R^2 = .40$, $F\,(2, 273) = 17.29$, $p < .001$, indicating that the addition of the FFMQ subscales to the equation significantly improved the prediction of LSHS-R scores. The summary regression statistics for the three steps are displayed in Table 2.3. The results indicate that in the final model only paranoid ideation, observing and acting with awareness significantly predicted hallucination-proneness. Between those three factors, however, acting with awareness represented the best predictor of LSHS-R scores as indicated by the squared semi-partial correlations, followed, in order of importance, by observing and paranoid ideation. Despite cognitive self-consciousness significantly predicting hallucination-proneness in step 2, after the inclusion of the FFMQ measures none of the subscales of the MCQ-30 significantly predicted hallucination-proneness.

Table 2.3
Summary of sequential regression analysis for variables predicting hallucination-proneness (N = 275)

Variable	*B*	*SE B*	β	sr^2(unique)
Step 1				
Constant	-7.47	2.82		
DTQsqrt	1.90	0.45	.28***	.050
PADSsqrt	2.52	0.67	.24***	.037
Step 2				
Constant	-7.27	2.99		
DTQsqrt	1.37	0.49	.20**	.021
PADSsqrt	2.02	0.74	.20**	.021
MCQ-UDT	0.20	0.14	.10	.005
MCQ-NCT	-0.09	0.16	-.04	.001
MCQ-CSC	0.25	0.11	.13*	.013
MCQ-CC	0.09	0.12	.04	.001
Step 3				
Constant	-20.61	3.74		
DTQsqrt	0.69	0.47	.10	.005
PADSsqrt	2.04	0.67	.20**	.020
MCQ-UDT	0.21	0.13	.11	.006
MCQ-NCT	0.19	0.15	.08	.004
MCQ-CSC	0.06	0.11	.03	.001
MCQ-CC	-0.05	0.11	-.02	.001
FFMQ-D	0.22	0.06	.02	.001
FFMQ-NJ	-0.11	0.08	-.01	.005
FFMQ-A	0.48	0.08	.35***	.086
FFMQ-O	0.35	0.07	.25***	.048

* $p < .05$. ** $p < .01$. *** $p < .001$

A second hierarchical regression was conducted to determine whether the metacognitive measures collected in this study improved the prediction of paranoid ideation scores beyond the intrusions frequency and hallucination-proneness. As above, the selection of the predictors was informed by the correlational analysis reported earlier. The inspection of the residuals scatterplot suggested that the assumptions of linearity, homoscedasticity and multivariate normality had not been violated. Screening of the standardized residuals revealed the presence of one extreme

case more than 3 standard deviations away from the mean. However, the examination of other residuals statistics (adjusted predicted values, Cook's distance and Mahalanobis distance using a $p < .001$ criterion) revealed that this extreme case did not exert undue influence over the regression parameters, and was therefore retained in the dataset.

After LSHS-R and square-root transformed cognitive intrusions scores were entered in the equation in step 1, $R^2 = .41$, $F(2, 276) = 98.14$, $p < .001$, indicating that the frequency of cognitive intrusions and hallucination-proneness accounted for 41% of the variance in paranoid ideation scores. After step 2, with the five MCQ-30 subscales in the equation, $R^2 = .50$, $F(5, 271) = 9.55$, $p < .001$, indicating that the addition of the metacognitive factors assessed by the MCQ-30 reliably improved the prediction of paranoia. After the inclusion of all the subscales of the FFMQ but observing, $R^2 = .52$, $F(4, 267) = 2.36$, $p = .053$ suggesting that improvement in variance explained by the model after the addition of the FFMQ scales was only marginally significant. The summary regression statistics for this analysis are shown in Table 2.4. In each step of the analysis, the frequency of cognitive intrusions was the best predictor of paranoid ideation. Hallucination-proneness was also found to be a significant predictor of paranoid ideation at each step. Amongst the metacognitive factors of the MCQ-30, negative beliefs about the uncontrollability of thoughts, beliefs about the importance of controlling thoughts and positive beliefs about worry were found to predict reliably square-root transformed PADS scores. None of the FFMQ subscales were found to predict paranoid ideation, although non-reactivity to inner experience approached statistical significance ($p = .053$).

Table 2.4
Summary of sequential regression analysis for variables predicting paranoid ideation (N = 279)

Variable	*B*	*SE B*	β	sr^2 (unique)
Step 1				
Constant	2.02	.21		
DTQsqrt	0.35	.03	.53***	.226
LSHS-R	0.02	.01	.20***	.031
Step 2				
Constant	1.81	.21		
DTQsqrt	0.22	.04	.34***	.065
LSHS-R	0.01	.01	.16***	.019
MCQ-UDT	0.04	.01	.21***	.026
MCQ-NCT	0.03	.01	.11*	.010
MCQ-CSC	-0.01	.01	-.02	.001
MCQ-CC	0.01	.01	.06	.003
MCQ-PB	0.02	.01	.12*	.012
Step 3				
Constant	2.41	.34		
DTQsqrt	0.19	.04	.29***	.040
LSHS-R	0.01	.01	.16**	.016
MCQ-UDT	0.03	.01	.13*	.007
MCQ-NCT	0.03	.01	.11*	.007
MCQ-CSC	0.01	.01	.01	.001
MCQ-CC	0.01	.01	.05	.002
MCQ-PB	0.03	.01	.14**	.017
FFMQ-D	-0.01	.01	-.06	.003
FFMQ-A	0.01	.01	.07	.003
FFMQ-NJ	0.01	.01	.02	.001
FFMQ-NR	-0.02	.01	-.10	.007

* $p < .05$. ** $p < .01$. *** $p < .001$

2.4.2 Between group-differences in reality discrimination and metacognitive variables

The behavioural data from Phase 2 were used to investigate group differences in reality discrimination performance, and to determine whether perturbed reality discrimination is specifically associated with hallucination-proneness rather than

cognitive intrusions. In addition, the self-report metacognitive measures collected during Phase 1 were used to investigate group differences in specific metacognitive variables associated with hallucination proneness and cognitive intrusions.

A mixed design ANOVA was conducted on d' scores using hallucination proneness (high and low) and intrusions frequency (high and low) as between-subjects factors and task repetition (first run and second run) as within-subjects variable. There was a significant main effect of task repetition on the measures of perceptual sensitivity, $F(1, 63) = 6.77$, $p < .05$, partial $\eta^2 = .10$ indicating that the participants' capacity to detect signals in the noise generally increased over the course of the task. No significant main effect was found for hallucination-proneness, $F(1, 63) = 2.69$, $p > .05$, partial $\eta^2 = .04$ or for intrusion frequency $F(1, 63) = 0.07$, $p > .05$, $r = .03$ partial $\eta^2 = .01$, indicating that the participants' ability to detect the signals presented was not affected either by their predisposition to hallucinate or by their disposition to experience intrusive thoughts. No significant interaction between hallucination-proneness and intrusion frequency was found $F(1, 63) = 0.25$, $p > .05$, partial $\eta^2 = .01$. Similarly, there was no significant interaction between task repetition and hallucination-proneness, $F(1, 63) = 1.5$, $p > .05$, partial $\eta^2 = .02$, or between task repetition and intrusions frequency, $F(1, 63) = 0.14$, $p > .05$, partial $\eta^2 = .01$. The task repetition x hallucination-proneness x intrusion frequency interaction was also nonsignificant, $F(1, 63) = 0.46$, $p > .05$, partial $\eta^2 = .01$.

The same analysis was conducted to examine the effect of hallucination-proneness, intrusions frequency and task repetition on response bias scores. There was no significant main effect of task repetition, $F(1, 63) = 2.49$, $p > .05$, partial $\eta^2 = .04$ indicating that overall response bias scores in different runs of the task did not differ significantly. A significant main effect for hallucination-proneness was found, $F(1,$

63) = 5.95, $p < .05$, partial $\eta^2 = .09$, indicating that hallucination-prone subjects presented significantly lower response bias scores . The effect of intrusions frequency and the interaction between hallucination-proneness and intrusions frequency were not significant, $F(1, 63) = 0.78$, $p > .05$, partial $\eta^2 = .01$, and $F(1, 63) = 0.12$, $p > .05$, partial $\eta^2 = .01$ respectively. The interaction between task repetition and frequency of intrusive thoughts was not significant $F(1, 63) = 2.71$, $p > .05$, partial $\eta^2 = .04$. However, there was a significant interaction effect between hallucination-proneness and task repetition $F(1, 63) = 6.37$, $p < .05$, partial $\eta^2 = .09$, indicating that hallucination-proneness affected β scores differently in the two repetitions of the task. Simple effects analysis with Bonferroni correction to adjust for multiple comparisons was conducted to decompose this effect. There was no significant difference between hallucination-prone subjects and participants not prone to hallucinations on response bias scores in the first run of the task (mean difference .08, $p = .37$). On the other hand, a significant between-group difference on response bias scores was found in the second run of the task (mean difference .29, $p < .001$). When response bias scores from the two repetitions of the task were compared within each group, we found that subjects not prone to hallucinations presented significantly higher β scores in the second run of the task (mean difference .15, $p < .01$). Conversely, there was no significant difference on response bias scores between repetitions of the task for hallucination-prone subjects (mean difference -.05, $p = 25$).

A correlational analysis was carried out to examine the association between reality discrimination performance and the metacognitive measures collected in the first phase of this study. Response bias scores for the first run of the task were not associated with any of the metacognitive measures. Conversely, β scores for the second run were significantly associated with several variables, including lack of

Table 2.5
Structure (loading) matrix showing the relative contribution of the different predictors to the discriminant functions

Predictor	Function 1 (Intrusions)	Function 2 (Hallucination-proneness)
FFMQ-NJ	.67*	-.10
MCQ-NCT	.60*	.01
MCQ-CSC	.51*	.28
MCQ-UDT	. 46*	-.08
FFMQ-A	.43	.61*
FFMQ-O	.21	.37*
FFMQ-NR	.20	.25
MCQ-PB	.16	.01
MCQ-CC	.25	.23
MCQ-D	-.28	.10

* Largest absolute correlation between the predictor and the discriminat functions

cognitive confidence, $r(67) = -.32$, $p < .01$; acting with awareness, $r(64) = -.29$, $p < .01$ and cognitive self-consciousness $r(67) = -.26$, $p < .05$.

A 2 (hallucinations proneness) x 2 (frequency of intrusions) multivariate analysis of variance (MANOVA) was carried out to test for between-groups differences on the metacognitive variables. Inspection of the Box's *M* test revealed that the assumption of homogeneity of variance-covariance matrices had been violated, $F(55, 3730.97) = 1.54$, $p < .01$. Therefore, Pillai's criterion was used to test for significance in the multivariate test, given its relative robustness in these circumstances (Tabacknick & Fidell, 2007). A significant main effect was found for both frequency of intrusive thoughts, $F(10, 42) = 7.86$, $p < .01$, partial $\eta^2 = .65$, and hallucination-proneness, $F(10, 42) = 5.1$, $p < .01$, partial $\eta^2 = .55$. However, the interaction between the two factors was not significant, $F(10, 42) = 0.35$, $p > .05$, partial $\eta^2 = .08$.

A direct discriminant analysis was conducted to follow-up the MANOVA significant main effects and to test whether different combinations of the

metacognitive variables could predict group membership reliably. Three functions were calculated. For the combination of the three variates, χ^2 (30, N = 55) = 91.99, p < .01, indicating that the first function discriminated significantly among groups. After removal of the first function, χ^2 (18, N = 55) = 39.98, p < .01, indicating that also the second function discriminated reliably amongst groups. After the removal of the second function, χ^2 (8, N = 55) = 2.23, p > .05, suggesting that the third variate did not discriminate reliably among groups.

The two significant discriminant functions accounted for 61.2% and 37.3% of the total between-group variability, with canonical R^2 of .67 and .55 respectively. The first variate discriminated between the high and low cognitive intrusions groups, whereas the second function maximally separated hallucination-prone groups from the non-prone groups. The structure matrix of correlations between the predictors and the discriminant functions (Table 2.5) indicated that, using the conventional cut-off point of .33 (Tabacknick & Fidell, 2007), the best predictors for distinguishing between high and low frequency of intrusion groups are non-judgment, need to control thoughts, cognitive self-consciousness and beliefs about the uncontrollability and danger of thoughts. Conversely, the dimension along which the hallucination-prone and non-prone groups differ is primarily associated with self-report measures of acting with awareness and observing. Of the usable 55 cases considered in this analysis (12 cases had at least one missing discriminating variable), 44 (80 %) were correctly classified, compared to 15.39 (27.98%) that would be correctly classified by chance alone.

2.5 Discussion

The results from Phase 1 of this study revealed a robust correlation between hallucination proneness and negative cognitive intrusions, replicating previous studies which have observed that hallucinations and hallucination-proneness are significantly associated with intrusive thoughts (Jones & Fernyhough, 2006, 2009; Morrison & Baker, 2000). However, the results from partial correlation and multiple regression analyses revealed that this association is relatively small compared to the association between intrusions and paranoid ideation. Frequency of cognitive intrusions was, in fact, the best predictor of paranoid ideation in each step of the multiple regression analysis carried out in this study. On the other hand, cognitive intrusions did not reliably predict hallucination-proneness in the final step of the analysis, once paranoia had been controlled for. Therefore, despite the initial correlation observed, these results suggest that intrusive thoughts play a more significant role in paranoid beliefs than hallucinations. An observation that helps to clarify this finding emerged from the methodology we used in the second phase of this study. Despite the positive correlation initially observed between intrusions frequency and hallucination-proneness during screening, we were able to identify a small number of hallucination-prone individuals who experienced infrequent intrusive thoughts, again suggesting that the predisposition to auditory and visual hallucinations is independent from the experience of intrusive thoughts, which is at odds with the predictions of the heuristic model of Morrison et al. (1995). On the other hand, it is worth noting that the reality discrimination account of hallucinations does not make any assumption regarding the nature of the cognitive events that might be misattributed to an external source. This model predicts that hallucination-prone individuals are characterized by a cognitive bias towards the externalization of certain internally generated cognitive events regardless of their origin (e.g. intrusive thoughts, portions of internal speech or other

internal cognitions alike). This model can therefore account for the existence of individuals prone to hallucinations who, nonetheless, experience infrequent intrusive thoughts.

A related cluster of findings from this study concerns the association between hallucination-proneness and metacognitive beliefs. Our regression analysis revealed that the metacognitive factors of the MCQ-30 were able to account for only a 2% increase in the explained variance in LSHS-R scores beyond that already accounted for by paranoia and intrusions frequency. Regarding the specific subscales of the MCQ-30, only cognitive self-consciousness significantly contributed to the prediction of hallucination-proneness once the effects of cognitive intrusions and paranoid ideation has been statistically controlled for in sequential regression. Consistent with this finding, Jones and Fernyhough (2006) also reported that, after controlling for intrusiveness of thoughts, cognitive self-consciousness was the most substantial predictor of hallucination-proneness among the MCQ-30 subscales. However, it is noteworthy that in the final step of our analysis, with the different subscales of the FFMQ also entered in the equation, even cognitive self-consciousness did not survive as a predictor. It seems possible, therefore, that many of the apparent associations between meta-cognitive beliefs and hallucinations observed in previous studies were in fact artifactual and caused by the failure to take into account the confounding effects of paranoia and intrusive thinking.

Conversely, as a set of predictors, the subscales of the MCQ-30 were able to explain a significant proportion of variance on paranoid ideation beyond the contribution given by cognitive intrusions and hallucination-proneness. Also, in our multiple regression analysis, negative beliefs about the uncontrollability of thoughts and associated danger, positive beliefs about worry and beliefs about the importance

of controlling thoughts reliably predicted paranoia scores. This result is perhaps not surprising, as previous research has associated both clinical and nonclinical paranoia with dysfunctional strategies for avoiding negative thoughts about the self (Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Udachina et al., 2009).

With respect to the FFMQ, as expected, we found evidence for a strong association between hallucination-proneness and acting with awareness. Indeed, acting with awareness was the variable most strongly associated with hallucination-proneness, and it accounted for a large proportion of unique variance in LSHS-R beyond that afforded by other predictors already entered in earlier regression steps (i.e. intrusive thoughts, paranoia and metacognitive beliefs). These results are therefore consistent with the findings of recent studies which found evidence for a relationship between dissociative-states and hallucination-proneness in both clinical and non clinical samples. The observing subscale of the FFMQ also significantly predicted LSHS-R scores in the same analysis, suggesting that the hallucination-proneness is related to higher predisposition to attend to sensations, thoughts and perceptions, again implying a relationship between hallucination-proneness and heightened self-focused attention. This finding is consistent with the results of previous studies which have observed an association between hallucinations and self-focused attention (Morrison & Haddock, 1997; Perona-Garcelán et al., 2008; Startup, Startup, & Sedgman, 2008) and helps to explain why only the self-consciousness subscale of the MCQ-30 showed any specific association with hallucination-proneness.

Our factorial design in Phase 2 led to findings that were largely consistent with those already described. Specifically, the result from discriminant analysis revealed that only acting with awareness and observing could reliably discriminate between

hallucination-prone participants and those who were not hallucination-prone. The findings from discriminant analysis also indicated that groups reporting different frequencies of cognitive intrusions were reliably separated by a set of metacognitive measures which included MCQ-30 subscales (uncontrollability and danger of thoughts, need to control thoughts and cognitive self-consciousness) and the non-judgment subscale of the FFMQ. Hence cognitive intrusions were associated with responses characterized by negative appraisal of thoughts as well as the deliberate attempt to monitor and control thoughts but these variables were mostly unrelated to hallucination-proneness.

As expected, we found evidence suggesting that performance on the SDT task was related to hallucination-proneness, but not to frequency of cognitive intrusions. therefore replicating previous evidence of disrupted reality discrimination in hallucination-prone subjects (Barkus et al., 2007; Bentall & Slade, 1985a; Rankin & O'Carroll, 1995). In contrast with previous studies, we found evidence for an effect of task repetition on task performance. Specifically, the participants' capacity to detect signals in the noise generally increased over the course of the task, a finding not observed by Barkus et al. (2007) using an identical task. Furthermore, simple effect analysis for the significant task-repetition × hallucination-proneness interaction revealed significant between-group differences on β scores in the second run of the task, but not for the first run of the task. Whilst response bias scores of the hallucination-prone groups remained relatively unchanged over the course of the task, participants not prone to hallucinations made more conservative responses over time. The cause for the discrepancies between the results obtained in this study and those reported by Barkus et al. are not clear. One possibility is that this might reflect differences in the way that the auditory thresholds were set. In both studies, thresholds

were estimated by administering an auditory test to 10 pilot participants in the same age-range of the experimental subjects, but this was not an exact procedure. If the present task was more difficult than Barkus et al's version, participants might have initially adopted a lax criterion to detect voices in the noise regardless of their hallucinatory predisposition. As the task progressed and participants adapted to it (as indicated by the significant mean effect of task repetition on perceptual sensitivity scores), participants not prone to hallucinations may have adopted a more conservative criterion. Conversely, no change in the bias scores of hallucination-prone subjects was observed over the course of the task.

Consistent with this interpretation, significant associations between task performance and the self-reported measures collected in Phase 1 were only observed for the second run of the task. The negative associations found between acting with awareness and response bias scores as well as between cognitive self-consciousness and response bias scores indicated that individuals experiencing frequent dissociation-like states and attentional self-focus had a greater disposition to commit false alarms. This intriguing result might indicate that dissociative-experiences and self-focused attention are associated with perturbed reality discrimination. The findings from this study also suggested that increased lack of cognitive confidence was associated with lower response bias scores, a finding consistent with previous studies which suggest that cognitive confidence might be associated with perturbed source monitoring (Larøi, Collignon, & Van der Linden, 2005; Larøi et al., 2004).

Several limitations of this study should be mentioned. Most importantly, our participants were students selected according to their scores on questionnaires, rather than psychiatric patients. Studies investigating metacognitive dysfunction (both metacognitive beliefs and reality discrimination) in hallucination-prone students have

typically obtained findings comparable to those from clinical samples (e.g. Bentall & Slade, 1985a; Morrison et al., 2000). Nonetheless, it will be important to replicate the present findings with patient samples to evaluate their generalizability to clinical populations. A second limitation is that our measures of mindfulness and attention-related processes were entirely self-report. Therefore, it would be useful to expand these results using behavioural paradigms designed to investigate attentional effects consistent with the constructs considered in this study. In addition, although previous studies have suggested a marked affinity between acting with awareness and other dissociation measures (e.g. Michal et al., 2007), it would be desirable to replicate these findings using other validated measures of dissociation (e.g. the Dissociative Experiences Scale; Bernstein & Putman, 1986).

Taken as a whole, this study suggests that the metacognitive beliefs previously found to be associated with hallucination-proneness may represent a response to cognitive intrusions rather than a specific vulnerability to experience auditory and visual hallucinations. The findings also suggest that intrusive negative thoughts and abnormal metacognitive beliefs are more associated with paranoid thinking than hallucination-proneness whereas hallucination-proneness appears to be more related to reality discrimination and abnormalities in the domain of dissociation and attention. As dissociation is a known consequence of trauma, this finding may help to explain an apparently specific relationship between trauma and hallucinations (e.g. Hammersley et al., 2003; Shevlin, Dornahy, & Adamson, 2007).

An important methodological implication of the present findings is that studies of the cognitive and affective processes in psychosis should always control for comorbid symptoms. In the present case, a widely accepted view that hallucinations are associated with metacognitive beliefs has been challenged by controlling for

intrusive thoughts and paranoia. In a previous study, an apparent relationship between insecure attachment and hallucinations (Berry, Wearden, Barrowclough, & Liversidge, 2006) was shown to disappear when controlling for paranoia, so that insecure attachment was specifically associated with paranoid thinking (Pickering, Simpson, & Bentall, 2008). It has been argued that an entirely satisfactory account of psychosis might be constructed by considering the role of specific psychological processes in specific symptoms (Bentall, 2003) but, clearly, this project will require careful consideration of the covariation between symptoms.

References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Allen, J. G., Coyne, L., & Console, D. A. (1997). Dissociative detachment relates to psychotic symptoms and personality decompensation. *Comprehensive Psychiatry, 38*(6), 327-334.

Altman, H., Collins, M., & Mundy, P. (1997). Subclinical hallucinations and delusions in nonpsychotic adolescents. *Journal of Child Psychology and Psychiatry, 38*(4), 413-420.

Baer, R. A., Smith, G. T., Hopkins, J., Krietmeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietmeyer, J., Sauer, S., et al. (2008). Construct validity of the Five Factors Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329-342.

Baker, C. A., & Morrison, A. P. (1998). Cognitive processes in auditory hallucinations: Attributional bias and metacognition. *Psychological Medicine, 28*(5), 1199-1208.

Barkus, E., Stirling, J., Hopkins, R., McKie, S., & Lewis, S. (2007). Cognitive and neural processes in non-clinical auditory hallucinations. *British Journal of Psychiatry, 191*(51), s76-s81.

Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucinations. *Psychological Bulletin, 107*(1), 82-95.

Bentall, R. P. (2003). *Madness explained: Psychosis and the human nature*. London: Penguin Books Ltd.

Bentall, R. P., Corcoran, R., Howard, R., Blackwood, N., & Kinderman, P. (2001). Persecutory delusions: A review and theoretical integration. *Clinical Psychology Review, 21*(8), 1143-1192.

Bentall, R. P., & Slade, P. (1985a). Reality testing and auditory hallucinations: A signal detection analysis. *British Journal of Clinical Psychology, 24*(3), 159-169.

Bentall, R. P., & Slade, P. (1985b). Reliability of a scale measuring disposition towards hallucination: a brief report. *Personality and Individual Differences, 6*(4), 527-529.

Bernstein, E. M., & Putman, F. W. (1986). Development, reliability and validity of a dissociation scale. *Journal of Nervous and Mental Disease, 174*(12), 727-735.

Berry, K., Wearden, A., Barrowclough, C., & Liversidge, T. (2006). Attachment styles, interpersonal relationships and psychotic phenomena in a non-clinical student sample. *Personality and Individual Differences, 41*(4), 707-718.

Carriere, J. S. A., Cheyne, J. A., & Smilek, D. (2008). Everyday attention lapses and memory failures: The affective consequences of mindlessness. *Consciousness and Cognition, 17*(3), 835-847.

Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The meta-cognitions questionnaire and its correlates. *Journal of Anxiety Disorders, 11*(3), 279-296.

Cheyne, J. A., Carriere, J. S. A., & Smilek, D. (2006). Absent-mindedness: Lapses in conscious awareness and everyday cognitive failures. *Consciousness and Cognition, 15*(3), 578-592.

Clark, D. A., & de Silva, P. (1985). The nature of depressive and anxious intrusive thoughts: distinct or uniform phenomena? *Behaviour Research and Therapy, 23*(4), 383-393.

Clark, D. A., & Purdon, C. (1995). The assessment of unwanted intrusive thoughts: A review and critique of the literature. *Behaviour Research and Therapy, 33*(8), 967-976.

Ditman, T., & Kuperberg, G. R. (2005). A source-monitoring account of auditory verbal hallucinations in patients with schizophrenia. *Harvard Review of Psychiatry, 13*(5), 280-299.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Stanford: SUP.

Flavell, J. H. (1979). Metacognition and cognitive monitoring. *American Psychologist, 34*(10), 906-911.

Fraser, J., Morrison, A. P., & Wells, A. (2006). Cognitive precesses, reasoning biases and persecutory delusions: A comparative study. *Behavioural and Cognitive Psychotherapy, 34*(4), 421-435.

García-Montes, J. M., Cangas, A., Pérez-Álvarez, M., Fidalgo, A. M., & Gutiérrez, O. (2006). The role of meta-cognition and thought control techniques in predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 45*(3), 309-317.

García-Montes, J. M., Cangas, A., Pérez-Álvarez, M., Hidalgo, Á. M., & Gutiérrez, O. (2005). Influence of metacognitive variables on paranoid ideation. *International Journal of Clinical and Health Psychology, 5*(3), 463-469.

García-Montes, J. M., Pérez-Álvarez, M., Balbuena, C. S., Garcelán, S. P., & Cangas, A. (2006). Metacognitions in patients with hallucinations and obsessive-

compulsive disorder: The superstition factor. *Behaviour Research and Therapy, 44*(8), 1091-1104.

Gibbons, J. D., & Chakraborti, S. (2003). *Nonparametric statistical inference* (4th ed.). New York: Marcel Dekker.

Glicksohn, J., & Barrett, T. R. (2003). Absorption and hallucinatory experience. *Applied Cognitive Psychology, 17*(7), 833-849.

Hammersley, P., Dias, A., Todd, G., Bowen-Jones, K., Reilly, B., & Bentall, R. P. (2003). Childhood trauma and hallucinations in bipolar affective disorder: preliminary investigation. *British Journal of Psychiatry, 182*(6), 543-547.

Johnson, R. A., & Wichern, D. W. (2002). *Applied multivariate statistical analysis* (5th ed.). Upper Saddle River, N.J: Prentice Hall.

Jones, S. R., & Fernyhough, C. (2006). The role of thought suppression and metacognitive beliefs in proneness to auditory verbal hallucinations in a non-clinical sample. *Personality and Individual Differences, 41*(8), 1421-1432.

Jones, S. R., & Fernyhough, C. (2009). Rumination, reflection, intrusive thoughts, and hallucination-proneness: Towards a new model. *Behaviour Research and Therapy, 47*, 54-59.

Kilcommons, A. M., & Morrison, A. P. (2005). Relationships between trauma and psychosis: An exploration of cognitive and dissociative factors. *Acta Psychiatrica Scandinavica, 112*, 351-359.

Kilcommons, A. M., Morrison, A. P., Knight, A., & Lobban, F. (2008). Psychotic experiences in people who have been sexually assaulted. *Social Psychiatry and Psychiatric Epidemiology, 43*(8), 602-611.

Larøi, F., Collignon, O., & Van der Linden, M. (2005). Source-monitoring for actions in hallucinations proneness. *Cognitive Neuropsychiatry, 10*(2), 105-123.

Larøi, F., & Van der Linden, M. (2005). Metacognitions and proneness towards hallucinations and delusions. *Behaviour Research and Therapy, 43*(11), 1425-1441.

Larøi, F., van der Linden, M., & Marczewski, P. (2004). The effects of emotional salience, cognitive effort and meta-cognitive beliefs on a reality monitoring task in hallucination-prone subjects. *British Journal of Clinical Psychology, 43*(3), 221-233.

Lobban, F., Haddock, G., Kinderman, P., & Wells, A. (2002). The role of metacognitive beliefs in auditory hallucinations. *Personality and Individual Differences, 32*(8), 1351-1363.

Mayer, J. L., & Farmer, R. F. (2003). The development and psychometric evaluation of a new measure of dissociative activities. *Journal of Personality Assessment, 80*(2), 185-196.

Melo, S., Corcoran, R., Shryane, N., & Bentall, R. P. (2009). The persecution and deservedness scale. *Psychology and Psychotherapy: Theory, Research and Practice, 82*(3), 247-260.

Michal, M., Beutel, M. E., Jordan, J., Zimmermann, M., Wolters, S., & Heidenreich, T. (2007). Depersonalization, mindfulness, and childhood trauma. *Journal of Nervous and Mental Disease, 195*(8), 693-696.

Morrison, A. P., & Baker, C. A. (2000). Intrusive thoughts and auditory hallucinations: A comparative study of intrusions in psychosis. *Behaviour Research and Therapy, 38*(11), 1097-1106.

Morrison, A. P., & Haddock, G. (1997). Self-focused attention in schizophrenic patients with and without auditory hallucinations and normal subjects: A comparative study. *Personality and Individual Differences, 23*(6), 937-941.

Morrison, A. P., Haddock, G., & Tarrier, N. (1995). Intrusive thoughts and auditory hallucinations: A cognitive approach. *Behavioural and Cognitive Psychotherapy, 23*(3), 265-280.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Morrison, A. P., & Wells, A. (2003). A comparison of metacognition in patients with hallucinations, delusions, panic disorder, and non-patients controls. *Behaviour Research and Therapy, 41*(2), 251-256.

Morrison, A. P., Wells, A., & Nothard, S. (2000). Cognitive factors in predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 39*(1), 67-78.

Morrison, A. P., Wells, A., & Nothard, S. (2002). Cognitive and emotional predictors of predisposition to hallucinations in non-patients. *British Journal of Clinical Psychology, 41*(3), 259-270.

Moskowitz, A., & Corstens, D. (2007). Auditory hallucinations: Psychotic symptom or dissociative experience. *The Journal of Psychological Trauma, 6*(2), 35-63.

Perona-Garcelán, S., Cuevas-Yust, C., García-Montes, J. M., Pérez-Alvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2008). Relationship between self-focused attention and dissociation in patients with and without auditory hallucinations. *Journal of Nervous and Mental Disease, 196*(3), 190-197.

Pickering, L., Simpson, J., & Bentall, R. P. (2008). Insecure attachment predicts proneness to paranoia but not hallucinations. *Personality and Individual Differences, 44*(5), 1212-1224.

Rankin, P. M., & O'Carroll, P. J. (1995). Reality discrimination, reality monitoring and disposition towards hallucination. *British Journal of Clinical Psychology, 34*(4), 517-528.

Shevlin, M., Dornahy, M., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*(3-4), 222-228.

Startup, M., Startup, S., & Sedgman, A. (2008). Immediate source-monitoring, self-focused attention and the positive symptoms of schizophrenia. *Behaviour Research and Therapy, 46*, 1176-1180.

Stirling, J., Barkus, E., & Lewis, S. (2007). Hallucination proneness, schizotypy and meta-cognition. *Behaviour Research and Therapy, 45*(6), 1401-1408.

Udachina, A., Thewissen, V., Myin-Germeys, I., Fitzpatrick, C., O'Kane, A., & Bentall, R. P. (2009). Understanding the relationships between self-esteem, experiential avoidance and paranoia: Structural equation modelling and experience sampling studies. *Journal of Nervous and Mental Disease, 197*(9), 661-668.

Vercammen, A., De Haan, E. H. F., & Aleman, A. (2008). Hearing a voice in the noise: Auditory hallucinations and speech perception. *Psychological Medicine, 38*, 1177=1184.

Wells, A., & Cartwright-Hatton, S. (2004). A short form of the Metacognitions Questionnaire: Properties of the MCQ-30. *Behaviour Research and Therapy, 42*(4), 385-396

Chapter 3

The metacognitive beliefs account of hallucinatory experiences: A literature review and meta-analysis

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3.1 Abstract

Background: An influential model of hallucinations proposed by Morrison et al. (1995) assumes that dysfunctional metacognitive beliefs lead to the misattribution of intrusive thoughts to external sources, therefore generating hallucinatory experiences.

Method: Following a comprehensive review of the literature, a series of meta-analyses were carried out to summarize the empirical findings on the association between hallucination-proneness and different metacognitive beliefs.

Results: The results of this research synthesis found little support for the existence of specific associations between hallucinations and dysfunctional metacognitive beliefs. Whilst metacognitive beliefs are robustly associated with hallucination-proneness in non-clinical studies, they were only moderately associated with hallucinations in clinical samples. Additional analyses revealed that, after controlling for the effect of comorbid symptoms, hallucination-proneness was only weakly associated with metacognitive beliefs, suggesting that the large associations observed in previous research might stem from the failure to consider the covariation between different symptoms.

Conclusions: These findings have important implications in relation to the role of metacognitive factors in psychopathological symptoms, as well as for the implementation of metacognitive-focused cognitive behavioural techniques for the treatment of psychosis.

3.2. Introduction

3.2.1. The metacognitive beliefs account of hallucinatory experiences

Hallucinations have been defined as percept-like experiences which occur in the absence of appropriate stimuli, have the full force of the corresponding actual (real) perceptions and which are usually unamenable to direct and voluntary control (Slade & Bentall, 1988). Even though they have often been regarded within mainstream psychiatry as pathognomonic for schizophrenia, hallucinations are reported by patients with different diagnoses, including bipolar disorder, unipolar depression, obsessive compulsive disorder, dissociative disorders and post-traumatic stress disorder (e.g. Allen & Coyne, 1995; Baethge et al., 2005; Fontenelle et al., 2008; Hammersley et al., 2003; Morrison, Frame, & Larkin, 2003; for a recent review of the prevalence of hallucinations in different psychiatric and neurological groups, see Alema & Larøi, 2008). In addition, they are also reported by individuals without any psychiatric diagnoses (e.g. Andrew, Gray, & Snowden, 2008; Honig et al., 1998), and recent epidemiological studies have reported lifetime prevalence rates for hallucinations in the general population ranging between 6.9% and 13% (Ohayon, 2000; Tien, 1991; van Os, Hanssen, Bijl, & Ravelli, 2000).

Although the factors and processes which might ultimately account for the genesis of hallucinatory experiences are still debated, there has been an emerging consensus among researchers that they are the consequence of the misattribution of internally generated cognitive events to external sources (Bentall, 1990; Frith, 1992; Hoffman, 1986; Larøi & Woodward, 2007). Along these lines, Morrison, Haddock and Tarrier (1995) have proposed a cognitive model that assumes that hallucinations are misattributed intrusive thoughts, and that their misattribution to an external source

is influenced by metacognitive beliefs (i.e. beliefs about cognition that can influence the processes used by the individuals to monitor and control their own thoughts; Flavell, 1979). Intrusive thoughts are generally defined as thoughts that are unwanted or unintended, perceived as uncontrollable, egodystonic and capable of interrupting ongoing activity (Clark & Purdon, 1995; Clark & Rhyno, 2005; Rachman, 1981). Intrusive cognitions are commonly associated with negative affect (e.g. Clark & de Silva, 1985), and with a number of deliberate strategies to suppress or control them (e.g. Purdon & Clark, 2001; Wells & Davies, 1994). The model proposed by Morrison et al. postulates that hallucinations are generated by the attempts to reduce the negative arousal that results from the experience of thoughts of this kind. Specifically, it is argued that hallucination-prone individuals hold certain metacognitive beliefs about the importance of thought consistency and the need to control thoughts. When intrusive thoughts are experienced, the inconsistency between these metacognitive beliefs and the experience of uncontrollable mental events leads to cognitive dissonance (Festinger, 1957), a state of negative arousal that individuals are motivated to escape. From this perspective, hallucination-prone individuals are therefore motivated to attribute their intrusive thoughts to an external source in the attempt to prevent cognitive dissonance from occurring.

Although the proponents of this account have described a number of additional factors believed to be involved in the maintenance of auditory and visual hallucinations (Morrison, 1998, 2001; Morrison et al., 1995), most of the empirical studies investigating testable predictions of the model have focused on the role played by metacognitive beliefs, and the relationship between cognitive intrusions and hallucination-proneness. The present systematic review will organize and synthesize the wealth of empirical findings on these topics. Firstly, the existing literature will be

reviewed to establish the empirical support for an association between cognitive intrusions and hallucinations. Secondly, a narrative review will be presented to describe and synthesize the existing literature on the association between hallucinatory experiences and maladaptive metacognitive beliefs. Finally, we will use meta-analytic methods to synthesize the results of quantitative investigations of the association between hallucinations and metacognitive beliefs.

3.2.2. Intrusive thoughts and hallucinatory experiences

The metacognitive account of hallucinatory experiences has received apparent support from a number of studies investigating the association between intrusive thoughts and hallucination-proneness in both clinical and non-clinical samples. In the first study that systematically examined the prevalence of intrusive cognitions in hallucinating and non-hallucinating psychotic patients, Morrison and Baker (2000) reported that hallucinating patients scored higher than controls on frequency of intrusive thoughts as measured by the Distressing Thoughts Questionnaire (Clark & de Silva, 1985). Similarly, Lobban Haddock, Kinderman and Wells (2002) found that hallucinating psychiatric patients scored significantly higher than patients with no history of auditory hallucinations on self-report measures of unwanted thoughts (although this difference was no longer significant after the effect of depression and anxiety had been taken into account). Although these two studies suggest the existence of a robust association between intrusive thoughts and hallucinatory experiences, in another clinical investigation Linney and Peters (2007) found no difference between hallucinating and non-hallucinating psychotic patients in terms of cognitive intrusions as assessed by the Obsessive Compulsive Thoughts Checklist (Bouvard, Mollard, Cottraux, & Guerin, 1989) and the revised Padua Inventory

(Burns, Keortge, Formea, & Sternberger, 1996). Conversely, in the same psychiatric sample cognitive intrusions were found to be significantly associated with symptoms of thought interference, suggesting that intrusive cognitions might be related to psychotic symptoms other than hallucinations.

In a recent non-clinical sample of undergraduate students, a robust positive association was found between hallucination-proneness and a subset of items of the White Bear Suppression Inventory (Wegner & Zanakos, 1994) that assessed intrusiveness of unwanted thoughts (Jones & Fernyhough, 2006). This finding has recently been replicated in a study of students conducted by Varese, Barkus and Bentall (in press), which nonetheless found that the association between intrusions and hallucinatory experiences was relatively small (τ_p (315) = .11, $p < .001$) when compared to the magnitude of the association between paranoia and intrusions (τ_p (315) = .31, $p < .001$) once the covariation between paranoid ideation and hallucination-proneness had been taken into account. In this study, Varese et al. were also able to identify a small number of hallucination-prone individuals who very infrequently experienced intrusions, a finding interpreted as suggesting that hallucinatory predisposition is to a certain extent independent from the proneness to experience intrusive thoughts.

3.2.3. Metacognitive beliefs and hallucinatory experiences: clinical studies

The cognitive model proposed by Morrison et al. (1995) has received further support from a number of studies which have investigated the association between maladaptive metacognitive beliefs and hallucination proneness in clinical and non-clinical samples. In the majority of these studies the Metacognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997) was used to assess metacognitive beliefs.

The MCQ is a self-report questionnaire comprising five subscales: (i) positive beliefs about worry (beliefs that worry helps to solve problems and avoid unpleasant events); (ii) negative beliefs about the uncontrollability of thoughts and corresponding danger (beliefs that one's own thought are uncontrollable and beliefs about the importance of controlling thought process in order to function effectively as a person); (iii) cognitive confidence (beliefs about one's own cognitive skills, in particular memory and attentional functioning); (iv) negative beliefs about thought in general (beliefs about potential negative consequences of having certain thoughts); and (v) cognitive self-consciousness (a subscale assessing the predisposition to monitor or focus upon one's own thought processes). The majority of the studies investigating the association between metacognitive beliefs and hallucination-proneness used the original 65-item version of the MCQ (in this review we will refer to this version as MCQ-65), whereas a smaller number of studies used a shorter version of the questionnaire with a comparable factor structure (the MCQ-30; Wells & Cartwright-Hatton, 2004) or other modified versions of the instrument (Lobban et al., 2002; Stirling, Barkus, & Lewis, 2007).

The studies which specifically investigated the association between metacognitive beliefs and hallucinatory experiences in clinical samples are listed in Table 3.1. Although these studies frequently compared hallucinating patients to both clinical and non-clinical controls, only the results from the comparison between hallucinating and non-hallucinating patients with comparable diagnoses will be considered, in order to evaluate the empirical support given by these studies to the alleged specific association between metacognitive beliefs and hallucinatory experiences. The first clinical study to examine group differences in metacognitive beliefs between hallucinating and non-hallucinating psychotic patients was carried out

by Baker and Morrison (1998). This study revealed that hallucinating patients scored significantly higher than non-hallucinating patients on two subscales of the MCQ-65 (positive beliefs about worry and negative beliefs about the uncontrollability and danger of thoughts). Lobban et al. (2002) tried to replicate these results in a subsequent study using a modified and shortened version of the MCQ which also included an additional subscale assessing beliefs about the importance of consistency of thoughts. In this study, hallucinating psychotic patients scored significantly higher than non-hallucinating patients only on beliefs about the importance of thought consistency. However, after controlling for the effect of anxiety and depression, there were no significant differences between hallucinating and non-hallucinating groups on MCQ scores, with the exception of lack of cognitive confidence, which was significantly greater in the non-hallucinating rather than the hallucinating patients. In a later study, hallucinating patients scored significantly higher than non-hallucinating patients with persecutory delusions on negative beliefs about uncontrollability and danger, lack of cognitive confidence and negative beliefs about thoughts in general (Morrison & Wells, 2003). Finally, García-Montes, Pérez-Álvarez, Balbuena, Garcelán, and Cangas (2006) found no significant differences between hallucinating psychotic patients and psychotic patients with no history of auditory hallucinations on the metacognitive factors of the MCQ-65.

More recently, following several studies suggesting elevated rates of dysfunctional metacognitive beliefs in individuals at ultra high risk of developing a psychotic disorder (Morrison, Bentall et al., 2002; Morrison et al., 2006; Morrison, French, & Wells, 2007). Brett, Johns, Peters and McGuire (2009) investigated the association between the metacognitive factors of the MCQ-65 and different psychotic-like anomalous experiences reported by psychotic patients, individuals experiencing

at risk mental states (ARMS) and non-clinical participants experiencing psychotic-like anomalies who had never sought or received psychiatric care. This study revealed no association between the metacognitive factors of the MCQ-65 and a subscale of the Appraisals of Anomalous Experiences Interview (AANEX; Brett et al., 2007) assessing lifetime occurrence of Shneiderian first rank symptoms (including auditory hallucinations, thought broadcast and passivity phenomena), therefore suggesting that metacognitive beliefs are not specifically implicated in the genesis of these experiences.

Further empirical evidence about the hypothesized association between hallucinatory experiences and dysfunctional metacognitive beliefs is provided by a small number of clinical studies which have used self-report measures other than the MCQ, although assessing comparable constructs. Morrison and Haddock (1997) found that hallucinating patients with a diagnosis of schizophrenia scored significantly higher than non-hallucinating patients on the Private Self-Consciousness Scale (PSCS; Fenigstein, Scheier, & Buss, 1975), a self-report measure assessing self-focused attention. However, these results were not replicated by a subsequent study which found no difference in terms of self-focused attention between currently hallucinating psychotic patients and psychotic patients with no history of auditory hallucinations (Perona-Garcelán et al., 2008). In addition, in a recent study of psychotic patients carried out by Linney and Peters (2007), metacognitive beliefs about the importance of controlling intrusive cognitions (as assessed by the Obsessive Beliefs Questionnaire-44; OCCWG, 2001) were associated with symptoms of thought interference, but not auditory hallucinations.

Table 3.1:

Summary of the published clinical and non-clinical studies investigating the association between hallucinations and dysfunctional metacognitive beliefs

Study	Sample characteristics	Assessment of hallucinatory experiences or hallucination-proneness	Assessment of metacognitive beliefs (or comparable constructs)
Clinical studies using the MCQ			
Baker & Morrison (1998)	AH psychotic patients (n = 15); Non-hallucinating psychotic patients (n = 15); Healthy controls (n = 15)	Modified KGV clinical interview (Lancashire, 1994)	MCQ-65
Lobban et al. (2002)	AH patients with diagnosis of schizophrenia (n = 32); Never hallucinated patients (n = 23); Anxiety control group (n = 24); Healthy controls (n = 28)	The KGV Symptom Scale (Krawiecka, Goldberg, & Vaughan, 1977)	MCQ-SAM (including measures of unwanted thoughts, consistency of thoughts and beliefs about normality of unwanted thoughts)
Morrison & Wells (2003)	AH psychotic patients (n = 49); Paranoid psychotic patients with no history of AH in the past year (n = 24); Panic disorder patients (n=35); Healthy controls (n = 50)	n/a	MCQ-65
García-Montes et al. (2006)	AH patients with diagnosis of schizophrenia (n = 21); Psychotic patients with no history of AH (n = 22); Psychotic patients with history of AH (n = 16); OCD patients (n = 23);	PANSS (Kay et al., 1988)	Spanish MCQ-65

	Clinical group with diverse psychological problems (n =26); Healthy controls (n = 20)		
Brett et al. (2009)	ARMS participants (n = 32) ; Psychotic patients (n = 27) ; Non-clinical participants reporting psychotic-like experiences (n = 24); Non-clinical participants reporting no psychotic-like experiences (n = 32)	Appraisal of Anomalous Experiences Interview (AANEX; Brett et al., 2007)	MCQ-65
Clinical studies using other self-report measures			
Morrison & Haddock (1997)	AH patients with diagnosis of schizophrenia (n = 15); Patients with diagnosis of schizophrenia with no history of AH (n = 15)	Case notes and modified KGV clinical interview (Lancashire, 1994)	PSCS
Linney & Peters (2007)	AH psychotic patients (n=31); Psychotic patients with no current AH (n = 19)	Scale for the Assessment of Positive Symptoms (Andreasen, 1984)	The Control-importance of thoughts subscale of the Obsessive Beliefs Questionnaire-44 (OCCWG, 2001)
Perona-Garcelán et al. (2008)	AH patients with diagnosis of schizophrenia (n=17); Patients with diagnosis of schizophrenia with history of AH (n=16); Patients with diagnosis of schizophrenia with no history of AH (n=18); Non-clinical controls (n=17)	PANSS (Kay et al., 1988)	PSCS
Analogue studies using the MCQ			
Morrison et al. (2000)	Non-clinical participants sample (N=105) separated in high and low	Revised Hallucination Scale - a 16-item version of the LSHS with 4-point	MCQ-65

	hallucination-proneness groups using median-split	Likert scale	
Morrison et al. (2002)	Non-clinical subjects (N=132)	Revised Hallucination Scale (RHS) – a 24-item version of the LSHS with 4-point Likert scale	MCQ-65
Morrison & Petersen (2003)	Non-clinical participants (n = 64)	Revised Hallucination Scale (RHS) – a 24-item version of the LSHS with 4-point Likert scale (Morrison et al., 2002)	MCQ-65
Larøi et al. (2004)	Hallucination-prone healthy subjects (n = 25); Non-hallucination-prone healthy subjects (n = 25)	Modified French LSHS (Larøi, Marczewski et al., 2004)	French MCQ-65 (Larøi et al., 2009)
Larøi & Van der Linden, (2005)	Non-clinical participants sample separated in high (n = 126) and low (n = 123) hallucination proneness groups using median-split	Modified French LSHS	French MCQ-65 (Larøi et al., 2009)
Larøi et al. (2005)	Non-clinical participants scoring in the upper (n = 16) and lower quartile (n = 16) of the distribution of LSHS scores	Modified French LSHS (Larøi & Van der Linden, 2005)	French MCQ-65 (Larøi et al., 2009)
Cangas et al. (2006)	Non-clinical participants (N = 81)	Spanish RHS (Fidalgo et al., 2003)	Spanish MCQ-65
García-Montes, Cangas et al. (2006)	Non-clinical participants (N = 150)	Spanish RHS (Fidalgo et al., 2003)	Spanish MCQ-65
Jones & Fernyhough (2006)	Non-clinical participant sample (N = 751)	LSHS-R (Bentall & Slade, 1985)	MCQ-30
Stirling et al. (2007)	Non-clinical participants divided in high (n = 35), medium (n = 35) and	Oxford-Liverpool Inventory of Feelings and Experiences (Mason et	MCQ-65 MCQ thinking (MCQ-th)

	low (n = 36) hallucination-proneness	al., 1995) and LSHS	
Debbane et al. (2009)	Non-clinical adolescents (N = 163) including a subsample of participants reporting hallucinatory experiences (n = 67)	French Schizotypy Personality Questionnaire (Dumas et al., 2000)	French Metacognitions Questionnaire – adolescents version (Cartwright-Hatton et al., 2004)
Varese et al. (in press)	Non-clinical participants (N = 388)	LSHS-R (Bentall & Slade, 1985)	MCQ-30
Analogue studies using other self-report measures			
Allen et al. (2005)	Non-clinical participants (N = 327)	Revised LSHS – a 12-item version of the LSHS with a 4-point Likert scale	PSCS

Notes: AH patients = Patients currently experiencing auditory hallucinations; LSHS = Launay Slade Hallucinations Scale (Launay & Slade, 1981); MCQ-65 = the 65-item version of the Metacognitions Questionnaire (Cartwright-Hatton & Wells, 1997); MCQ-30 = the 30-item version of the Metacognitions Questionnaire (Wells & Cartwright-Hatton, 2004); MCQ-SAM = the Metacognitions Questionnaire – Shortened and Modified (Lobban et al., 2002); PSCS = Private Self-Consciousness Scale (Fenigstein et al., 1975);

3.2.4. Metacognitive beliefs and hallucination-proneness in non-clinical studies

A number of analogue studies (i.e. studies carried out on non-clinical samples presenting characteristics which resemble specific features of clinical populations) investigating the association between metacognitive beliefs and hallucination-proneness have been reported in recent years. In the first study of this kind, Morrison, Wells and Nothard (2000) showed that hallucination-prone students identified using a modified version of the Launay-Slade Hallucination Scale (LSHS; Launay & Slade, 1981) scored significantly higher than non-prone students on a number of subscales of the MCQ-65, including cognitive self-consciousness and negative beliefs about the uncontrollability and danger of thoughts, whereas the difference for the general negative beliefs subscale only approached statistical significance. Using a modified version of the LSHS which allows the independent assessment of the predisposition to auditory and visual hallucinations, the same research group found that, after controlling for the effect of trait anxiety, the positive beliefs about worry subscale of the MCQ-65 was the only significant predictor of auditory hallucination-proneness whereas uncontrollability and danger and positive beliefs about worry were the only significant predictors of the predisposition to experience visual hallucinations (Morrison, Wells & Nothard, 2002). Divergent results were obtained in a subsequent study by Morrison and Petersen (2003) which found that the negative beliefs about the uncontrollability of thoughts and lack of cognitive confidence subscales of the MCQ-65 were significantly related to both visual and auditory hallucination-proneness in a small sample of undergraduate students, whereas cognitive self-consciousness was associated only with the predisposition to experience visual hallucinations.

Three successive studies used the French version of the MCQ-65 (Larøi, Van der Linden, & d'Acremont, 2009) to compare hallucination-prone university students (identified using a French version of the LSHS; Larøi, Marczewski, & Van der Linden, 2004) with students not prone to hallucinations. The results from these studies revealed that hallucination-prone students scored significantly higher than non-prone controls on all the subscales of the French version of the MCQ-65 (Larøi, van der Linden & Marczewsky, 2004; Larøi, Collignon, & Van der Linden, 2005; Larøi & Van der Linden, 2005). Similar results were obtained in a subsequent study which examined the association between metacognitive beliefs (as assessed by the Meta-Cognitions Questionnaire - Adolescent version; Cartwright-Hatton et al., 2004) and positive schizotypy (i.e. the expression in non-clinical populations of experiences similar to the positive symptoms of schizophrenia, including hallucinations and delusions) in a sample of Swiss adolescents (Debbané, Van der Linden, Gex-Fabry, & Eliez; 2009). The results of this study revealed that all the subscales of the MCQ significantly predicted the positive schizotypy scores of the French version of the Schizotypal Personality Questionnaire (SPQ; Dumas et al., 2000). Convergent results were obtained when the same analysis was carried out on a subsample of adolescents endorsing at least one of the three hallucination-related items of the SPQ.

Two additional published studies used the MCQ-65 to investigate the association between hallucination-proneness and metacognitive beliefs in samples of Spanish undergraduate students. Using a Spanish version of the Revised Hallucination Scale (Fidalgo, Gutierrez, García-Montes, & Cangas, 2003), Cangas et al. (2006) found that negative beliefs about the uncontrollability and danger of thoughts was the only significant predictor of auditory hallucination-proneness, whereas both beliefs about uncontrollability and danger of thoughts and cognitive confidence significantly

predicted visual hallucination-proneness scores. These results were at variance with the findings of a subsequent study conducted by the same research group, which reported that, after statistically controlling for the effect of trait anxiety, auditory hallucination-proneness was significantly associated only with lack of cognitive confidence, whilst both lack of cognitive confidence and positive beliefs about worry were positively associated with the predisposition to visual hallucinations (García-Montes, Cangas, Pérez-Álvarez, Fidalgo, & Gutiérrez, 2006).

Four recent studies have also investigated the relationship between hallucination-proneness and the metacognitive factors measured by the MCQ in large samples of British undergraduate students. Jones and Fernyhough (2006) found that hallucinatory predisposition was significantly associated with all the subscales of the MCQ-30. After statistically controlling for the effect of intrusiveness of thoughts, cognitive self-consciousness, negative beliefs about uncontrollability and danger and lack of cognitive confidence survived as significant predictors of hallucination-proneness. In a subsequent study, Stirling et al. (2007) compared three groups of participants with different levels of hallucination-proneness (high, medium and low hallucination-prone participants) selected using the LSHS and the unusual experiences subscale of the Oxford-Liverpool Inventory of Feelings and Experiences (Mason, Claridge, & Jackson, 1995). This study found that hallucination-proneness was associated with higher scores on four of the five subscales of the MCQ-65: negative beliefs about uncontrollability and danger, general negative beliefs, lack of cognitive confidence and cognitive self-consciousness. Stirling et al. also explored between-group differences on a modified version of the MCQ-65 named MCQ-thinking (MCQ-th) in which all the worry-related items were reworded to avoid overt reference to worry and anxiety, instead focusing on thought processes and cognition.

Hallucination-proneness was associated with higher scores on three of the MCQ-th metacognitive factors: negative beliefs about uncontrollability and danger of thoughts, negative beliefs about thinking and awareness and usefulness of controlling thoughts (a factor including items corresponding to the cognitive self-consciousness and positive beliefs subscales of the MCQ-65). In another study, Varese, et al. (in press) investigated whether the metacognitive factors of the MCQ-30 are specifically related to hallucination-proneness while controlling for comorbid symptoms. The results of this study revealed that, after controlling for the effect of intrusive cognitions and paranoid ideation, cognitive self-consciousness was the only significant predictor of hallucination-proneness in a large student sample. In this study, metacognitive beliefs assessed by the MCQ-30 were more robustly associated with paranoia and intrusive thoughts rather hallucination-proneness. Finally, Allen et al. (2005) found that hallucination-proneness was related to self-focused attention as assessed by the PSCS in another large sample of British undergraduate students.

3.2.5. The confounding effect of comorbid symptoms

Although several studies reviewed in sections 3.2.3 and 3.2.4 suggest a relationship between metacognitive beliefs and hallucinatory experiences, some also indicate that metacognitive beliefs may be associated with proneness to psychotic symptoms other than auditory and visual hallucinations. Consistent with the findings from several studies suggesting that metacognitive beliefs are implicated in both clinical and non-clinical paranoia (Fraser, Morrison, & Wells, 2006; García-Montes et al., 2005), two of the reviewed studies revealed that metacognitive beliefs are associated with both delusion-proneness (Larøi & Van der Linden, 2005) and paranoid ideation (Varese et al., in press) in non-clinical samples. Metacognitive

beliefs were also found to be associated with symptoms of thought interference but not with auditory hallucinations in a psychiatric sample (Linney & Peters, 2007). A growing body of literature also indicates that the metacognitive factors of the MCQ are associated with non-psychotic symptoms such as anxiety (e.g. Cartwright-Hatton & Wells, 1997; Davies & Valentiner, 2000), depression (e.g. Wells & Carter, 2001) and obsessive-compulsive symptoms (e.g. Gwilliam, Wells, & Cartwright-Hatton, 2004; Irak & Tosun, 2008; Myers & Wells, 2005). These findings are consistent with the results from many of the clinical studies reviewed in section 3.2.3. For example, García-Montes, Pérez-Álvarez et al. (2006) showed that, even though both hallucinating psychotic patients and patients with diagnosis of obsessive compulsive disorder (OCD) scored significantly higher than healthy controls on several subscales of the MCQ-65, there were no significant differences on metacognitive belief measures between these two clinical groups . Similarly, Lobban et al. (2002) found no significant differences between hallucinating psychotic patients and patients with anxiety disorders. Furthermore, Morrison and Wells (2003) showed that hallucinating psychotic patients, paranoid patients with no history of auditory hallucinations and patients with diagnosis of panic disorder all showed elevated MCQ-65 scores when compared to non-clinical controls. Overall, these findings raise doubts about the specific contribution of metacognitive beliefs to hallucinations and hallucination-proneness. In addition, these results suggest that the effect of comorbid symptoms which have been linked to dysfunctional metacognitive beliefs in previous research might represent an important confound in the relationship between hallucination-proneness and metacognitive beliefs.

3.2.6. Summary and need for integration

Although the metacognitive beliefs account of hallucinatory experiences proposed by Morrison and colleagues (1995) has been widely accepted by researchers and clinicians in recent years, the findings of the studies reviewed in sections 3.2.2, 3.2.3 and 3.2.4 offer at best mixed support to the model. To complicate matters, the relationship between intrusive thoughts and hallucination-proneness that might be predicted from the metacognitive belief model is not entirely obvious; a number of researchers have argued that, if hallucination-prone individuals are specifically motivated to misattribute intrusive thoughts to an external source when compared to non-prone individuals, fewer rather than more reported intrusive thoughts would be expected (e.g. Linney & Peters, 2007) whereas others have made the opposite prediction (e.g. Morrison & Baker, 2000). The investigations conducted to test whether hallucinatory experiences are specifically related to dysfunctional metacognitive beliefs have not consistently supported the more straightforward empirical predictions pertaining to this aspect of the model. Whilst several studies suggest that hallucinatory experiences might be associated with elevated scores on the metacognitive factors assessed by the MCQ (e.g. Baker & Morrison, 1998; Morrison & Wells, 2003), other have failed to find evidence supporting this association (e.g. Brett et al., 2009; García-Montes et al., 2006; Linney & Peters, 2007). In addition, those studies which have reported associations between hallucinations or hallucination-proneness and MCQ scores have often pointed to the importance of different MCQ subscales. Hence, there is the need for an empirical summary of the existing findings generated in the substantial number of studies that have so far been conducted to address this issue.

With this purpose in mind, we conducted a series of meta-analyses to summarise the relevant quantitative findings. In addition to estimating the magnitude

of the association observed between metacognitive beliefs and hallucinations we interrogated the existing data to establish the importance of methodological factors that were considered likely to influence the results observed in the individual studies. Finally, we carried out separate analyses of those studies which controlled for comorbid symptoms in order to establish the specificity of the association between metacognitive beliefs and hallucinatory experiences.

3.3 Method

3.3.1 Literature search and eligibility criteria

A comprehensive search of relevant papers published between January 1995 and October 2009 was conducted using several computerized databases (PsychINFO, Web of Knowledge; PubMed) and different combinations of the following keywords: "metacognit*", "self-focus*", "hallucinat*" "psychosis" and "schizo *". In addition, a careful inspection of the studies' reference lists was carried out to identify any reports not previously retrieved through the databases search. In an attempt to reduce the file drawer effect, we tried to locate any relevant unpublished data by contacting the authors of all the identified articles. The inclusions of unpublished sources is justified by the compelling evidence documenting the impact of publication bias on the findings of meta-analytic research syntheses (for reviews see Borenstein et al., 2009; Rothstein & Hopewell, 2009; Rothstein, Sutton & Borenstein, 2005).

Studies were considered eligible for the research synthesis if they investigated the relationship between hallucination-proneness and metacognitive beliefs using the MCQ-65, the MCQ-30 or other self-report instruments assessing equivalent

constructs. Studies were deemed eligible if they included sufficient statistical information for the computation of group comparisons between hallucination-prone and comparable non-prone participant groups (i.e. hallucinating patients vs non-hallucinating psychotic patients; hallucinating ARMS patients vs non-hallucinating ARMS patients; hallucination-prone healthy participants vs healthy participants not prone to hallucinations). In addition, studies reporting indices of the association between metacognitive beliefs and hallucination-proneness measures using correlational or regression approaches were considered eligible. In the case of studies lacking sufficient information for the computation of effect sizes, the first authors were invited to provide the additional information required to allow these calculations. If this information was not available, the studies were excluded from the analysis.

3.3.2 Coding protocol and effect sizes computation

A coding protocol specifying the information to be extracted from each eligible study was developed after a preliminary review of a sample of representative studies. The protocol was used to code relevant methodological features of the primary studies that were likely to influence the nature and magnitude of the reported effect sizes. Specifically, the following study-level characteristics were coded: the study type (non-clinical or clinical participants; the latter including both psychotic and ARMS patients), the research design implemented (between-groups design or correlational design); the instrument used to assesses the metacognitive factors considered (whether the MCQ or a modified version of the instrument was used or other self-report measures assessing comparable constructs); investigation of relevant

covariates (whether a study reported the results from analyses which statistically controlled for effect of comorbid symptoms).

For all studies, the computation of effect sizes was conducted with bias-corrected Hedges' *g* (Hedges, 1981). For studies reporting between-group comparisons, Hedges' *g* was computed directly from the group means, standard deviations and confidence intervals reported in the primary studies. When such descriptive statistics were not available, other computational methods were used. For studies reporting correlations between hallucination-proneness measures and the constructs of interest, correlations coefficients were converted to *d*–based effect sizes using the computational methods described by Borenstain et al. (2009), and Hedges' correction was applied thereafter. For studies reporting only standardized regression coefficients, *r*-based effect sizes were estimated using the computational approach developed by Peterson and Brown (2005), and converted to Hedges' *g* as above. For studies reporting analysis of covariance (ANCOVA), effect-sizes based on standardized mean differences were computed according the computational approach described by Lipsey and Wilson (2001). The computation of the effect sizes was standardised so that a positive value always indicated a positive association between hallucination-proneness and the constructs of interest.

For all clinical studies reporting group differences between hallucinating psychiatric patients, non-hallucinating patients and healthy controls, effect-sizes were computed exclusively for the hallucinating vs non-hallucinating patients contrast. In the case of studies including ARMS samples, participants in the ARMS group were separated into two subgroups according to the presence or absence of hallucinatory experiences using available clinical assessment instruments. Effect sizes were therefore computed for the hallucinating vs non-hallucinating contrast rather than for

the comparisons reported in the original studies. When written reports included multiple samples of interest (e.g. studies investigating group differences between psychotic and ARMS groups), each sample was divided into hallucinating and non-hallucinating subgroups as above, and effect sizes were estimated separately for each sample. When separated analyses for predisposition to auditory hallucinations and predisposition to visual hallucinations were reported (e.g. Cangas et al., 2006), the effect sizes were averaged prior to the analysis. When studies included high, medium and low hallucination-proneness groups (e.g. Stirling et al., 2007), effect sizes were computed exclusively for the high vs low hallucination-proneness contrast. Finally, when different instruments assessing metacognitive beliefs were used in the same study (e.g. Stirling et al., 2007), only statistical information from the MCQ-65 subscales was used to estimate effect sizes, to improve the comparability with other reported studies.

3.3.3 Studies controlling for emotional distress and other comorbid symptoms

To estimate the magnitude of the specific association between metacognitive factors and hallucination-proneness, effect size information for statistical analyses which controlled for the effect of comorbid symptoms was also coded when available. In the case of studies which included measures of emotional distress (e.g. anxiety, depression) or psychotic symptoms other than hallucinations (e.g. paranoia; delusion proneness) without statistically controlling for their effect in the analyses reported, the first authors have been invited to provide additional information to allow the computation of effect sizes when controlling for the available covariates (i.e. partial correlation coefficients, summary ANCOVA statistics). A separate set of meta-analyses was therefore conducted using the effect size estimated from studies for

which such information was either available or provided by the approached researchers. Effect sizes were estimated using the computational methods described in section 3.3.2.

3.4. Results

3.4.1 Literature search results

Twenty-six studies were retrieved through the search of the computerized databases and examination of cross-references. In addition, four additional studies were made available by the research groups contacted (Barkus, Stirling, & Lewis, in press; Johns, 2009; Varese et al., in press; Varese & Bentall, 2008). Two studies (Ensum & Morrison, 2003; Startup, Startup, & Sedgman, 2008) reported statistical analyses from methodological manipulations which prevented the computation of effect-sizes comparable to other reported studies, and were therefore excluded from the analysis. Further inspection of the research reports revealed that four studies (Barkus et al., in press; Morrison, Bentall et al., 2002; Morrison et al., 2006; Morrison et al., 2007) reported findings drawn from the same sample of ARMS patients (the Early Detection and Intervention Evaluation trial originally reported by Morrison, Bentall et al., 2002). Therefore, a single set of effect sizes was computed from these data. Similarly, the schizotypy sample considered in Barkus et al. (in press) presented some degree of overlap with the sample of a previously published report by Stirling et al. (E. Barkus, personal communication, November 5, 2009), therefore this study was not included in the present analysis to avoid bias stemming from statistical dependence. The remaining eligible reports comprised ten clinical studies with a total of 476 patients (193 hallucinating psychotic patients; 148 non-hallucinating psychotic

patients; 91 hallucinating ARMS patients; 44 non-hallucinating ARMS patients), and 15 analogue studies with a total of 2746 non-clinical participants.

3.4.2 Analysis of the total sample

Statistical analyses were carried out using the "metafor" package for R (Viechtbauer, 2010). The computation of mean summary effect sizes was carried out under the random-effects model using the DerSimonian-Laird estimator. The analyses were carried out on 112 individual effect sizes computed from the 25 studies available for the research synthesis (22 effect sizes for positive beliefs about worry; 22 for uncontrollability and danger; 21 for cognitive confidence; 22 for negative beliefs in general and 25 for cognitive self-consciousness). Table 3.2 displays the individual effects size estimates with their associated variances and 95% confidence intervals. The results of the analysis revealed that, when both clinical and analogue studies are considered, the metacognitive factors of the MCQ are robustly associated with hallucination-proneness (positive beliefs, $g = 0.31$, $SE = 0.06$, 95% CI [0.20, 0.43]; uncontrollability and danger, $g = 0.71$, $SE = 0.11$, 95% CI [0.50, 0.93]; cognitive confidence, $g = 0.54$, $SE = 0.08$, 95% CI [0.37, 0.70]; general negative beliefs about thought, $g = 0.45$, $SE = 0.08$, 95% CI [0.29, 0.61]; cognitive self-consciousness $g = 0.54$, $SE = 0.07$, 95% CI [0.40, 0.7]). All mean effect sizes were statistically significant ($p < .001$). The computed average association between hallucination-proneness and uncontrollability and danger represents a moderately large effect according to established conventional criteria to evaluate the magnitude of standardized mean difference effect sizes (ES $\leq .20$ for small effects, ES $\leq .50$ for moderate effects and ES $\geq .80$ for large effects; Cohen, 1988). According to the same criteria, the strength of the associations between hallucination-proneness and

Table 3.2:

Effect size estimates with associated variances and 95% confidence intervals for the eligible studies

Study	N	Cognitive self-consciousness			Uncontrollability and danger			Positive beliefs about worry			Cognitive confidence			Negative beliefs in general		
		g	v	95% CI	g	v	95% CI	g	v	95% CI	g	v	95% CI	g	v	95% CI
Clinical studies																
Morrison & Haddock (1997)	15/15	1.44	0.17	[0.64, 2.24]	na	na	na	na	na	na	na	na	na	na	na	na
Baker & Morrison (1998)	15/15	0.77	0.14	[0.18, 0.78]	2.38	0.23	[1.45, 3.32]	0.96	0.15	[0.20, 1.72]	0.7	0.14	[-0.04, 1.43]	0.92	0.15	[0.16, 1.67]
Lobban et al. (2002)	32/23	0.62	0.08	[0.07, 1.17]	-0.19	0.08	[-0.73, 0.35]	0.19	0.08	[-0.35, 0.73]	-0.22	0.08	[-0.75, 0.48]	na	na	na
Morrison , Bentall et al. (2002)	28/15	0.03	0.11	[-0.61, 0.66]	-0.19	0.10	[-0.81, 0.44]	-0.35	0.11	[-0.99, 0.30]	0.45	0.1	[-0.19, 1.08]	-0.06	0.11	[-0.70, 0.57]
Morrison & Wells (2003)	49/24	0.39	0.06	[-0.11, 0.88]	1.82	0.08	[1.25, 2.39]	0.53	0.06	[0.03, 1.02]	0.92	0.07	[0.41, 1.43]	0.76	0.07	[0.25, 1.26]
García-Montes et al. (2006)	21/22	0.26	0.09	[-0.34, 0.86]	0.59	0.10	[-0.02, 1.20]	0.42	0.1	[-0.19, 1.02]	-0.12	0.09	[-0.72, 0.48]	0.65	0.10	[0.04, 1.27]
Linney & Peters (2007)	31/19	na	na	na	na	na	na	na	na	na	na	na	na	-0.16	0.09	[-0.73, 0.41]
Perona-Garcelán et al. (2008)	17/18	0.19	0.11	[-0.47, 0.85]	na	na	na	na	na	na	na	na	na	na	na	na
Brett et al. (2009)	13/12	0.74	0.17	[-0.07, 1.55]	0.75	0.17	[-0.07, 1.56]	-0.30	0.16	[-1.09, 0.48]	0.95	0.18	[0.12, 1.78]	0.52	0.17	[-0.28, 1.32]
Psychotic patients sample Brett et al. (2009)	9/12	-0.78	0.21	[-1.68, 0.12]	-0.19	0.20	[-1.06, 0.67]	0.37	0.20	[-0.50, 1.24]	-0.18	0.20	[-1.04, 0.69]	0.03	0.19	[-0.83, 0.89]
ARMS patients sample Johns (2009)	54/17	0.05	0.08	[-0.50, 0.59]	-0.43	0.08	[-0.98, 0.12]	0.46	0.08	[-0.09, 1.01]	-0.47	0.08	[-1.02, 0.08]	-0.19	0.08	[-0.74, 0.36]
Analogue studies																
Morrison et al. (2000)	47/46	0.65	0.05	[0.23, 1.07]	0.60	0.04	[0.18, 1.01]	0.34	0.04	[-0.07, 0.75]	0.25	0.04	[-0.16, 0.66]	0.41	0.04	[0.00, 0.82]

Morrison,Wells et al. (2002)	132	na	na	na	0.30	0.03	[-0.06, 0.65]	0.46	0.04	[0.09, 0.83]	na	na	na	-0.24	0.03	[-0.59, 0.11]
Morrion & Petersen (2003)	64	0.38	0.06	[-0.11, 0.88]	0.79	0.11	[0.13, 1.44]	0.39	0.06	[-0.10, 0.89]	0.85	0.14	[0.10, 1.60]	0.20	0.06	[-0.29, 0.69]
Larøi et al. (2004)	25/25	0.96	0.09	[0.38, 1.55]	1.60	0.11	[0.96, 2.24]	1.17	0.09	[0.57, 1.78]	0.96	0.09	[0.38, 1.55]	1.22	1.22	[0.61, 1.82]
Allen et al. (2005)	327	0.58	0.01	[0.36, 0.81]	na	na	na	na	na	na	na	na	na	na	na	Na
Larøi et al. (2005)	16/16	0.91	0.14	[0.18, 1.64]	1.52	0.16	[0.73, 2.30]	1.23	0.15	[0.48, 1.99]	1.52	0.16	[0.74, 2.31]	1.29	0.15	[0.53, 2.05]
Larøi & Van der Linden (2005)	126/123	0.46	0.02	[0.21, 0.71]	1.19	0.02	[0.92, 1.46]	0.44	0.09	[-0.15, 1.03]	0.98	0.02	[0.72, 1.24]	0.44	0.02	[0.19, 0.69]
Cangas et al. (2006)	751	0.58	0.03	[0.23, 0.94]	0.82	0.04	[0.43, 1.22]	0.30	0.01	[-0.02, 0.62]	0.57	0.01	[0.22, 0.92]	0.57	0.01	[0.22, 0.92]
Garcia-Montes et al. (2006b)	81	0.17	0.03	[-0.15, 0.49]	0.28	0.03	[-0.04, 0.60]	0.24	0.03	[-0.08, 0.56]	0.48	0.03	[0.15, 0.81]	0.23	0.03	[-0.09, 0.55]
Jones & Fernyhough (2006)	150	0.65	0.01	[0.48, 0.82]	0.73	0.01	[0.56, 0.90]	0.18	0.03	[0.04, 0.33]	0.44	0.03	[0.28, 0.59]	0.44	0.03	[0.28, 0.59]
Allen et al. (2007)	47	1.30	0.12	[0.62, 1.98]	na	na	na	na	na	na	na	na	na	na	na	Na
Stirling et al. (2007)	35/35	1.25	0.07	[0.74, 1.76]	1.42	0.07	[0.90, 1.95]	0.23	0.06	[-0.24, 0.70]	0.95	0.06	[0.45, 1.44]	1.30	0.07	[0.79, 1.82]
Varese & Bentall (2008)	125	0.56	0.04	[0.18, 0.94]	0.92	0.04	[0.52, 1.33]	0.32	0.04	[-0.05, 0.69]	0.72	0.04	[0.33, 1.11]	0.70	0.04	[0.31, 1.09]
Varese et al. (submitted)	388	0.79	0.01	[0.57, 1.02]	0.82	0.01	[0.60, 1.04]	0.16	0.01	[-0.05, 0.37]	0.67	0.01	[0.46, 0.89]	0.56	0.01	[0.35, 0.77]
Brett et al. (2009)	12/12	-0.37	0.17	[-1.18, 0.44]	-0.16	0.17	[-0.97, 0.64]	-0.46	0.17	[-1.27, 0.35]	0.06	0.17	[-0.74, 0.86]	-0.48	-0.17	[-1.29, 0.33]
Analogue sample Debbane et al. (2009)	67/96	0.37	0.03	[0.05, 0.68]	0.66	0.03	[0.34, 0.98]	0.30	0.03	[-0.02, 0.61]	0.61	0.03	[0.29, 0.93]	0.80	0.03	[0.48, 1.12]

Notes: na = information non-available or not reported ; For studies reporting between-group comparisons, separate sample sizes for the hallucination-prone and non hallucination-prone groups are displayed

cognitive confidence, as well as between hallucination-proneness and cognitive self-consciousness fall into the medium range. Conversely, only effects of small-to-moderate magnitude were found between hallucination-proneness and positive beliefs about worry, and between hallucination-proneness and negative beliefs in general.

3.4.3 Subgroup analysis (clinical vs analogue studies)

Subgroup analysis was carried out to estimate and compare mean effect sizes from studies which investigated the relationship between metacognitive factors and hallucinations in clinical samples and studies carried out on analogue samples.

All the mean effect sizes for the analogue subgroup were statistically significant ($p < .001$) and of similar magnitude to those obtained from the pooled sample analysis reported in section 3.2 (positive beliefs, $g = 0.32$, $SE = 0.07$, 95% CI [0.19, 0.45]; uncontrollability and danger, $g = 0.80$, $SE = 0.10$, 95% CI [0.61, 1.00]; cognitive confidence, $g = 0.66$, $SE = 0.08$, 95% CI [0.50, 0.81]; general negative beliefs, $g = 0.51$, $SE = 0.09$, 95% CI [0.33, 0.70]; cognitive self-consciousness $g = 0.60$, $SE = 0.07$, 95% CI [0.46, 0.74]). When the clinical subgroup was considered, only the mean effect sizes for cognitive self-consciousness and positive beliefs about worry were statistically significant ($g = 0.37$, $SE = 0.15$, 95% CI [0.07, 0.67], $p < .05$ and g = 0.30, $SE = 0.14$, 95%CI [0.02, 0.57] $p < .05$, respectively) whereas the effects for the remaining metacognitive factors did not reach statistical significance (negative beliefs in general, $g = 0.30$, $SE = 0.17$, 95% CI [-0.03, 0.63], $p = .07$; uncontrollability and danger, $g = 0.54$, $SE = 0.35$, 95% CI [-0.14, 1.23], $p = .12$; cognitive confidence, $g = 0.24$, $SE = 0.21$, 95% CI [-0.17, 0.65], $p = .25$).

3.4.4 Heterogeneity analysis

To investigate whether the studies included in the analyses presented effects of similar magnitude, a set of heterogeneity statistics was examined. The Q statistics was used to test whether the dispersion of the effect sizes estimates could be attributed to sampling error alone (Borenstein et al., 2009; Hedges & Olkin, 1985; Lipsey & Wilson, 2001). As this test has limited statistical power for meta-analyses with small numbers of studies (Higgins & Thompson, 2002), a significance level of .10 was adopted instead of the conventional .05 (Fleiss, 1993). In addition, the estimated variance of the true effect sizes was computed using the T^2 statistic. Finally, inconsistency in effect sizes across studies was quantified using the I^2 statistic, which describes the percentage of observed variance which is accounted by true heterogeneity rather than sampling error (Higgins & Thompson, 2002; Higgins, Thompson, Deeks, & Altman, 2003). Summary statistics for heterogeneity analyses are displayed in Table 3.3.

The results of the analyses revealed that the effect estimates varied considerably across studies for each of the constructs considered. The Q test for the homogeneity of effects was statistically significant for all the metacognitive factors considered, indicating that the estimated dispersion in true effect sizes exceeded the amount of variation expected by sampling error alone. Regarding the percentage of variance in effect sizes due to heterogeneity, Higgins et al. (2003) proposed a tentative categorization of values of the I^2 statistic so that values of 25%, 50% and 75% correspond to low, moderate and high heterogeneity respectively. Uncontrollability and danger presented a high proportion of variance due to heterogeneity. Conversely, I^2 values for cognitive confidence, cognitive self-consciousness and negative beliefs fell in the moderate-to-high heterogeneity range, whereas heterogeneity analysis for

Table 3.3:

Summary statistics for heterogeneity analyses

	Q (df)	*p*	T^2	T	I^2
Total sample					
PB	32.82 (20)	0.04	0.03	0.16	39.05%
UDT	115.88 (20)	< .001	0.21	0.46	82.74%
CC	60.50 (20)	< .001	0.09	0.3	68.60%
SPR	63.55 (20)	< .001	0.09	0.29	68.53%
CSC	54.08 (24)	< .001	0.06	0.24	57.47%
Clinical subgroup					
PB	10.40 (7)	0.17	0.05	0.22	32.72%
UDT	60.58 (7)	< .001	0.85	0.92	88.45%
CC	22.88 (7)	0.002	0.23	0.48	69.41%
SPR	14.51 (7)	0.04	0.11	0.34	51.78%
CSC	18.72 (9)	0.03	0.12	0.34	51.95%
Analogue subgroup					
PB	22.29 (12)	0.03	0.03	0.16	46.17%
UDT	47.55 (12)	< .001	0.1	0.31	74.76%
CC	27.23 (11)	0.004	0.04	0.21	59.60%
SPR	47.29 (12)	< .001	0.08	0.29	74.62%
CSC	10.12 (13)	0.004	0.04	0.19	56.84%

Notes: PB = Positive beliefs about worry; UDT = Negative beliefs about uncontrollability and danger of thoughts; CC = Lack of cognitive confidence; SPR = Negative beliefs about thoughts in general, including themes of superstition, punishment and responsibility; CSC = Cognitive self-consciousness

positive beliefs lead to a lower (but still substantial) estimate of inconsistency in effect sizes. As shown in Table 3.3, when heterogeneity statistics where examined separately for the clinical and analogue subgroups, there was still considerable evidence of heterogeneity, which was in some instances more extreme than the corresponding figures estimated for the aggregated sample.

3.4.5 Explaining heterogeneity in the total sample using meta-regression

Meta-regression was used to investigate whether methodological heterogeneity between the primary studies could account for the observed inconsistency in true effect sizes. Specifically, we tested the impact of study type (studies conducted on clinical samples versus analogue studies) and research design (between-groups versus correlational designs) on the effect sizes estimated for each metacognitive factor considered. The analyses were carried out under the mixed-effects model using the DerSimonian-Laird estimator.

The simultaneous test of moderators was statistically significant only for cognitive confidence ($Q_M = 7.24$, $p < .05$), indicating that differences in study characteristics influenced significantly the estimated effect sizes for this construct when considered collectively. However, the test was non-significant for all remaining analyses (positive beliefs $Q_M = 1.34$, $p > .05$; uncontrollability and danger $Q_M = 3.12$, $p > .05$; general negative beliefs $Q_M = 4.80$, $p > .05$; cognitive self-consciousness $Q_M = 2.47$, $p > .05$). The tests for statistical significance of single meta-regression coefficients (see Table 3.4) indicated that differences in research design did not affect the magnitude of the effects considered. The impact of study type on the magnitude of the computed effect sizes was statistically significant only for cognitive confidence and negative beliefs about thought in general, and indicating that the magnitude of the association between these two constructs and hallucination-proneness is larger in non-clinical samples compared to clinical studies. However, the results of the test for residual heterogeneity for cognitive confidence ($Q_E = 44.77$, $p <.001$) and negative beliefs in general ($Q_E = 59.15$, $p <.001$) indicated that there was still significant

Table 3.4:

Mixed-effects model regression results for the different metacognitive factors considered

	Estimate	SE	95% CI	Z-value	*p*
Positive Beliefs					
Intercept	0.43	0.11	[0.20, 0.65]	3.74	< .001
Design	-0.16	0.14	[-0.44, 0.11]	-1.17	0.11
Study type	-0.13	0.17	[-0.46, 0.21]	-0.76	0.45
Uncontrollability and					
Intercept	0.98	0.19	[0.60, 1.36]	5.06	< .001
Design	-0.32	0.26	[-0.84, 0.20]	-1.21	0.23
Study type	-0.48	0.28	[-1.02, 0.06]	-1.72	0.08
Cognitive Confidence					
Intercept	0.75	0.13	[0.49, 1.01]	5.61	< .001
Design	-0.16	0.18	[-0.52, 0.20]	-0.87	0.38
Study type	-0.52	0.2	[-0.91, -0.14]	-2.64	<.01
Negative beliefs in general					
Intercept	0.72	0.15	[0.43, 1.00]	4.91	< .001
Design	-0.36	0.19	[-0.73, 0.02]	-1.84	0.07
Study type	-0.42	0.21	[-0.84, -0.01]	-1.97	0.04
Cognitive self-consciousness					
Intercept	0.61	0.13	[0.36, 0.86]	4.81	< .001
Design	-0.02	0.16	[-0.34, 0.30]	-0.1	0.92
Study type	-0.25	0.18	[-0.60, 0.11]	-1.37	0.17

inconsistency across effect size estimates after the significant moderator effect of study type was taken into account, therefore suggesting that the impact of study type could not entirely account for the observed statistical heterogeneity in these two analyses.

3.4.6 Bias assessment and sensitivity analyses

Assessment of publication bias was conducted through visual examination of funnel plots for the different constructs considered by plotting the estimated effect sizes against their corresponding standard errors. In addition the Egger test for funnel plot asymmetry (Egger, Davey Smith, Schneider, & Minder, 1997) was carried out to provide converging evidence regarding the inferences drawn from visual inspection In the Egger test, the standard normal deviate (defined as the effect size estimate divided by its standard error) is regressed against the estimate's precision (defined as the inverse of the estimate's standard error) using conventional linear regression techniques. The intercept of the resulting regression equation provides an estimate of funnel plot asymmetry so that any significant deviation from zero indicates substantial asymmetry, which is regarded as indicative of the presence of bias. Given the limited power of statistical tests for funnel plot asymmetry in meta-analyses with limited number of studies included, funnel plot analyses were conducted exclusively on the aggregated sample using the level of significance of .10 (Egger et al., 1997; Sterne, Becker, & Egger, 2005; Sterne & Egger, 2005). For all analyses, the visual inspection of the funnel plots revealed no evidence of substantial asymmetry. Similarly, the results of the Egger test were non-significant for all analyses (positive beliefs about worry, $p = .13$; uncontrollability and danger, $p = .87$; cognitive confidence, $p = .80$; general negative beliefs, $p = .98$; cognitive self-consciousness , $p = .43$), suggesting that publication bias or other selection bias are unlikely to have influenced the results from the above reported analyses.

Three separate sensitivity analyses were carried out to investigate the impact of the inclusion of the following groups of studies on the summary effects reported in section 3.4.2 and 3.4.3: (i) studies which exclusively reported findings concerning the association between hallucination-proneness and metacognitive beliefs when

controlling for the effect of trait anxiety (k = 2; García-Montes, Cangas et al., 2006; Morrison, Wells et al., 2002); (ii) studies carried out using self-report measures other than the MCQ (k = 5; Allen et al., 2007; Allen et al., 2005; Linney & Peters, 2007; Morrison & Haddock, 1997; Perona-Garcelán et al., 2008) and (iii) unpublished datasets (k = 2; Johns, 2009; Varese & Bentall, 2008). The results revealed that the exclusion of studies which controlled for comorbid symptoms did not significantly alter the findings obtained from the aggregated sample and subgroup analyses. Similarly, the exclusion of studies which adopted measures other than the MCQ did not alter substantially the pattern of findings obtained from the aggregated sample and analogue subgroup analyses. The results from the clinical subgroup, however, diverged to some extent from the previously reported analyses. When only findings from studies adopting the MCQ or modified version of the instrument were considered, the previously negligible association between hallucinations and general negative beliefs was found to be statistically significant, $g = 0.37$, SE = 0.18, 95% CI [0.03, 0.72], whereas the summary effect sizes calculated for the remaining constructs did not diverge considerably from the analyses reported in section 3.4.3. The exclusion of unpublished datasets did not alter the summary effect sizes obtained for the aggregated and analogue subgroup analyses. The results obtained for the clinical subgroup indicated that the association between hallucinations and general negative beliefs was statistically significant, $g = 0.38$, SE = 0.17, 95% CI [0.05, 0.72], whereas the previously significant association between hallucinations and positive beliefs was found to be non-significant when only published reports were considered $g = 0.27$, SE = 0.16, 95% CI [-0.05, 0.58].

3.4.7. Analysis for studies controlling for emotional distress and comorbid symptoms

A separate subgroup analysis was conducted to investigate the magnitude of the association between metacognitive factors and hallucination-proneness when controlling for other symptom measures associated with dysfunctional metacognitive beliefs, such as emotional distress (anxiety and depression) and other comorbid symptoms (paranoia, delusion proneness and intrusive thoughts). The subgroup analysis included: (i) effect size estimates from two studies which included analyses for the relationship between metacognitive beliefs and hallucination-proneness when controlling for comorbid symptoms (Lobban et al., 2002; Varese et al., in press); (ii) effect size estimates from two studies which exclusively reported analyses which controlled for the effect of emotional symptoms (García-Montes, Cangas et al., 2006; Morrison, Wells et al., 2002); (iii) effect size estimates from 10 additional studies for which it was possible to control for the effect of other available symptom measures. As the dataset provided for the schizotypy sample considered in Barkus et al (in press) included measures which allowed the computation of effect sizes when controlling for comorbid symptoms, these estimates were included in the analysis instead of the ones computed from Stirling et al. (2007). The analyses were carried out on 64 individual effect sizes computed from the 14 available studies (13 effect size estimates for positive beliefs; 13 for uncontrollability and danger; 12 for cognitive confidence; 12 for negative beliefs in general and 14 for cognitive self-consciousness) under the random-effects model using the DerSimonial-Laird estimator. The effect size estimates included in the analyses and their associated variances and 95% CIs are displayed in Table 3.5.

Table 3.5:
Individual effect sizes with their associated variances and 95% confidence intervals for studies controlling for comorbid symptoms

	Cognitive self-consciousness			Uncontrollability and danger			Positive beliefs about worry			Cognitive confidence			Negative beliefs in general		
Study and covariate measures	G	v	95% CI	g	v	95% CI	g	v	95% CI	g	v	95% CI	g	v	95% CI
Lobban et al. (2002) STAI, BDI	0.54	0.07	[0.01, 1.08]	0.18	0.07	[-0.34, 0.71]	0.20	0.08	[-0.33, 0.73]	-0.55	0.07	[-1.09, -0.02]	na	na	na
Morrison, Bentall et al. (2002) PANSS P1, PANSS P6	-0.19	0.10	[-0.82, 0.43]	-0.38	0.10	[-1.00, 0.24]	-0.53	0.11	[-1.17, 0.11]	0.34	0.10	[-0.28, 0.96]	-0.32	0.10	[-0.94, 0.31]
Morrison, Wells et al. (2002) STAI	na	na	na	0.30	0.03	[-0.06, 0.65]	0.46	0.04	[0.09, 0.83]	na	na	na	-0.24	0.03	[-0.59, 0.11]
Allen et al. (2005) DASS A, DASS D, PS	0.17	0.01	[-0.05, 0.39]	na	na	na	na	na	na	na	na	na	na	na	na
Larøi & Van der Linden (2005) PDI	0.16	0.01	[-0.07, 0.39]	0.43	0.01	[0.20, 0.66]	0.16	0.01	[-0.07, 0.39]	0.60	0.01	[0.37, 0.84]	0.20	0.01	[-0.03, 0.43]
García-Montes, Cangas et al. (2006) PS, STAI	0.20	0.03	[-0.12, 0.52]	0.29	0.03	[-0.04, 0.61]	0.17	0.03	[-0.16, 0.49]	0.17	0.03	[-0.16, 0.49]	0.32	0.03	[-0.02, 0.66]
Jones & Fernyhough (2006) WBSI intru, O-LIFE (except unusual experiences subscale)	0.43	0.01	[0.29, 0.58]	0.16	0.01	[0.02, 0.31]	-0.03	0.01	[-0.17, 0.11]	0.06	0.03	[-0.09, 0.20]	0.24	0.01	[0.10, 0.39]
Allen et al. (2007) BAI, PDI	0.46	0.9	[-0.13, 1.04]	na	na	na	na	na	na	na	na	na	na	na	na
Barkus et al. (2010) SPQ (except hallucination-related items)	0.69	0.07	[0.16, 1.22]	0.57	0.07	[0.05, 1.10]	-0.30	0.07	[-0.82, 0.22]	0.57	0.07	[0.04, 1.09]	0.58	0.07	[0.05, 1.11]
Varese & Bentall (2008) PANAS NA	0.41	0.04	[0.01, 0.80]	0.56	0.04	[0.15, 0.96]	-0.07	0.04	[-0.45, 0.32]	0.57	0.04	[0.17, 0.97]	0.57	0.04	[0.17, 0.97]
Brett et al. (2009) Analogue sample SCL90-R A, SCL-90-R D	-0.36	0.16	[-1.16, 0.44]	-0.20	0.16	[-0.99, 0.59]	-0.50	0.17	[-1.31, 0.30]	0.03	0.16	[-0.76, 0.82]	-0.54	0.17	[-1.34, 0.27]

Brett et al. (2009) Psychotic patients sample SCL90-R A, SCL-90-R D	0.27	0.16	[-0.51, 1.04]	-0.05	0.16	[-0.82, 0.72]	-0.80	0.17	[-1.61, 0.00]	0.32	0.16	[-0.45, 1.10]	-0.26	0.16	[-1.04, 0.51]
Debbane et al. (2009) CDI, R-CMAS	0.36	0.03	[0.04, 0.67]	0.45	0.03	[0.13, 0.76]	0.05	0.03	[-0.26, 0.36]	0.28	0.03	[-0.03, 0.59]	0.27	0.03	[-0.04, 0.58]
Johns (2009) CAARMS UTC	0.14	0.08	[-0.40, 0.68]	-0.43	0.08	[-0.97, 0.11]	0.57	0.08	[0.02, 1.11]	-0.36	0.08	[-0.90, 0.18]	-0.11	0.08	[-0.65, 0.43]
Varese et al. (in press) DTQ, PADS	0.26	0.01	[0.57, 1.02]	0.22	0.01	[0.02, 0.42]	-0.22	0.01	[-0.05, 0.37]	0.10	0.01	[-0.10, 0.30]	-0.02	0.01	[-0.22, 0.18]

Notes : BAI = Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988); BDI = Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961); CAAMS UTC = Severity of unusual thought content subscale of the Comprehensive Assessment of At Risk Mental States (Yung et al., 2005); CDI = French version of the Children's Depression Inventory (Saint-Laurent, 1990); DASS A = Anxiety subscale of the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995); DASS D = Depression subscale of the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995); DTQ = Intrusions frequency subscale of the Distressing Thoughts Questionnaire (Clark & de Silva, 1985); O-LIFE = Oxford-Liverpool Inventory of Feelings and Experiences (Mason et al., 1995); PADS = Persecution subscale of the Persecution and Deservedness Scale (Melo, Corcoran, Shryane, & Bentall, 2009); PANAS NA = Trait negative affect scale of the Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988); PANSS P1 = Delusions subscale of the Positive and Negative Syndromes Scale (Kay, Fiszbein, & Opler, 1987); PANSS P6 = Suspiciousness/Paranoia subscale of the Positive and Negative Syndromes Scale (Kay et al., 1987); PDI = Peters et al. Delusions Inventory (Peters & Garety, 1996); PS = Paranoia Scale (Fenigstein & Vanable, 1992); R-CMAS = Revised Children's Manifest Anxiety Scale (Turgeon & Chartrand, 2003), SPQ = Schyzotypy Personality Questionnaire (Raine, 1991); SCL-90-R A = Anxiety subscale of the Symptoms Checklist 90 – Revised (Derogatis, 1983); SCL-90-R D = Depression subscale of the Symptoms Checklist 90 – Revised (Derogatis, 1983); STAI = State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970); WBSI intru = Intrusiveness of thoughts subscale of the White Bear Suppression Inventory (Wegner & Zanakos, 1994).

The results revealed that, once the effect of comorbid symptoms had been accounted for, the effects of positive beliefs about worry and general negative beliefs were not statistically significant (g = 0.01, SE = 0.08, 95% CI [-0.15, 0.15] $p > .05$ and g = 0.13, SE = 0.08, 95% CI [-0.02, 0.28] $p > .05$, respectively). Conversely, statistically significant mean effects were found for uncontrollability and danger (g = 0.24, SE = 0.07, 95% CI [0.11, 0.37] $p < .01$), cognitive confidence (g = 0.19, SE = 0.10, 95% CI [0.02, 0.38], $p < .05$) and cognitive self-consciousness (g = 0.28, SE = 0.05, 95% CI [0.19, 0.38], $p < .01$), but the magnitude of these associations was small.

The Z test of significance of mean difference in effect sizes under the random-effects model (Borenstein et al., 2009) was used to compare these summary effects to the average effect sizes computed from the remaining studies which did not allow the computation of effect sizes when controlling for comorbid symptoms. For this subgroup, all the summary effect sizes were statistically significant ($p < .001$); positive beliefs, g = 0.56, SE = 0.11, 95%CI [0.33, 0.78]; uncontrollability and danger g = 1.08, SE = 0.22, 95%CI [0.66, 1.50]; cognitive confidence g = 0.60, SE = 0.16, 95%CI [0.29, 0.90]; general negative beliefs, g = 0.57, SE = 0.07, 95%CI [-0.11, 0.15]; cognitive self-consciousness, g = 0.54, SE = 0.12, 95%CI [0.30, 0.78].
The results from the Z test indicated that the summary effects from studies which controlled for comorbid symptoms were significantly smaller than the corresponding effects from studies in which the effect of covariates was not taken into account (positive beliefs: mean effects difference = -0.55, Z = -4.04, $p < .001$; uncontrollability and danger: mean effects difference = -0.84, Z = -3.42, $p < .001$; cognitive confidence: mean effects difference = -0.41, Z = -2.17, $p < .05$; general negative beliefs: mean effects difference = -0.44, Z = -4.14, $p < .001$; cognitive self-consciousness: mean effects difference = -0.26 Z = -2.00, $p < .05$).

3.5. Discussion

3.5.1. The association between metacognitive beliefs and hallucination proneness in clinical and non-clinical samples

The present meta-analysis aimed to evaluate and summarize the existing empirical evidence pertaining to the cognitive model of hallucinations proposed by Morrison et al. (1995). The results from the both the aggregated and analogue subgroup analyses indicated that, overall, the constructs assessed by the MCQ are robustly associated with hallucinations-proneness, with summary effect sizes presenting moderate-to-large magnitudes according to the conventional criteria proposed by Cohen (1988). However, when we aggregated the effect sizes from studies which compared hallucinating and non-hallucinating patients on metacognitive beliefs measures, only small-to-moderate effects were found for the association between hallucination-proneness and metacognitive beliefs. Most interestingly, the effects of several metacognitive factors which have been implicated in auditory and visual hallucinations by previous research in clinical samples (i.e. cognitive confidence, negative beliefs about thought in general and negative beliefs about the uncontrollability of thoughts and associated danger) did not reach statistical significance.

The results from the heterogeneity analyses conducted to estimate the degree of inconsistency in effect sizes and to investigate possible systematic causes of variability clarify the meta-analytic findings reported above. Although several studies included in this meta-analysis showed that metacognitive factors are associated with hallucination-proneness, they differed greatly in the magnitude of these effects. Both

the results from the Q test of heterogeneity and the estimated amount of inconsistency in effect sizes for the different analyses conducted showed evidence of statistical heterogeneity across studies for the five constructs considered. Therefore, these results suggest that simply combining the effect size estimates from these studies might be misleading without providing any explanation of the reasons for the observed heterogeneity. The results from meta-regression showed that the methodological features of the primary studies had little or no impact on the effect estimates. Specifically, we found no connection between effect sizes and the different research designs implemented in the primary studies. Further analyses revealed that there were systematic differences in the effect size estimates between clinical and analogue studies; the relationship between hallucination-proneness and lack of cognitive confidence and between hallucination-proneness and general negative beliefs were significantly stronger in the non-clinical studies reviewed compared to clinical studies. Differences in study type did not affect the magnitude of the effect sizes for any of the remaining constructs, although a trend towards significance was apparent for negative beliefs about the uncontrollability of thoughts and, to a lesser extent, cognitive self-consciousness. The impact of these methodological differences could not, however, fully account for the observed statistical heterogeneity, as indicated by the test of residual heterogeneity and the results from the heterogeneity analyses conducted separately within the analogue and clinical subgroups.

The results from the sensitivity analyses revealed that the findings were minimally influenced by the inclusion of studies which controlled for covariate measures in their original reports. Similarly, the exclusion of unpublished datasets and studies which employed measures other than the MCQ lead to findings that were largely consistent with the results of the main analyses reported in section 3.4.2 (with

the notable exception of the summary effect of general negative beliefs, which nonetheless did not differ largely from the estimate reported in our original subgroup analysis in terms of effect size magnitude). It is therefore unlikely that the observed heterogeneity in the effect sizes could be exclusively attributed to methodological heterogeneity or selection effects. As statistical heterogeneity may be caused by unknown or unrecorded confounding variables (Thompson, 1994), it is possible that the observed inconsistency could stem from the failure to evaluate the effect of concomitant symptoms that have been linked to dysfunctional metacognitive beliefs.

The apparently differing results obtained from the analogue subgroup and clinical subgroup analyses might be explained in terms of certain methodological features of the studies reviewed that could not be fully captured by the meta-analyses we conducted. For all the clinical studies included in this review it was possible to estimate effect sizes by comparing hallucinating patients with non-hallucinating patients with identical diagnosis. This comparison implicitly assumes that the participants in the two groups differ from each other only in terms of hallucination-proneness. Although this procedure does not preclude the possibility that unrecorded variables might have an impact on the effects estimated, it nonetheless offers some degree of control over a number of symptoms which might be associated with dysfunctional metacognitive beliefs. Conversely, the majority of the analogue studies included in the present review compared groups of non-clinical subjects selected exclusively according to their scores on hallucination-proneness measures. As these groups are likely to differ along other important symptom dimensions, the failure to take into account the effect of third variables associated with metacognitive beliefs might be more influential for this subgroup of studies, possibly leading to inflated estimates of the association between the constructs considered and hallucination-

proneness. These methodological differences might explain the apparent differences between the meta-analytic findings obtained from the analogue and clinical subgroups. In addition, they provide an explanation for the observed trend for the analogue studies to produce larger effect estimates than the clinical studies. From this perspective, although the use of analogue samples in studies investigating the cognitive processes underling hallucinations is justifiable on both theoretical (as psychotic experiences have been shown to exists on a continuum with normal function; van Os et al., 2000; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009) and pragmatic grounds (e.g. the possibility of testing larger, unmedicated samples; the possibility of gathering preliminary data prior to conducting investigations with clinical populations etc), findings from non-clinical studies might be misleading unless rigorous measures are implemented to account for the effect of covariates.

3.5.2. The association between hallucination-proneness and metacognitive factors when controlling for comorbid symptoms

Another cluster of analyses included in the present review concerned the specific association between hallucination-proneness and metacognitive beliefs when controlling for other confounding variables that have been linked to dysfunctional metacognitive beliefs in previous research. The results from these analyses revealed that once the effect of covariate symptoms had been taken into account, the metacognitive factors of the MCQ were only weakly associated with hallucination-proneness. Specifically, only small-sized relationships were found for beliefs about the uncontrollability and danger, lack of cognitive confidence and cognitive self-consciousness, whereas the summary effects computed for the remaining

metacognitive factors were statistically negligible. In addition, these effects were found to be significantly smaller than the corresponding summary effects estimated for studies for which covariate information was not available. Overall, these findings suggest that the observed large associations between metacognitive beliefs and hallucination-proneness in previous research might be at least partially artifactual, and stemming from the failure to carefully consider the covariation between different symptoms found to be associated with maladaptive metacognitive beliefs.

3.5.3 Theoretical, methodological and clinical implications

Taken as a whole, the results from this research synthesis offer at best limited support to the metacognitive account of hallucinatory experiences proposed by Morrison et al. (1995). Although the results from the analogue studies included in this review support the existence of robust relationships between hallucination-proneness and metacognitive beliefs, these studies suffered from methodological limitations which might have lead to inflated estimations of these associations. The quantitative integration of research findings from studies involving the direct comparison between hallucinating and comparable non-hallucinating clinical samples suggests that metacognitive beliefs are not strongly associated with the presence of hallucinations in clinical samples. In addition, the analyses conducted solely on studies which controlled for the confounding effect of comorbid symptoms showed that metacognitive beliefs are weakly associated with hallucination-proneness. Furthermore, the investigations included in this review presented great diversity in the magnitude of the effects detected, a finding which could not be simply explained in terms of systematic methodological differences between studies. Finally, as all the studies included in this research synthesis implemented correlational or cross-

sectional designs, no unequivocal support can be given to any claim of direct causality of metacognitive factors on the aetiology of hallucinatory experiences. Indeed, greater endorsement of dysfunctional metacognitive beliefs in hallucination-prone individuals might conceivably be regarded as a consequence of hallucinatory experiences, rather than an aetiological factor. It should also be noted that this meta-analytic investigation was focused exclusively on the five metacognitive factors assessed by the MCQ. Thus, the conclusions drawn from this research synthesis do not necessarily generalize to other metacognitive constructs that might be implicated in hallucination-proneness.

As the results from this research synthesis do not support the existence of specific association between hallucinations and dysfunctional metacognitive beliefs, further research might be carried out to investigate whether the metacognitive factors assessed by the MCQ might be implicated in psychotic symptoms other than hallucinations. For example, some researchers have suggested that metacognitive beliefs may be implicated in the aetiology of thought insertion and delusions of control (Linney & Peters, 2007; Morrison, 2001; Morrison et al., 1995). Similarly, the results of a recent non-clinical investigation have suggested that intrusive thoughts and dysfunctional metacognitive beliefs are more robustly associated with paranoid thinking rather than hallucination-proneness (Varese et al., in press), a finding which is consistent with recent evidence indicating that dysfunctional strategies for avoiding negative thoughts about the self are involved in both non-clinical and clinical paranoia (Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Udachina et al., 2009). Additional corroborating evidence is required, and it will undoubtedly be worthwhile to further investigate the nature of these apparent symptom-specific associations. Alternatively, it is possible that the metacognitive factors of the MCQ might be

associated with a wide range of psychological complaints, without necessarily playing a specific causal role in the development of any particular symptom. This conceptualization is consistent with the findings of studies which suggest that dysfunctional metacognitive beliefs might represent a general vulnerability factor to the development of emotional and psychological disorders (e.g. Morrison & Wells, 2003).

A methodological implication of these findings concerns the importance of controlling for the covariation between symptoms when investigating cognitive processes believed to underlie specific psychological complaints. It has been argued that a satisfactory account of the processes underlying psychotic symptoms can be achieved by considering each symptom in isolation (Bentall, 2003) but this approach requires efforts to avoids confounds stemming from the interrelations between different symptoms. This study also points at the importance of carrying out systematic quantitative reviews to improve our understanding of the cognitive processes believed to underlie specific psychotic symptoms. In the present research synthesis, a widely accepted model of hallucinations has been shown to be less secure once the available evidence has been evaluated using meta-analytic methods. Although several narrative reviews pertaining to alternative models of hallucinatory experiences have been published in recent years (e.g. the source monitoring account of auditory verbal hallucinations; Ditman & Kuperberg, 2005; Larøi & Woodward, 2007), these reviews did not attempt to integrate the relevant quantitative findings. It is therefore advisable for future reviews to implement meta-analytic methods to evaluate the validity and specificity of the mechanisms considered in these models.

The results of this research synthesis also have important clinical implications. The findings from previous studies on the association between metacognitive beliefs

and hallucinatory experiences have generally encouraged researchers and clinicians to consider potential clinical applications of the metacognitive beliefs model. Previous researchers and reviewers argued that if metacognitive beliefs are implicated in the genesis of hallucinations, specific cognitive-behavioural interventions focusing on the modification of dysfunctional metacognitive beliefs, such as metacognitive focused cognitive therapy (Wells, 2000), might prove useful for the treatment of these symptoms (Aleman & Larøi, 2008; Lobban et al., 2002). As the findings from the present review offer little support to the often presumed causal role of metacognitive beliefs in the genesis of hallucinations, it follows that such metacognitive interventions lack sufficient theoretical justification if the aim is to reduce symptoms. However, it is possible that metacognitive beliefs influence not hallucinatory experiences per se but the distress associated with them. For example, a recent study conducted by Brett et al. (2009) on both clinical (ARMS and psychotic patients) and non-clinical participants found that, although psychotic-like experiences were not directly associated with metacognitive beliefs, negative beliefs about thoughts predicted the distress consequent on the occurrence of psychotic-like experiences. This observation provides a rationale for the application of metacognitive focused interventions for the reduction of distress, which (given the existence of large numbers of people who cope well with hallucinatory experiences; e.g., van Os et al., 2000) may, for some patients, be a more important target for intervention than symptoms.

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References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Allen, J. G., & Coyne, L. (1995). Dissociation and vulnerability to psychotic experience. *Journal of Nervous and Mental Disease, 183*(10), 615-622.

Allen, P., Freeman, D., McGuire, P., Garety, P., Kuipers, E., Fowler, D., et al. (2005). The prediction of hallucinatory predisposition in non-clinical individuals: Examining the contribution of emotion and reasoning. *British Journal of Clinical Psychology, 44*, 127-132.

Andrew, E. M., Gray, N. S., & Snowden, R. J. (2008). The relationship between trauma and beliefs about hearing voices: A study of psychiatric and non-psychiatric voice hearers. *Psychological Medicine, 38*, 1409-1417.

Baethge, C., Baldessarini, R. J., Freudenthal, K., Streeruwitz, A., Bauer, M., & Bschor, T. (2005). Hallucinations in bipolar disorder: Characteristics and comparison to unipolar depression and schizophrenia. *Bipolar Disorders, 7*(2), 136-145.

Baker, C. A., & Morrison, A. P. (1998). Cognitive processes in auditory hallucinations: Attributional bias and metacognition. *Psychological Medicine, 28*(5), 1199-1208.

Barkus, E., Stirling, J., & Lewis, S. (in press). Relationship between distress and metacognitions in a hypothetically psychosis prone non-clinical sample. *The Journal of Nervous and Mental Disease*.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893-897.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 41*, 53-63.

Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucinations. *Psychological Bulletin, 107*, 82-95.

Bentall, R. P. (2003). *Madness explained: Psychosis and the human nature*. London: Penguin Books Ltd.

Bentall, R. P., Corcoran, R., Howard, R., Blackwood, N., & Kinderman, P. (2001). Persecutory delusions: A review and theoretical integration. *Clinical Psychology Review, 21*(8), 1143-1192.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis*. Chichester, UK: John Wiley & Sons.

Bouvard, M., Mollard, E., Cottraux, J., & Guerin, J. (1989). Etude de validation et analyse factorielle de la version francaise de l'echelle d'obsession compulsion de Yale Brown. *Journal de Therapie Comportementale et Cognitive, 2*(4), 18-22.

Brett, C. M. C., Johns, L. C., Peters, E. P., & McGuire, P. K. (2009). The role of metacognitive beliefs in determining the impact of anomalous experiences: A comparison of help-seeking and non-help-seeking groups of people experiencing psychotic-like anomalies. *Psychological Medicine, 39*, 939-950.

Brett, C. M. C., Peters, E. P., Johns, L. C., Tabraham, P., Valmaggia, L. R., & McGuire, P. K. (2007). Appraisal of Anomalous Experiences Interview

(AANEX): a multidimensional measure of psychological responses to anomalies associated with psychosis. *British Journal of Psychiatry, 191*(51), s23-s30.

Burns, L. G., Keortge, S. G., Formea, G. M., & Sternberger, L. G. (1996). Revision of the Padua inventory of obsessive compulsive disorder symptoms: Distinctions between worry, obsessions, and compulsions. *Behaviour Research and Therapy, 34*(2), 163-173.

Cangas, A., Errasti, J. M., García-Montes, J. M., Álvarez, R., & Ruiz, R. (2006). Metacognitive factors and alterations of attention related to predisposition to hallucinations. *Personality and Individual Differences, 40*, 487-496.

Cartwright-Hatton, S., Mather, A., Illingworth, V., Brocki, J., Harrington, R., & Wells, A. (2004). Development and preliminary validation of the Meta-cognitions Questionnaire--Adolescent Version. *Journal of Anxiety Disorders, 18*(3), 411-422.

Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: the meta-cognitions questionnaire and its correlates. *Journal of Anxiety Disorders, 11*(3), 279-296.

Clark, D. A., & de Silva, P. (1985). The nature of depressive and anxious intrusive thoughts: distinct or uniform phenomena? *Behaviour Research and Therapy, 23*(4), 383-393.

Clark, D. A., & Purdon, C. (1995). The assessment of unwanted intrusive thoughts: A review and critique of the literature. *Behaviour Research and Therapy, 33*(8), 967-976.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Davies, R. N., & Valentiner, D. P. (2000). Does meta-cognitive theory enhance our understanding of pathological worry and anxiety? *Personality and Individual Differences, 29*(3), 513-526.

Debbané, M., Van der Linden, M., Gex-Fabry, M., & Eliez, S. (2009). Cognitive and emotional associations to positive schizotypy during adolescence. *Journal of Child Psychology and Psychiatry, 50*(3), 326-334.

Derogatis, L. R. (1983). *SCL-90-R : Administration, scoring, and procedures manual* (2nd ed.). Towson, MD: Clinical Psychometric Research.

Ditman, T., & Kuperberg, G. R. (2005). A source-monitoring account of auditory verbal hallucinations in patients with schizophrenia. *Harvard Review of Psychiatry, 13*(5), 280-299.

Dumas, P., Bouafia, S., Gutknecht, C., Saoud, M., Dalery, J., & d'Amato, T. (2000). [Validation of the French version of the Raine Schizotypal Personality Disorder Questionnaire - categorical and dimensional approach to schizotypal personality traits in a normal student population]. *Encephale, 26*, 23-29.

Egger, M., Davey Smith, G., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *British Medical Journal, 315*, 629-634.

Ensum, I., & Morrison, A. P. (2003). The effects of focus of attention on attributional bias in patients experiencing auditory hallucinations. *Behaviour Research and Therapy, 41*(8), 895-907.

Fenigstein, A., Scheier, M. F., & Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology, 43*, 522-527.

Fenigstein, A., & Vanable, P. A. (1992). Paranoia and self-consciousness. *Journal of Personality and Social Psychology, 62*, 129 -138.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Stanford: SUP.

Fidalgo, Á. M., Gutierrez, O., García-Montes, J. M., & Cangas, A. (2003). Escala de predisposicion a las alucinaciones: estructura factorial de la adaptacio´n para la poblacion espanola [Predisposition to hallucinations scale: Factorial structure of the Spanish adaptation]. In A. Cangas & J. Gil (Eds.), *Avances en la etiologıa y tratamiento de los trastornos del espectro esquizofrenico.* Granada (Spain): Nemesis.

Flavell, J. H. (1979). Metacognition and cognitive monitoring. *American Psychologist, 34*(10), 906-911.

Fleiss, J. L. (1993). The statistical basis of meta-analysis. *Statistical Methods in Medical Research, 2*, 121-145.

Fontenelle, L. F., Lopes, A. P., Borges, M. C., Pacheco, P. G., Nascimento, A. L., & Versiani, M. (2008). Auditory, visual, tactile, olfactory, and bodily hallucinations in patients with obsessive-compulsive disorder. [Article]. *Cns Spectrums, 13*(2), 125-130.

Fraser, J., Morrison, A. P., & Wells, A. (2006). Cognitive precesses, reasoning biases and persecutory delusions: A comparative study. *Behavioural and Cognitive Psychotherapy, 34*(4), 421-435.

Frith, C. D. (1992). *The cognitive neuropsychology of schizophrenia*. Hillsdale, NJ: Lawrence Erlbaum.

García-Montes, J. M., Cangas, A., Pérez-Álvarez, M., Fidalgo, A. M., & Gutiérrez, O. (2006). The role of meta-cognition and thought control techniques in

predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 45*(3), 309-317.

García-Montes, J. M., Cangas, A., Pérez-Álvarez, M., Hidalgo, Á. M., & Gutiérrez, O. (2005). Influence of metacognitive variables on paranoid ideation. *International Journal of Clinical and Health Psychology, 5*(3), 463-469.

García-Montes, J. M., Pérez-Álvarez, M., Balbuena, C. S., Garcelán, S. P., & Cangas, A. (2006). Metacognitions in patients with hallucinations and obsessive-compulsive disorder: The superstition factor. *Behaviour Research and Therapy, 44*(8), 1091-1104.

Gwilliam, P., Wells, A., & Cartwright-Hatton, S. (2004). Dose meta-cognition or responsibility predict obsessive-compulsive symptoms: a test of the metacognitive model. *Clinical Psychology & Psychotherapy, 11*(2), 137-144.

Hammersley, P., Dias, A., Todd, G., Bowen-Jones, K., Reilly, B., & Bentall, R. P. (2003). Childhood trauma and hallucinations in bipolar affective disorder: preliminary investigation. *British Journal of Psychiatry, 182*(6), 543-547.

Hedges, L. V. (1981). Distribution theory for Glass's estimator of effect size and related estimators. *Journal of Educational Statistics, 6*, 107-128.

Hedges, L. V., & Olkin, I. (1985). *Statistical Methods for Meta-analysis*. San Diego, CA: Academic Press.

Higgins, J. P. T., & Thompson, S. G. (2002). Quantifying heterogeneity in meta-analysis. *Statistics in Medicine, 21*(11), 1539-1558.

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *British Medical Journal, 327*, 557-560.

Hoffman, R. E. (1986). Verbal hallucinations and language production processes in schizophrenia. *Behavioral and Brain Sciences, 9*, 503-548.

Honig, A., Romme, M. A. J., Ensink, B. J., Escher, S. D. M. A. C., Pennings, M. H. A., & DeVries, M. W. (1998). Auditory hallucinations: A comparison between patients and nonpatients. *Journal of Nervous and Mental Disease, 186*(10), 646-651.

Irak, M., & Tosun, A. (2008). Exploring the role of metacognition in obsessive-compulsive and anxiety symptoms. *Journal of Anxiety Disorders, 22*(8), 1316-1325.

Johns, L. C. (2009). [Metacognitive beliefs in at risk mental states individuals]. *Unpublished raw data.*

Jones, S. R., & Fernyhough, C. (2006). The role of thought suppression and metacognitive beliefs in proneness to auditory verbal hallucinations in a non-clinical sample. *Personality and Individual Differences, 41*(8), 1421-1432.

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin, 12*(2), 261-276.

Larøi, F., Collignon, O., & Van der Linden, M. (2005). Source-monitoring for actions in hallucinations proneness. *Cognitive Neuropsychiatry, 10*(2), 105-123.

Larøi, F., Marczewski, P., & Van der Linden, M. (2004). The multi-dimensionality of hallucinatory predisposition: Factor structure of a modified version of the Launay-Slade Hallucinations Scale in a normal sample. *European Psychiatry, 19*, 15-20.

Larøi, F., & Van der Linden, M. (2005). Metacognitions and proneness towards hallucinations and delusions. *Behaviour Research and Therapy, 43*(11), 1425-1441.

Larøi, F., Van der Linden, M., & d'Acremont, M. (2009). Validity and reliability of a French version of the Metacognitions Questionnaire in a nonclinical population. *Journal, 68*(3), 125-132.

Larøi, F., van der Linden, M., & Marczewski, P. (2004). The effects of emotional salience, cognitive effort and meta-cognitive beliefs on a reality monitoring task in hallucination-prone subjects. *British Journal of Clinical Psychology, 43*(3), 221-233.

Larøi,, F., & Woodward, T. S. (2007). Hallucinations from a cognitive perspective. *Harvard Review of Psychiatry, 15*, 109-117.

Launay, G., & Slade, P. (1981). The measurement of hallucinatory predisposition in male and female prisoners. *Personality and Individual Differences, 2*, 221-234.

Linney, Y. M., & Peters, E. R. (2007). The psychological processes underlying symptoms of thought interference in psychosis. *Behaviour Research and Therapy, 45*, 2726-2741.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical Meta-analysis*. London: Sage.

Lobban, F., Haddock, G., Kinderman, P., & Wells, A. (2002). The role of metacognitive beliefs in auditory hallucinations. *Personality and Individual Differences, 32*(8), 1351-1363.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy, 33*(3), 335-343.

Mason, O., Claridge, G., & Jackson, M. (1995). New scales for the assessment of schizotypy. *Personality and Individual Differences, 18*(1), 7-13.

Melo, S., Corcoran, R., Shryane, N., & Bentall, R. P. (2009). The persecution and deservedness scale. *Psychology and Psychotherapy: Theory, Research and Practice, 82*(3), 247-260.

Morrison, A. P. (1998). A cognitive analysis of the maintenance of auditory hallucinations: Are voices to schizophrenia what bodily sensations are to panic? *Behavioural and Cognitive Psychotherapy, 26*, 289-302.

Morrison, A. P. (2001). The interpretation of intrusions in psychosis: An integrative cognitive approach to hallucinations and delusions. *Behavioural and Cognitive Psychotherapy, 29*(3), 257-276.

Morrison, A. P., & Baker, C. A. (2000). Intrusive thoughts and auditory hallucinations: A comparative study of intrusions in psychosis. *Behaviour Research and Therapy, 38*(11), 1097-1106.

Morrison, A. P., Bentall, R. P., French, P., Walford, L., Kilcommons, A. M., Knight, A., et al. (2002). Randomised controlled trial of early detection and cognitive therapy for preventing transition to psychosis in high-risk individuals. *British Journal of Psychiatry, 181*(43), s78-s84.

Morrison, A. P., Frame, L., & Larkin, W. (2003). Relationship between trauma and psychosis: A review and integration. *British Journal of Clinical Psychology, 42*, 331-353.

Morrison, A. P., French, P., Lewis, S. W., Roberts, M., Raja, S., Neil, S. T., et al. (2006). Psychological factors in people at ultra-high risk of psychosis: comparison with non-patients and associations with symptoms. *Psychological Medicine, 36*(10), 1395-1404.

Morrison, A. P., French, P., & Wells, A. (2007). Metacognitive beliefs across the continuum of psychosis: Comparisons between patients with psychotic

disorders, patients at ultra-high risk and non-patients. *Behaviour Research and Therapy, 45*, 2241-2246.

Morrison, A. P., & Haddock, G. (1997). Self-focused attention in schizophrenic patients with and without auditory hallucinations and normal subjects: A comparative study. *Personality and Individual Differences, 23*(6), 937-941.

Morrison, A. P., Haddock, G., & Tarrier, N. (1995). Intrusive thoughts and auditory hallucinations: A cognitive approach. *Behavioural and Cognitive Psychotherapy, 23*(3), 265-280.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Morrison, A. P., & Wells, A. (2003). A comparison of metacognition in patients with hallucinations, delusions, panic disorder, and non-patients controls. *Behaviour Research and Therapy, 41*(2), 251-256.

Morrison, A. P., Wells, A., & Nothard, S. (2000). Cognitive factors in predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 39*(1), 67-78.

Morrison, A. P., Wells, A., & Nothard, S. (2002). Cognitive and emotional predictors of predisposition to hallucinations in non-patients. *British Journal of Clinical Psychology, 41*(3), 259-270.

Myers, S. G., & Wells, A. (2005). Obsessive-compulsive symptoms: The contributions of metacognition and responsibility. *Journal of Anxiety Disorders, 19*(7), 806-817.

Obsessive Compulsive Cognitions Working Group. (2001). Development and initial validation of the obsessive beliefs questionnaire and interpretation of intrusions inventory. *Behaviour Research and Therapy, 39*, 987-1006.

Ohayon, M. M. (2000). Prevalence of hallucinations and their pathological associations in the general population. *Psychiatry Research, 97*, 153-164.

Perona-Garcelán, S., Cuevas-Yust, C., García-Montes, J. M., Pérez-Alvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2008). Relationship between self-focused attention and dissociation in patients with and without auditory hallucinations. *Journal of Nervous and Mental Disease*(196), 3.

Peters, E. P., & Garety, P. A. (1996). The Peters et al. Delusions Inventory (PDI): New forms for the 21-item version. *Schizophrenia Research, 18*(2), 118-119.

Purdon, C., & Clark, D. A. (2001). Suppression of obsession-like thoughts in nonclinical individuals: Impact on thought frequency, appraisal and mood state. *Journal, 39*(10), 1163-1181. doi:10.1016/S0005-7967(00)00092-9

Rachman, S. J. (1981). Unwanted intrusive cognitions. *Advances in Behaviour Research and Therapy, 3*, 89-99.

Raine, A. (1991). The SPQ: A scale for the assessment of schizotypal personality based on DSM-III-R criteria. *Schizophrenia Bulletin, 17*(4), 555-564.

Rothstein, H. R., & Hopewell, S. (2009). Grey literature. In H. Cooper, L. V. Hedges & J. C. Valentine (Eds.), *The handbook of reserach synthesis and meta-analysis* (2nd ed., pp. 103-125). New York: Russel Sage Fundation.

Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). *Publication bias in meta-analysis: Prevention, Assessment & Adjustment*. Chichester, England: John Wiley & Sons.

Saint-Laurent, L. (1990). Etude psychometrique de l'inventaire de depression pour enfants de Kovacs aupres d'un echantillon francophone [Psychometric study of Kovacs' Children's Depression Inventory with a French-speaking sample]. *Canadian Journal of Behavioural Science, 22*(4), 377-384.

Slade, P., & Bentall, R. P. (1988). *Sensory deception: a scientific analysis of hallucination*. London: Croom Helm.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. (1970). *Manual of the State-Trait Anxiety Inventory (''Self-Evaluation Questionnaire'')*. Palo Alto, CA: Consulting Psychologists Press.

Startup, M., Startup, S., & Sedgman, A. (2008). Immediate source-monitoring, self-focused attention and the positive symptoms of schizophrenia. *Behaviour Research and Therapy, 46*(10), 1176-1180.

Sterne, J. A. C., Becker, B. J., & Egger, M. (2005). The funnel plot. In H. R. Rothstein, A. J. Sutton & M. Borenstein (Eds.), *Publication bias in meta-analysis: Prevention, assessment and adjustments*. Chichester, England: John Wiley & Sons.

Sterne, J. A. C., & Egger, M. (2005). Regression methods to detect publication and other bias in meta-analysis. In H. R. Rothstein, A. J. Sutton & M. Borenstein (Eds.), *Publication bias in meta-analysis: Prevention, assessment and adjustments*. Chichester, England: John Wiley & Sons.

Stirling, J., Barkus, E., & Lewis, S. (2007). Hallucination proneness, schizotypy and meta-cognition. *Behaviour Research and Therapy, 45*(6), 1401-1408.

Thompson, S. G. (1994). Systematic review: Why sources of heterogeneity in meta-analysis should be investigated. *British Medical Journal, 309*(6965), 1351-1355.

Tien, A. Y. (1991). Distribution of hallucinations in the population. *Social Psychiatry and Psychiatric Epidemiology, 26*, 287-292.

Turgeon, L., & Chartrand, E. (2003). Reliability and validity of the Revised Children's Manifest Anxiety Scale in a French-Canadian sample. *Psychological Assessment, 15*(3), 378-383.

Udachina, A., Thewissen, V., Myin-Germeys, I., Fitzpatrick, C., O'Kane, A., & Bentall, R. P. (2009). Understanding the relationships between self-esteem, experiential avoidance and paranoia: Structural equation modelling and experience sampling studies. *Journal of Nervous and Mental Disease, 197*(9), 661-668.

van Os, J., Hanssen, M., Bijl, R. V., & Ravelli, A. (2000). Strauss (1969) revisited: A psychosis continuum in the normal population? *Schizophrenia Research, 45*, 11-20.

van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis-proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine, 39*(2), 179-195.

Varese, F., Barkus, E., & Bentall, R. P. (in press). Dissociative and metacognitive factors in hallucination-proneness when controlling for comorbid symptoms. *Cognitive Neuropsychiatry.*

Varese, F., & Bentall, R. P. (2008). [Relationship between hallucination-proneness, metacognitive beliefs, dispositional mindfulness and experiential avoidance]. *Unpublished raw data.*

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, 36(3), 1-48

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070.

Wegner, D. M., & Zanakos, S. (1994). Chronic thought suppression. *Journal, 62*(4), 615-640. doi:10.1111/j.1467-6494.1994.tb00311.x

Wells, A. (1997). *Cognitive therapy of anxiety disorders*. Chichester, England: Wiley.

Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester, England: John Wiley & Sons.

Wells, A., & Carter, C. S. (2001). Further tests of a cognitive model of generalised anxiety disorder: Metacognitions and worry in GAD, panic disorder, social phobia, depression and nonpatients. *Behavior Therapy, 32*, 85-102.

Wells, A., & Cartwright-Hatton, S. (2004). A short form of the Metacognitions Questionnaire: properties of the MCQ-30. *Behaviour Research and Therapy, 42*(4), 385-396.

Wells, A., & Davies, M. I. (1994). The Thought Control Questionnaire: A measure of individual differences in the control of unwanted thoughts. *Behaviour Research and Therapy, 32*(8), 871-878.

Yung, A. R., Yuen, H. P., McGorry, P. D., Phillips, L. J., Kelly, D., Dell-Olio, M., et al. (2005). Mapping the onset of psychosis: The Comprehensive Assessment of At Risk Mental States (CAARMS). *Australian & New Zealand Journal of Psychiatry, 39*, 964-971.

Chapter 4

The relationship between dissociation and auditory verbal hallucinations in the flow of daily life of patients with psychosis

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4.1 Abstract

Background: It has been proposed that dissociation plays a role in the aetiology of hallucinatory experiences. The present study examined the relationship between reports of auditory hallucinations and dissociative experiences in the daily lives of patients with psychosis. The influence of everyday stressors on dissociation and on the hypothesised relationship between dissociation and hallucinatory experiences was also investigated. Finally, this study examined the association between and hallucinations other non-dissociative dysfunctional strategies used to suppress unpleasant mental events (i.e. experiential avoidance)

Method: Forty-two patients with a diagnosis of schizophrenia spectrum disorder and 23 healthy controls were studied using the Experience Sampling Method (ESM), a 6-day prospective self-assessment technique.

Results: Patients who hallucinated during the assessment period ($n = 21$) reported elevated levels of dissociation compared to non-hallucinating patients and healthy controls. Within the hallucinating patient group, auditory hallucinations were significantly predicted by both dissociation and experiential avoidance, although only the effect of dissociation remained significant after controlling for comorbid paranoia. Dissociation predicted the occurrence of auditory hallucinations, especially under high stress. Hallucinating patients also reported a greater increase in dissociation in response to minor daily life stress compared to clinical and non-clinical controls.

Conclusions: These results further support the link between auditory hallucinations and experiences of dissociative detachment, and might inform future investigations into the mechanisms underlying this association. Interventions designed to reduce dissociation should be studied as potential treatments for auditory hallucinations.

4.2 Introduction

Auditory hallucinations are primarily observed in patients with a diagnosis of schizophrenia spectrum disorder (i.e. schizophrenia, schizoaffective disorder, delusional disorder, psychotic disorder not otherwise specified) but also in other diagnostic groups, including bipolar disorder and unipolar depression (Baethge, et al., 2005; Hammersley, et al., 2003), post-traumatic stress disorder (PTSD; Anketell, et al., 2010; Hamner, et al., 2000), obsessive compulsive disorder (Fontenelle, et al., 2008) and dissociative disorders (Dorahy, et al., 2009; Honig, et al., 1998). Hallucinations similar to those observed in psychiatric samples are also reported by individuals with no history of mental illness (e.g. Andrew, Gray, & Snowden, 2008; Honig, et al., 1998; Lawrence, Jones, & Cooper, 2010; Thornton, Varese, Jackson, & Linden, submitted) and epidemiological and large community-based studies have confirmed that they are experienced by a sizable minority of individuals in the general population who do not meet diagnostic criteria for psychotic disorders (e.g. Johns, Nazroo, Bebbington, & Kuipers, 2002; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009).

Recent research has witnessed a growing interest in the potential contribution of dissociative processes to psychosis proneness in general (Allen & Coyne, 1995; Moskowitz, Read, Farrelly, Rudegeair, & Williams, 2009), and auditory hallucinations in particular (Moskowitz & Corstens, 2007). Different conceptualizations of the construct of dissociation have been used to describe a variety of clinical and non-clinical psychological phenomena (Brown, 2002, 2006; Holmes, et al., 2005). Bernstein and Putnam (1986) defined dissociation as the "lack of normal integration of thoughts, feelings and experiences into the stream of

consciousness and memory" (p. 727). A widely accepted unitary conceptualization of dissociation assumes that dissociative experiences lie on a continuum ranging from the relatively benign forms of absorption and psychological/attentional disengagement frequently observed in non-clinical populations (Glicksohn & Barrett, 2003; Mayer & Farmer, 2003) to the more disabling experiences of depersonalisation and derealisation, identity alteration and dissociative amnesia observed in the severe dissociative disorders (Waller, Putman, & Carlson, 1996).

The existence of a specific connection between dissociation and hallucinatory experiences is supported by the findings of several cross-sectional studies. Dissociative experiences have been found to be strongly associated with self-report measures of hallucination-proneness in non-clinical samples (Glicksohn & Barrett, 2003; Morrison & Petersen, 2003; Varese, Barkus, & Bentall, 2010). Similarly, dissociation has been found to be related to hallucination-proneness and delusional ideation in survivors of sexual abuse (Kilcommons, Morrison, Knight, & Lobban, 2008). Furthermore, in a clinical study carried out by Perona-Garcelán et al. (2008), hallucinating psychotic patients scored higher on measures of trait dissociation than psychotic patients with no history of hallucinatory experiences. These results have recently been replicated in a sample of hallucinating and non-hallucinating PTSD patients (Anketell, et al., 2010). Several studies also suggest that dissociation might be specifically related to hallucinatory experiences rather than other psychotic symptoms. Altman, Collins and Mundy (1997) found that dissociation significantly predicted auditory hallucinations in non-psychotic adolescents after controlling for depressive and schizotypal symptomatology. Conversely, no association was observed between dissociation and delusional symptoms. In a longitudinal study of a group of adolescents experiencing auditory hallucinations (Escher, et al., 2004; Escher,

Romme, Buiks, Delespaul, & Van Os, 2002a, 2002b), dissociation was significantly associated with hallucinations persistence over a 3-year follow-up period. In contrast, dissociation was not associated with development of delusional ideation. Kilcommons and Morrison (2005) found that dissociation was related to severity of hallucinations but not delusions in patients diagnosed with schizophrenia spectrum disorders. Finally, Perona-Garcelán et al. (2010) found that psychotic patients with frequent dissociative experiences scored higher on hallucinations severity than patients who rarely experienced dissociative states. However, these two groups did not differ significantly from each other in terms of severity of delusions.

Despite these consistent findings, the available evidence relies exclusively on trait measures which require respondents to estimate the frequency of certain experiences and symptoms attributable to dissociation (such as the Dissociative Experiences Scale; Bernstein & Putnam, 1986; Carlson & Putnam, 1993). From this perspective, these results are only indicative that hallucination-prone individuals are also predisposed to dissociate, and therefore offer only indirect support for a causal relationship between dissociative states and hallucinations. Furthermore, these retrospective measures are vulnerable to memory distortions which might threaten the validity of the findings. To overcome these limitations, the present study examined the relationship between dissociative states and auditory hallucinations in a sample of psychotic patients using the Experience Sampling Method (ESM), a momentary self-assessment technique developed to investigate mental states and behaviours in the course of daily life (Csikszentmihalyi & Larson, 1987; Delespaul, 1995; Myin-Germeys, et al., 2009). In the ESM each participant is provided with a signalling device (e.g. an electronic wristwatch) programmed to prompt participants to fill in short self-report measures assessing different aspects of behavioural, emotional and

cognitive experience (e.g. current activity; positive and negative affect; current symptoms; stress etc). The ESM has been previously employed in psychotic samples, and it has been shown to be a valid, reliable and feasible method of investigating psychotic experiences (for reviews, see Delespaul, 1995; Myin-Germeys, et al., 2009; Myin-Germeys, et al., 2003; Oorschot, Kwapil, Delespaul, & Myin-Germeys, 2009).

The ESM was used to test whether daily-life reports of auditory hallucinations are significantly predicted by increased dissociation. As previous research suggests that the investigation of the predictors of hallucinatory experiences might be confounded by the comorbid symptoms (Pickering, Simpson, & Bentall, 2008; Varese, et al., 2010), this study also examined the specificity of this relationship by testing whether dissociation survived as a significant predictor of auditory hallucinations after controlling for concurrent paranoid ideation. In addition, as recent research findings suggest that dissociative states might be triggered by minor daily life stressors (Stiglmayr, et al., 2008) and that stress can influence fluctuations in psychotic symptoms (Myin-Germeys, Delespaul, & van Os, 2005), this study also examined the interplay between stress and dissociative tendencies on the likelihood to experience auditory hallucinations.

A corollary objective of this study was to examine the association between auditory hallucinations and non-dissociative maladaptive strategies used to control unpleasant mental events. Specifically, this study examined the relationship between auditory hallucinations and experiential avoidance, a psychological construct defined as intolerance toward negatively evaluated mental experiences and associated deliberate attempts to suppress them (Hayes, et al., 2004). Recent cognitive models have proposed that hallucinations might be linked to dysfunctional beliefs about the importance of thought control (Jones & Fernyhough, 2006; Morrison, 2001;

Morrison, Haddock, & Tarrier, 1995). Although this relationship has received some apparent support from cross-sectional studies (Aleman & Larøi, 2008; Varese & Bentall, 2011), recent research findings suggest that it might be artifactual, arising from the failure to control the covariation between hallucinations and other psychopathological symptoms (Thornton, et al., submitted; Varese, et al., 2010; Varese & Bentall, 2011). In the only study to date which included the necessary control for the covariation between hallucination-proneness and comorbid symptoms, Varese et al. (2010) found that hallucination-proneness was significantly predicted by measures of dissociation-like experiences, but not by measures assessing negative appraisal of thoughts or deliberate strategies for monitoring and controlling thoughts. Conversely, these variables were strongly related to paranoia, a finding which is congruent with theoretical accounts which have linked paranoia to avoidance of negative thoughts about the self (Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Udachina, et al., 2009). We therefore tested the hypothesis that, after controlling for the effect of concurrent paranoia, auditory hallucinations would be related to dissociation but not experiential avoidance.

4.3 Method

Participants

Fifty-four patients with diagnoses in the schizophrenia spectrum (schizophrenia, schizoaffective, or delusional disorder) were recruited from inpatients and outpatients facilities in North Wales (UK). In addition, 23 healthy participants with no history of mental health difficulties or auditory and visual hallucinations were recruited through the Bangor University Community Research Panel. Of the 77

Table 4.1

Clinical and sociodemegraphic characteristics of the sample

	Hallucinating (n =21)	Non-hallucinating (n = 21)	Controls (n = 23)	F/ $\chi 2$	Pairwise contrasts
Age	40.09 (13.56)	40.14 (12.36)	37.78 (15.21)	F (2, 62) = 0.21	all ns
Quick Test score	42.95 (4.48)	44.95 (3.63)	46.83 (2.87)	F (2, 59) = 5.77 *	C > H
Years of education	12.19 (2.34)	12.95 (1.86)	15.04 (2.36)	F (2, 62) = 9.98 ***	C > H, NH
Gender	13 males	11 males	14 males	$\chi 2(2) = 0.94$	all ns
Employment	17 unemployed	16 unemployed	3 unemployed	$\chi 2(2) = 25.92$ ***	H, NH > C
Diagnosis	Schizophrenia = 20 Schizoaffective = 1	Schizophrenia = 14 Schizoaffective = 6 Delusional = 1	na	$\chi 2(2) = 5.63$	na

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; ns = non-significant; na = not applicable; H = Hallucinating patients; NH = Non-hallucinating patients; C= Controls; Pairwise contrasts were carried out using Bonferroni correction where appropriate.

participants approached, 12 were unable to comply with the research protocol (i.e. they completed < 20 valid ESM reports and were excluded from the analyses). For the purpose of the analyses, patients were divided in two subgroups according to their ESM auditory hallucinations scores. The hallucinating patients group (n = 21) comprised participants who reported auditory hallucinations on at least one occasion over the six-day assessment period. The non-hallucinating patients group (n = 21) reported no hallucinations throughout the 6-day assessment period. Clinical and sociodemographic characteristics of the final sample are shown in Table 4.1.

Between-group differences on the clinical and demographic variables were tested using analysis of variance (ANOVA) and Pearson's χ^2 test. No significant differences were observed for age and gender. Participants in both patient groups were more likely to be unemployed and spent significantly fewer years in education compared to healthy controls. In addition, hallucinating patients scored significantly lower on verbal intelligence compared to healthy controls, whereas the remaining contrasts did not reach statistical significance (all $p > .28$). Nineteen out of 21

participants in both the hallucinating and non-hallucinating groups were taking antipsychotic medication at the time of testing.

Measures

The Positive and Negative Syndrome Scales (PANSS)

The PANSS (Kay, Fiszbein, & Opler, 1987) was used to assess participants' present mental state. The PANSS is administered in the form of a semi-structured clinical interview, and it provides three subscales assessing the presence and severity of positive and negative psychotic symptoms as well as general symptoms of psychopathology in the week preceding the interview. Each symptom included in the three subscales is scored on a scale ranging from 1 (symptom absent) to 7 (extreme symptom severity). The three PANSS subscales have good reliability and validity (Kay, Opler, & Lindenmayer, 1988).

The Quick Test

The Quick Test (Ammons & Ammons, 1962) was included as a measure of premorbid verbal intelligence. Participants are required to associate a list of 50 words of increasing difficulty to four different line drawings. The test's score is then calculated from the number of correct word-drawing associations before six consecutive incorrect responses.

ESM materials and measures

Participants were provided with an electronic wristwatch programmed to emit a signal (beep) ten times per day for six consecutive days at quasi-random intervals between 7.30am and 10.30pm. They also received six pocket-sized booklets, each one

comprising ten ESM assessment forms. After each beep, participants were instructed to complete an ESM assessment form and to record the time at which they completed filling in the entry. The ESM assessment forms comprised several items assessing current psychotic symptoms (paranoia and auditory hallucinations), stress, dissociation and experiential avoidance. All items were rated on 7-point Likert scales (1 = not at all; 7 = very much).

Auditory hallucinations. Presence and intensity of auditory hallucinations (AH intensity) were assessed using the item "Right now I hear voices that other people can't hear". Similar items have been previously used in previous ESM studies with psychiatric samples (e.g. Delespaul, DeVries, & Van Os, 2002).

Paranoia was defined as the mean score of three items assessing suspiciousness and paranoid ideation: "Right now I worry that others are plotting against me", "Right now I feel that I can trust no-one", "Right now I believe that some people want to hurt me deliberately" (Cronbach's $\alpha = .94$). Principal component analysis (PCA) on the raw within-subjects scores revealed one factor with eigenvalue greater than 1, explaining 90% of the scores variability.

Stress was defined as the mean score of three items assessing activity-related stress ("I'd rather be doing something else', 'This activity is difficult', and 'I like this activity' [reverse scored]) and three items assessing social stress ("I like this company" [reverse scored], "Right now, I'd prefer to be alone," "I'm enjoying myself" [reverse scored]). PCA uncovered one factor with eigenvalue > 1 accounting for 58% of the total variance. The internal consistency of the scale was adequate (Cronbach's $\alpha = .79$).

Experiential avoidance was defined as the mean score of three items reflecting intolerance towards unpleasant mental events: "Since the last beep my emotions have

got in the way of things which I wanted to do", "Since the last beep I've tried to block negative thoughts out of my mind", "Since the last beep I've tried to avoid painful memories" (Cronbach's $\alpha = .89$). These items have been previously used by Udachina et al. (2009) to assess experiential avoidance in the context of non-clinical paranoia. PCA indentified one factor with eigenvalue > 1, explaining 91% of the scores variability.

Dissociation was defined as the mean score of three items assessing detachment from ongoing experience derived from the acting-with-awareness subscale of the Five Factors Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietmeyer, & Toney, 2006): "Since the last beep I've found it difficult to focus on what was happening around me", "Since the last beep I've been easily distracted", "Since the last beep I've found myself doing things without paying attention" (Cronbach's $\alpha = .92$). PCA indentified one factor with eigenvalue > 1, explaining 88% of the underling variability. The validity of our ESM dissociation measure was examined by administering a widely used self-report questionnaire of trait dissociation, the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986), to a subsample of 34 participants (9 healthy controls and 25 patients). ESM dissociation scores (averaged across participants) were significantly related to trait dissociation, $r_s = .51, p = .002$. This effect corresponds to a large association according to conventional criteria to evaluate the magnitude of correlational effect sizes (Cohen, 1988; Lipsey & Wilson, 2001).

Procedure

Participants met the researchers twice, with an interval of six to ten days. During the first meeting, the researchers administered the Quick Test and explained

the ESM procedure to the participants. Each participant received one ESM wristwatch and six ESM diaries. Participants were asked to wear the wristwatch constantly during the 6-day study period, but were instructed to take it off before going to sleep to avoid any alteration of their sleeping habits. In addition, each participant was required to complete a practice ESM assessment form to make sure they were able to understand the format and content of the ESM items. Participants were instructed to complete each ESM assessment form immediately after the beep to minimise bias stemming from retrospective reporting. Participants were also instructed to record the time at which they finished filling in each diary entry. At the second meeting participants returned the ESM diaries and wristwatch to the researchers, and underwent the PANSS.

Statistical analysis

Based on the indicated times in which participants completed each diary entry, all reports completed more than 15min after the wristwatch had beeped were excluded from the analysis as the reports completed outside this time interval are less reliable and valid (Delespaul, 1995; Palmier-Claus, et al., in press). The ESM data were analysed using multilevel linear regression modelling. Multilevel regression models are an extension of the more common unilevel linear regression methods, and are ideally suited for the analysis of hierarchically organized or clustered datasets (Hox, 2010; Schwartz & Stone, 1998; Tabachnick & Fidell, 2007). ESM data present a hierarchical structure in which longitudinal observations (beeps) are clustered within participants. This may lead to violations of the assumption of independence of observations, as repeated observations from the same participants are likely to correlate more strongly with each other than with observations from other

participants. Multilevel regression models adequately control for this (Hox, 2010). All analyses were carried out using the STATA 9.1. Multilevel regression models with continuous outcomes were estimated using the STATA XTREG module, whilst multilevel models with binary outcomes were estimated using the STATA XTGEE module. Effect sizes are reported as standardised regression coefficients (β) for multilevel models with continuous outcomes, and as odds-ratios (OR) for multilevel models with binary outcomes.

Multilevel regression models were estimated to investigate between-group differences on ESM measures of dissociation, experiential avoidance and paranoia. Multilevel regression analyses were also employed to: (i) estimate the association between experiential avoidance and dissociation; (ii) test whether dissociation and avoidance predicted auditory hallucinations when controlling for the confounding effect of concurrent paranoia; and (iii) investigate the impact of current stress on dissociation and on the relationship between dissociation and auditory hallucinations. All analyses involving auditory hallucinations data were carried out within the hallucinating patients sample.

4.4 Results

4.4.1 Descriptives and between-group differences on the PANSS

A preliminary inspection of the distribution of hallucination intensity scores within the patients group revealed that this variable was highly skewed. Hallucinations intensity scores were therefore dichotomised to define the variable "presence of auditory hallucinations" (1 = hallucination present – i.e. hallucination intensity ≥ 2; 0 = hallucination absent – i.e. hallucination intensity < 2) to be used in

subsequent analyses. Within the hallucinating patients group, auditory hallucinations were reported in 618 out of 955 beeps (64.7%). The total numbers of beeps in which hallucinations were reported varied substantially across participants. Nine participants hallucinated at each reported beep, whilst the rest hallucinated between 2.40% and 82.05% of occasions.

Descriptive statistics for the PANSS subscales and ESM measures are summarised in Table 4.2. Separate ANOVAs were carried out to test for between-group differences on the three PANSS subscales. The results revealed that both patients groups scored significantly higher than healthy controls on all the PANSS subscales. In addition, hallucinating patients scored significantly higher than non-hallucinating patients on positive symptoms, whereas the contrast for the negative symptoms and the general psychopathology subscales did not reach statistical significance. To determine whether this result might be accounted for by differences on hallucinations scores, a second analysis on the positive symptoms scale was carried out after excluding the hallucinatory behaviour item of the PANSS. The difference between hallucinating and non-hallucinating patients remained statistically significant.

4.4.2 Between-group differences on the ESM measures

To investigate whether groups differed in paranoid ideation, a multilevel linear regression analysis was carried out with paranoia as the dependent variable and group as the independent variable. The hallucinating patients reported higher paranoia scores compared to non-hallucinating patients ($\chi^2(1) = 36.93, p < .001$) and healthy controls ($\beta = 1.56, SE = 0.21, p < .001$ 95% CI [1.16, 1.96]), whilst the difference

between non-hallucinating patients and controls was non-significant (β = 0.29, *SE* = 0.20, $p > .05$ 95% CI [-0.11, 0.68]).

Table 4.2

Means, standard deviations and between-group differences on PANSS scores and ESM measures

	Hallucinating (n =21)	Non-hallucinating (n = 21)	Controls (n = 23)	F / χ2	Pairwise contrasts
Positive symptoms	19.20 (4.98)	12.35 (3.27)	7.41 (0.85)	F (2, 59) = 62.62 ***	H > NH, C; NH > C
Negative symptoms	15.10 (5.43)	11.95 (4.96)	7.32 (0.48)	F (2, 59) = 18.48 ***	H, NH > C
General psychopathology	33.25 (8.33)	29.40 (9.10)	17.77 (1.87)	F (2, 59) = 27.40 ***	H, NH > C
Positive symptoms (without hallucinations)	14.90 (4.47)	10.85 (2.66)	6.41 (0.85)	F (2, 59) = 42.19 ***	H > NH, C; NH > C
ESM Paranoia	4.12 (2.12)	1.62 (1.13)	1.06 (0.11)	χ2(2) = 63.92 ***	H > NH, C
ESM Stress	3.22 (0.86)	2.64 (0.58)	2.46 (0.55)	χ2(2) = 16.25 ***	H > NH, C
ESM Dissociation	3.59 (1.41)	2.00 (1.14)	1.72 (0.98)	χ2(2) = 31.85 ***	H > NH, C
ESM Avoidance	3.69 (1.59)	2.24 (1.32)	1.35 (0.60)	χ2(2) = 41.59 ***	H > NH, C; NH > C

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; H = Hallucinating patients; NH = Non-hallucinating patients; C= Controls; Pairwise contrasts were carried out using Bonferroni correction where appropriate; Means and SDs for the ESM measures were obtain by averaging momentary ratings across participants

A similar model was estimated using dissociation scores as the dependent variable and group as the independent variable. The hallucinating patients reported higher levels of dissociation compared to both non-hallucinating patients ($\chi^2(1) = 19.41$, $p < .001$) and healthy controls (β = 1.14, *SE* = 0.22, $p < .001$ 95% CI [0.72, 1.57]). The difference between non-hallucinating patients and controls was non-significant (β = 0.17, *SE* = 0.21, $p > .05$ 95% CI [-0.24, 0.59]). When similar analyses were performed with experiential avoidance scores as the dependent variable, the results showed that hallucinating patients scored higher on experiential avoidance than both non-hallucinating patients ($\chi^2(1) = 15.13$, $p < .001$) and controls (β = 1.38, *SE* = 0.21, $p < .001$ 95% CI [0.96, 1.80]). Non-hallucinating patients had higher

experiential avoidance scores than healthy controls (β = 0.52, *SE* = 0.21, $p < .05$ 95% CI [0.11, 0.94]).

4.4.3 Experiential avoidance, dissociation and the onset of auditory hallucinations

To investigate the association between experiential avoidance and dissociation, a multilevel regression analysis was carried out using experiential avoidance as the dependent variable and dissociation as the independent variable. Experiential avoidance was positively associated with dissociative experiences (β = 0.41, *SE* = .01, $p < .001$, 95% CI [0.38, 0.43]).

To test whether dissociation predicted auditory hallucinations, a multilevel linear regression model was estimated with the presence of auditory hallucinations as the dependent variable and dissociation scores as the independent variable. The model was later corrected for the potential confounding effect of concurrent paranoia. The results revealed that the presence of auditory hallucinations was predicted by greater dissociation (OR = 1.20, *SE* = 0.08, $p < .01$, 95% CI [1.05, 1.36]). This effect remained significant after controlling for concurrent paranoia (OR = 1.17, *SE* = 0.08, $p < .05$, 95% CI [1.02, 1.35]). The presence of auditory hallucinations was also associated with greater paranoia (OR = 1.24, *SE* = 0.13, $p < .05$, 95% CI [1.01, 1.51]).

A separate multilevel regression model was estimated with presence of auditory hallucinations as the dependent variable and experiential avoidance as the independent variable. As above, paranoia was subsequently included in the model. The results of the analysis indicated that experiential avoidance significantly predicted auditory hallucinations (OR = 1.20, *SE* = 0.09, $p < .05$, 95% CI [1.04, 1.40]) but this effect was no longer significant after controlling for the confounding effect of paranoia (OR = 1.16, *SE* = 0.10, $p > .05$, 95% CI [0.98, 1.36]). As in the previous

model, the effect of paranoia was statistically significant (OR = 1.23, *SE* = 0.13, $p <$ .05, 95% CI [1.01, 1.52]).

4.4.4 The relationship between hallucinations, dissociation and stress

A multilevel regression analysis conducted on the total sample with dissociation as the dependent variable and current stress as the independent variable revealed that dissociation was significantly predicted by stress ($\beta = .14$, *SE* = .01, $p <$ .001, 95% CI [.12, .17]). To investigate whether this association varied across groups, an additional model was estimated with the interaction between current stress and the categorical predictor group as the independent variable. The group × stress interaction was statistically significant ($\chi^2(2) = 30.28$, $p < .001$). Follow-up comparisons indicated that the relationship between dissociation and stress was stronger in the hallucinating patients ($\beta = .23$, *SE* = .03, $p < .001$, 95% CI [.18, .28]) relative to the non-hallucinating ($\chi^2(1) = 7.42$, $p < .01$; $\beta = .15$, *SE* = .02, $p < .001$, 95% CI [.10, .19]) and healthy control groups ($\chi^2(1) = 30.23$, $p < .001$; $\beta = .07$, *SE* = .01, $p < .001$, 95% CI [.04, .10]). The comparison between non-hallucinating patients and healthy controls was also significant ($\chi^2(2) = 30.28$, $p < .001$).

To investigate the impact of stress on the relationship between dissociation and hallucinations, an analysis was performed with presence of hallucinations as the dependent variable and the interaction between dissociation and current stress scores as the independent variable. The interaction between dissociation and stress was significant (OR = 1.10, *SE* = 0.04, $p < .05$, 95% CI [1.02, 1.17]). To clarify this finding, the previous analysis was stratified by dividing current stress scores into tertiles to obtain three levels of stress: low, moderate and high. The results revealed that the relationship between dissociation and hallucinations was stronger for high

stress (OR = 1.52, *SE* = 0.25, $p < .01$, 95% CI [1.11, 2.10]) compared to moderate stress ($\chi^2(1) = 6.27$, $p < .05$; OR = 0.95, *SE* = 0.11, $p > .05$, 95% CI [0.75, 1.19]) and low stress ($\chi^2(1) = 4.03$, $p < .05$; OR = 1.34, *SE* = 0.13, $p < .05$, 95% CI [1.11, 1.61]). The comparison between moderate and low stress was non-significant ($\chi^2(1) = 0.25$, $p > .05$).

4.5 Discussion

Hallucinating patients reported elevated levels of dissociation compared to non-hallucinating patients and healthy controls. Dissociation also predicted auditory hallucinations after controlling for the confounding effect of paranoia. Conversely, although experiential avoidance was significantly related to hallucinations, its predictive power was not statistically significant once the effect of paranoia had been taken into account. The strength of the relationship between dissociation and hallucinatory experiences was also influenced by the severity of current stress. Dissociation was more strongly predictive of auditory hallucinations under high stress compared to lower stress. In addition, patients with auditory hallucinations were more vulnerable to dissociative states in response to stress compared to non-hallucinating patients and healthy controls.

Overall, these results support the hypothesized relationship between auditory hallucinations and dissociative tendencies. The momentary assessment framework employed in the present study confirmed that the experience of auditory hallucinations is directly linked to increased dissociative detachment in the daily life of psychotic patients, a finding which corroborates the results of previous investigations which linked auditory hallucinations to elevated scores on trait

dissociation measures. The results of the present study are also congruous with previous findings suggesting that hallucinatory experiences are specifically related to dissociative processes rather than dysfunctional attempts to regulate and suppress unwanted or unpleasant cognitions (Anketell, et al., 2010; Varese, et al., 2010). The observed relationship between dissociation and minor stressful events in daily life is also consistent with studies suggesting that subtle fluctuations in dissociative states may represent a relatively common response to stress in both clinical and non-clinical individuals (Stiglmayr, et al., 2008). That psychotic patients, and hallucinating patients in particular, are more prone to this effect is of considerable theoretical interest given previous evidence that psychosis-proneness is linked to heightened reactivity to daily life stress (Myin-Germeys, et al., 2003; Myin-Germeys & van Os, 2007; Myin-Germeys, Van Os, Schwartz, Stone, & Delespaul, 2001), and that stress reactivity may in turn lead to intensification of psychotic symptoms (Myin-Germeys, et al., 2005).

As both trait dissociation and stress sensitivity have been linked to antecedent stressful life events, including childhood trauma (Glaser, van Os, Portegijs, & Myin-Germeys, 2006; Lardinois, Lataster, Mengelers, Van Os, & Myin-Germeys, in press; Myin-Germeys, et al., 2003; van Ijzendoorn & Schuengel, 1996) future studies should investigate the influence of traumatic life events on the effects observed in this study. This line of inquiry would help to clarify the apparent relationship observed between trauma and hallucinations found in psychiatric patients (e.g. Hammersley, et al., 2003) and community samples (e.g.Hammersley, et al., 2003; Shevlin, Dorahy, & Adamson, 2007).

The present findings should be interpreted in the context of several methodological limitations. Firstly, the magnitudes of the effects in the different

analyses were generally small, although not negligible. Small effect sizes are not uncommon in ESM studies, but their cumulative effect may be substantial (Myin-Germeys, et al., 2005). Although the ESM measures were assessed longitudinally, the ESM analyses remain cross-sectional, limiting inferences about the direction of causality. In addition, although this study found that auditory hallucinations were more closely related to dissociative processes than experiential avoidance, this difference was not large. Our difficulties in distinguishing between these two effects probably stemmed from the comorbidity between auditory hallucinations and paranoia in our sample. As our results indicated that hallucinating patients reported elevated levels of paranoia, and that in turn heightened paranoia was significantly associated with hallucinations at the momentary level, discriminating between the specific predictors of hallucinations and paranoia presented a challenge. A related limitation of the present study concerns the impossibility to compare directly the predictive power of dissociation and experiential avoidance within the same multilevel model due to multicollinearity between the two predictors. Future studies aiming to investigate these apparent symptom-specific relationships might therefore benefit from the recruitment samples that are more diversified in terms of symptoms. It would be also interesting to attempt to replicate these findings in hallucinating and non-hallucinating patients with pathologies other than disorders in the psychotic-spectrum, or in comparisons between clinical and non-clinical voice-hearers.

A separate methodological issue pertains to the implementation of ESM items adapted from a scale assessing acting-with-awareness rather than other validated measures of dissociation. Most trait dissociation questionnaires require the retrospective recollection of highly contextualised behaviours which are difficult to capture in a momentary framework (e.g. the experience of driving a car and not

remembering what happened during the trip; the experience of finding things amongst one's belongings and not remembering having bought them; Bernstain & Putman, 1986; Mayer & Farmer, 2003). The inclusion of acting-with-awareness items was therefore justified by the need to implement a short measure able to capture moment-to-moment variability in dissociative detachment. It should be noted that the content of ESM dissociation items used in this study is consistent with the item content of widely used measures of peritraumatic dissociation (e.g. feeling that one is on automatic pilot; blanking out/ losing track of what is going on; Marmar, Metzler, & Otte, 2004). In addition, the robust association observed between ESM dissociation scores and trait dissociation suggests that our scale may be regarded as a valid proxy measure of dissociative detachment. Future studies may expand our findings by adapting peritraumatic dissociation scales to assess different types of dissociative experiences. It has been proposed that dissociation might be regarded as a multifaceted rather than a unitary construct (e.g. Brown, 2006; Holmes, et al., 2005). This conceptualization implies that the measurement of different features of dissociation is necessary to provide an exhaustive account of the relationship between this complex construct and hallucinatory phenomena. Future studies might therefore attempt to explore the relationship between auditory hallucinations and other subtypes of dissociative experiences found to be associated with hallucinations in previous research, such as experiences of depersonalisation and derealisation (Kilcommons & Morrison, 2005; Perona-Garcelán, et al., 2008).

In conclusion, our results document for the first time the relationship between dissociation and auditory hallucinations in the everyday life of psychotic patients. The results of this study are consistent with recent attempts to understand auditory hallucinations within the context of dissociative processes (Moskowitz & Corstens,

2007; Moskowitz et al., 2009), and should encourage further research into the mechanisms (or shared aetiological factors) which might account for the association between dissociative tendencies and specific psychotic symptoms. Our findings might inform the implementation of therapeutic techniques aimed at promoting a reduction of dissociative tendencies in hallucinating patients. One possible approach is the Attention Training Technique (Wells, 1990), an intervention developed to encourage metacognitive control of attention, which has shown promising results in initial studies with hallucinating patients (Valmaggia, Bouman, & Schuurman, 2007; Wells, 2007). Finally, these results add to the increasing evidence documenting the pervasive prevalence of dissociative experiences among patients with diagnoses in the schizophrenia spectrum (Schäfer, Aderhold, Fryberger & Spitzer, 2008). From a clinical perspective, the high prevalence of dissociative symptoms among psychotic patients underscores the need of evaluating the impact that these experiences have on the patients' condition, and of offering psychological interventions aimed to target these potentially disabling experiences in this clinical population.

References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Allen, J. G., & Coyne, L. (1995). Dissociation and vulnerability to psychotioc experience. *Journal of Nervous and Mental Disease, 183*(10), 615-622.

Altman, H., Collins, M., & Mundy, P. (1997). Subclinical hallucinations and delusions in nonpsychotic adolescents. *Journal of Child Psychology and Psychiatry, 38*(4), 413-420.

Ammons, R. B., & Ammons, C. H. (1962). The Quick Test (QT): Provisional manual. *Psychological Reports, 11*, 111-161.

Andrew, E. M., Gray, N. S., & Snowden, R. J. (2008). The relationship between trauma and beliefs about hearing voices: A study of psychiatric and non-psychiatric voice hearers. *Psychological Medicine, 38*, 1409-1417.

Anketell, C., Dorahy, M. J., Shannon, M., Elder, R., Hamilton, G., Corry, M., et al. (2010). An exploratory analysis of voice hearing in chronic PTSD: Potential associated mechanisms. *Journal of Trauma and Dissociation, 11*(1), 93-107. doi: 10.1080/15299730903143600

Baer, R. A., Smith, G. T., Hopkins, J., Krietmeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45.

Baethge, C., Baldessarini, R. J., Freudenthal, K., Streeruwitz, A., Bauer, M., & Bschor, T. (2005). Hallucinations in bipolar disorder: Characteristics and comparison to unipolar depression and schizophrenia. *Bipolar Disorders, 7*(2), 136-145. doi: 10.1111/j.1399-5618.2004.00175.x

Bentall, R. P., Corcoran, R., Howard, R., Blackwood, N., & Kinderman, P. (2001). Persecutory delusions: A review and theoretical integration. *Clinical Psychology Review, 21*(8), 1143-1192.

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability and validity of a dissociation scale. *Journal of Nervous and Mental Disease, 174*(12), 727-735.

Brown, R. J. (2002). The cognitive psychology of dissociative states. *Cognitive Neuropsychiatry, 7*(3), 221-235. doi: 10.1080/13546800244000085

Brown, R. J. (2006). Different types of "dissociation" have different psychological mechanism. *Journal of Trauma and Dissociation, 7*(4), 7-28. doi: 0.1300/J229v07n04_02

Carlson, E. B., & Putnam, F. W. (1993). An update on the Dissociative Experiences Scale. *Dissociation, 6*(1), 16-27.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the Experience-Sampling Method. *Journal of Nervous and Mental Disease, 175*(9), 526-536.

Delespaul, P. (1995). *Assessing schizophrenia in daily life: The Experience Sampling Method.* Maastricht, the Netherlands: Universitaire Pers Maastricht.

Delespaul, P., DeVries, M. W., & Van Os, J. (2002). Determinants of occurrence and recovery from hallucinations in daily life. *Soc Psychiatry Psychiatric Epidemiol, 37*(3), 97-104.

Dorahy, M. J., Shannon, C., Seagar, L., Corr, M., Stewart, K., Hanna, D., et al. (2009). Auditory hallucinations in dissociative identity disorder and schizophrenia with and without a childhood trauma history. *Journal of Nervous and Mental Disease, 197*(12), 892-898.

Escher, S., Morris, M., Buiks, A., Delespaul, P., Van Os, J., & Romme, M. (2004). Determinants of outcome in the pathways through care for children hearing voices. *International Journal of Social Welfare, 13*(3), 208-222. doi: 10.1111/j.1369-6866.2004.00315.x

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002a). Formation of delusional ideation in adolescents hearing voices: A prospective study. *American Journal of Medical Genetics (Neuropsychiatric Genetics), 114*, 913-920.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002b). Independent course of childhood auditory hallucinations: A sequential 3-year follow up study. *British Journal of Psychiatry, 181*(suppl 43), s10-s18.

Fontenelle, L. F., Lopes, A. P., Borges, M. C., Pacheco, P. G., Nascimento, A. L., & Versiani, M. (2008). Auditory, visual, tactile, olfactory, and bodily hallucinations in patients with obsessive-compulsive disorder. [Article]. *Cns Spectrums, 13*(2), 125-130.

Glaser, J. P., van Os, J., Portegijs, P. J., & Myin-Germeys, I. (2006). Childhood trauma and emotional reactivity to daily life stress in adult frequent attenders of general practitioners. *Journal of Psychosomatic Research, 61*(2), 229-239. doi: 10.1016/j.jpsychores.2006.04.014

Glicksohn, J., & Barrett, T. R. (2003). Absorption and hallucinatory experience. *Applied Cognitive Psychology, 17*(7), 833-849.

Hammersley, P., Dias, A., Todd, G., Bowen-Jones, K., Reilly, B., & Bentall, R. P. (2003). Childhood trauma and hallucinations in bipolar affective disorder: preliminary investigation. *British Journal of Psychiatry, 182*(6), 543-547.

Hamner, M. B., Frueh, B. C., Ulmer, H. G., Huber, M. G., Twomey, T. J., Tyson, C., et al. (2000). Psychotic features in chronic posttraumatic stress disorder and schizophrenia. *Journal of Nervous and Mental Disease, 188*(4), 217-221.

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., et al. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record, 54*, 553-578.

Holmes, E. A., Brown, R. J., Mansell, W., Pasco Fearon, R., Hunter, E. C. M., Frasquilho, F., et al. (2005). Are there two qualitatively distinct froms of dissociation? A review and some clinical implications. *Clinical Psychology Review, 25*(1), 1-23. doi: 10.1016/j.cpr.2004.08.006

Honig, A., Romme, M., Ensink, B., Escher, S., Pennings, M., & DeVries, M. (1998). Auditory hallucinations: A comparison between patients and nonpatients. *Journal of Nervous and Mental Disease, 186*(10), 646-651.

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (2nd ed.). Hove, UK: Routledge.

Johns, L. C., Nazroo, J. Y., Bebbington, P. E., & Kuipers, E. (2002). Occurrance of hallucinatory experiences in a community sample and ethnic variations. *British Journal of Psychiatry, 180*, 174-178

Jones, S. R., & Fernyhough, C. (2006). The role of thought suppression and metacognitive beliefs in proneness to auditory verbal hallucinations in a non-clinical sample. *Personality and Individual Differences, 41*(8), 1421-1432.

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin, 12*(2), 261-276.

Kay, S. R., Opler, L. A., & Lindenmayer, J. P. (1988). Reliability and validity of the positive and negative syndrome scale for schizophrenics. *Psychiatry Research, 23*(1), 99-110.

Kilcommons, A. M., & Morrison, A. P. (2005). Relationships between trauma and psychosis: An exploration of cognitive and dissociative factors. *Acta Psychiatrica Scandinavica, 112*(5), 351-359.

Kilcommons, A. M., Morrison, A. P., Knight, A., & Lobban, F. (2008). Psychotic experiences in people who have been sexually assaulted. *Social Psychiatry and Psychiatric Epidemiology, 43*(8), 602-611.

Lardinois, M., Lataster, T., Mengelers, R., Van Os, J., & Myin-Germeys, I. (in press). Childhood trauma and increased stress sensitivity in psychosis. *Acta Psychiatrica Scandinavica*. doi: 10.1111/j.1600-0447.2010.01594.x

Lawrence, C., Jones, J., & Cooper, M. (2010). Hearing voices in a non-psychiatric population. *Behavioural and Cognitive Psychotherapy, 38*(3), 363-373. doi: 10.1017/S1352465810000172

Lipsey, M. W., & Wilson, D. B. (2001). *Practical Meta-analysis*. London: Sage.

Mayer, J. L., & Farmer, R. F. (2003). The development and psychometric evaluation of a new measure of dissociative activities. *Journal of Personality Assessment, 80*(2), 185-196.

Marmar, C. R., Metzler, T. J., & Otte, C. (2004). The Peritraumatic Dissociative Experiences Questionnaire. In J. P. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (2nd ed., pp. 144-167). New York: Guilford.

Morrison, A. P. (2001). The intepretation of intrusions in psychosis: An integrative cognitive approach to hallucinations and delusions. *Behavioural and Cognitive Psychotherapy, 29*(3), 257-276.

Morrison, A. P., Haddock, G., & Tarrier, N. (1995). Intrusive thoughts and auditory hallucinations: A cognitive approach. *Behavioural and Cognitive Psychotherapy, 23*(3), 265-280.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Moskowitz, A., & Corstens, D. (2007). Auditory hallucinations: Psychotic symptom or dissociative experience. *The Journal of Psychological Trauma, 6*(2), 35-63.

Moskowitz, A., Read, J., Farrelly, S., Rudegeair, T., & Williams, O. (2009). Are psychotic symptoms traumatic in origin and dissociative in kind? In P. Dell & J. O'Neil (Eds.), *Dissociation and dissociative disorders: DSM-V and beyond.* New York: Routledge.

Myin-Germeys, I., Delespaul, P., & van Os, J. (2005). Behavioural sensitization to daily life stress in psychosis. *Psychological Medicine, 35*(5), 733-741. doi: 10.1017/S0033291704004179

Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P., & van Os, J. (2009). Experience sampling research in psychopathology: Opening the black box of daily life. *Psychological Medicine, 39*(9), 1533-1547. doi: 10.1017/S0033291708004947

Myin-Germeys, I., Peeters, F., Havermans, R., Nicolson, N. A., deVries, M. W., Delespaul, P., et al. (2003). Emorional reactivity to daily life stress in psychosis and disorder: an experience sampling study. *Acta Psychiatrica Scandinavica, 107*(33), 124-131. doi: DOI: 10.1017/S0033291702006785

Myin-Germeys, I., & van Os, J. (2007). Stress-reactivity in psychosis: Evidence for an affective pathway to psychosis. *Clinical Psychology Review, 27*(4), 409-424. doi: 10.1016/j.cpr.2006.09.005

Myin-Germeys, I., Van Os, J., Schwartz, J. E., Stone, A. A., & Delespaul, P. (2001). Emotional reactivity to daily life stress in psychosis. *Archives of General Psychiatry, 58*, 1137-1144.

Oorschot, M., Kwapil, T., Delespaul, P., & Myin-Germeys, I. (2009). Momentary assessment research in psychosis. *Psychological Assessment, 21*(4), 498-505.

Palmier-Claus, J. E., Myin-Germeys, I., Barkus, E., Udachina, A., Delespaul, P., Lewis, S. W., et al. (in press). Experience Sampling Method in individuals with mental illness: Reflections and guidance. *Acta Psychiatrica Scandinavica.*

Perona-Garcelán, S. P., Cuevas-Yust, C., García-Montes, J. M., Pérez-Alvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2008). Relationship between self-focused attention and dissociation in patients with and without auditory hallucinations. *Journal of Nervous and Mental Disease, 196*(3), 190-197.

Perona-Garcelán, S. P., García-Montes, J. M., Cuevas-Yust, C., Pérez-Álvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., et al. (2010). A preliminary exploration of trauma, dissociation and positive psychotic symptoms in a Spanish sample. *Journal of Trauma and Dissociation, 11*(3), 284-292. doi: 10.1080/15299731003786462

Pickering, L., Simpson, J., & Bentall, R. P. (2008). Insecure attachment predicts proneness to paranoia but not hallucinations. *Personality and Individual Differences, 44*(5), 1212-1224.

Schäfer, I., Aderhold, V., Fryberger, H. J., & Spitzer, R. L. (2008). Dissociative symtpoms in schizophrenia. In A. Moskowitz, I. Schäfer & M. Dorahy (Eds.), *Psychosis, tauma and dissociation: Emerging perspectives on severe psychopathology* (pp. 149-163). Chichester, England: Wiley-Blackwell.

Schwartz, J. E., & Stone, A. A. (1998). Strategies for analysing ecological momentary assessment data. *Health Psychology, 17*(1), 6-16. doi: 10.1037/0278-6133.17.1.6

Shevlin, M., Dorahy, M., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*(3-4), 222-228.

Stiglmayr, C. E., Ebner-Priemer, U. W., Bretz, J., Behm, R., Mohse, M., Lammers, C. H., et al. (2008). Dissociative symptoms are positively related to stress in borderline personality disorder. *Acta Psychiatrica Scandinavica, 117*(2), 139-147. doi: 10.1111/j.1600-0447.2007.01126.x

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education.

Thornton, K., Varese, F., Jackson, M. C., & Linden, D. E. J. (submitted). The relationship between metacognitive beliefs, auditory hallucinations and hallucination-related distress in clinical and non-clinical voice-hearers. *Manuscript submitted for publication.*

Udachina, A., Thewissen, V., Myin-Germeys, I., Fitzpatrick, C., O'Kane, A., & Bentall, R. P. (2009). Understanding the relationships between self-esteem, experiential avoidance and paranoia: Structural equation modelling and experience sampling studies. *Journal of Nervous and Mental Disease, 197*(9), 661-668.

Valmaggia, L. R., Bouman, T. K., & Schuurman, L. (2007). Attention training with auditory hallucinations: A case study. *Cognitive and Behavioural Practice, 14*(2), 127-133. doi: 10.1016/j.cbpra.2006.01.009

van Ijzendoorn, M. H., & Schuengel, C. (1996). The measurement of dissociation in normal and clinical populations: Meta-analytic validation of the Dissociative Experiences Scale (DES). *Clinical Psychology Review, 16*(5), 365-382.

van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis-proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine, 39*(2), 179-195. doi: 10.1017/S0033291708003814

Varese, F., Barkus, E., & Bentall, R. P. (2010). Dissociative and metacognitive factors in hallucination-proneness when controlling for comorbid symptoms. *Cognitive Neuropsychiatry*. doi: 10.1080/13546805.2010.495244

Varese, F., & Bentall, R. P. (2011). The metacognitive beliefs account of hallucinatory experiences: A literature review and meta-analysis. Clinical Psychology Review. doi: 10.1016/j.cpr.2010.12.001

Waller, N. G., Putman, F. W., & Carlson, E. B. (1996). Types of dissociation and dissociative types: A taxometric analysis of dissociative experiences. *Psychological Methods, 1*(3), 300-321.

Wells, A. (1990). Panic disorder in association with relaxation induced anxiety: An attentional training approach to treatment. *Behavior Therapy, 21*(3), 273-280.

Wells, A. (2007). The attention training technique: Theory, effects and a metacognitive hypothesis on auditory hallucinations. *Cognitive and Behavioural Practice, 14*(2), 134-138. doi: 10.1016/j.cbpra.2006.01.010

Chapter 5

Dissociation mediates the relationship between childhood trauma and hallucination-proneness

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5.1 Abstract

Background: It has been proposed that the relationship between childhood trauma and hallucinations can be explained by dissociative processes. The present study examined whether the effect of childhood trauma on hallucination-proneness is mediated by dissociative tendencies. In addition, the influence of dissociative symptoms on a cognitive process believed to underlie hallucinatory experiences (i.e. reality discrimination; the capacity to discriminate between internal and external cognitive events) was also investigated.

Method: Patients with schizophrenia spectrum disorders and healthy controls (with no history of hallucinations) completed questionnaire measures of hallucination-proneness, dissociative tendencies and childhood trauma, as well as performing an auditory signal detection task.

Results: Compared to both clinical and healthy controls, hallucinating patients reported both significantly higher dissociative tendencies and childhood sexual abuse. Dissociation positively mediated the effect of childhood trauma on hallucination-proneness. This meditational role was particularly robust for sexual abuse over other types of trauma. Signal detection abnormalities were evident in hallucinating patients and patients with a history of hallucinations, but were not associated with pathological dissociative symptoms.

Conclusions: These results are consistent with dissociative accounts of the trauma-hallucinations link. Dissociation, however, does not affect reality discrimination. Future research should examine whether other cognitive processes associated with

both dissociative states and hallucinations (e.g. deficits in cognitive inhibition) may explain the relationship between dissociation and hallucinatory experiences.

5.2 Introduction

Hallucinatory experiences, especially in the auditory modality, are regarded as pathognomonic symptoms of schizophrenia spectrum disorders, although similar complaints are also reported by patients with other diagnoses (Aleman & Larøi, 2008) and non-clinical individuals who do not meet diagnostic criteria for psychiatric disorders (e.g. Andrew, Gray, & Snowden, 2008; Honig et al., 1998; Johns, Nazroo, Bebbington, & Kuipers, 2002; Lawrence, Jones, & Cooper, 2010; Thornton, Varese, Jackson, & Linden, submitted). From a cognitive perspective, hallucinations are believed to arise from the misattribution of internally generated cognitive events (e.g. inner speech) to external sources (Bentall, 1990; Ditman & Kuperberg, 2005; Frith, 1992; Larøi & Woodward, 2007). Bentall (1990) proposed that hallucinatory experiences may be explained by reality discrimination, a metacognitive process used to discriminate agency between internal and external perceptions (for reviews, see Aleman & Larøi, 2008; Ditman & Kuperberg, 2005). According to this account, hallucination-prone individuals are impaired in their capacity to discriminate between internally and externally generated cognitive events, and present a specific cognitive bias towards the misattribution of internal cognitive events to external sources.

Several studies have employed signal detection theory (SDT) to investigate the relationship between reality discrimination and hallucination-proneness. SDT assumes that the capacity to discern signals from noise relies on two parameters: perceptual sensitivity (i.e. the capacity to detect a signal from background noise) and response bias (i.e. the extent to which an individual is more or less likely to report the presence of a signal in background noise). Studies which employed auditory SDT tasks have generally supported the reality discrimination model of hallucinations by showing that

both hallucinating patients and non-clinical hallucination-prone individuals are characterised by greater bias towards the detection of signals (and not by perceptual sensitivity impairment) when compared to controls (Barkus et al., in press; Barkus, Stirling, Hopkins, McKie, & Lewis, 2007; Bentall & Slade, 1985a; Varese, Barkus, & Bentall, 2010; Vercammen, De Haan, & Aleman, 2008).

Recent research has witnessed a growing interest in the contribution of trauma to hallucination-proneness. Large population-based investigations and several cross-sectional studies suggest traumatic events may increase the likelihood of experiencing psychotic symptoms (for reviews see Read, Fink, Rudegeair, Felitti, & Whitfield, 2008; Read, Goodman, Morrison, Ross, & Aderhold, 2004; Read, Van Os, Morrison, & Ross, 2005; van Os, Kenis, & Rutten, 2010), and that there might be specific associations between different types of adversities and specific psychotic complaints (Bentall & Fernyhough, 2008). In this context, the experience of early adversity, especially childhood sexual abuse (CSA), has been specifically linked to the hallucinations in schizophrenia (Read, Agar, Argyle, & Aderhold, 2003) and bipolar disorder patients (Hammersley *et al.*, 2003) as well as in community samples (Shelvin, Dorahy, & Adamson, 2007; Whitfield, Dube, Felitti, & Anda, 2005).

It has been proposed that the relationship between trauma and psychotic symptoms could be accounted for by dissociative processes (e.g. Anketell et al., 2010; Moskowitz & Corstens, 2007; Moskowitz, Read, Farrelly, Rudegeair, & Williams, 2009). Dissociation has been defined as the "lack of normal integration of thoughts, feelings and experiences into the stream of consciousness and memory" (p. 727 Bernstein & Putnam, 1986) and represents the core component of DSM-IV diagnosis of dissociative disorders. Although dissociative states can be experienced in the absence of antecedent trauma (Mayer & Farmer, 2003; Merckelbach & Muris, 2001),

research findings suggest that dissociation is a pervasive sequela of traumatic events in non-psychotic samples (van Ijzendoorn & Schuengel, 1996), and that psychotic patients exposed to traumatic life experiences score higher on measures of dissociative tendencies compared to patients with no history of trauma (Dorahy et al., 2009; Goff, Brotman, Kindlon, Waites, & Amico, 1991; Holowka, King, Saheb, Pukall, & Brunet, 2003; Offen, Waller, & Thomas, 2003; Perona-Garcelán et al., 2010).

Although studies have linked dissociative tendencies to psychotic symptoms and psychosis-proneness in general (Moskowitz, Barker-Collo, & Ellson, 2005; Pope & Kwapil, 2000; Startup, 1999), increasing evidence suggests dissociation is specifically related to hallucinations rather than other psychotic symptoms (Altman, Collins, & Mundy, 1997; Escher, Romme, Buiks, Delespaul, & Van Os, 2002a, 2002b; Kilcommons & Morrison, 2005). Several cross-sectional studies have found robust associations between dissociative tendencies and hallucinatory experiences in psychotic patients (Kilcommons & Morrison, 2005; Perona-Garcelán et al., 2008; Perona-Garcelán, et al., 2010), sexual abuse victims (Kilcommons, Morrison, Knight, & Lobban, 2008), post-traumatic stress disorder patients (Anketell, et al., 2010), non-psychotic adolescents (Altman, et al., 1997; Yoshizumi, Murase, Honjo, Kaneko, & Murakami, 2004) and adult non-clinical samples (Barkus, Stirling, & Cavill, 2010; Glicksohn & Barrett, 2003; Morrison & Petersen, 2003; Varese, et al., 2010). In a longitudinal study of adolescents experiencing auditory hallucinations (Escher, et al., 2002a, 2002b), dissociation significantly predicted the persistence of hallucinations over a 3-year follow-up period. Finally, in a recent experience-sampling study, increased state dissociation was found to be a significant predictor of auditory

hallucinations in the flow of daily life of psychotic patients (Varese, Udachina, Myin-Germeys, Oorschot, & Bentall, 2011).

The accumulating evidence linking childhood trauma, dissociation and hallucinations has lead to speculation the effect of childhood trauma on hallucination-proneness may be mediated by increased dissociative tendencies (Anketell, et al., 2010; Moskowitz & Corstens, 2007). This hypothesis, however, has not been empirically tested to date. Similarly, no published studies have yet investigated the interplay between dissociation and the cognitive mechanisms believed to underlie hallucinatory experiences. Allen et al. (1997) proposed that dissociation might represent a vulnerability to experience psychotic symptoms in virtue of its capacity of "loosening the moorings in inner and outer reality" (p. 327), therefore making individuals vulnerable to psychotic states by impairing reality testing. From this perspective, it can be assumed dissociative tendencies could directly interfere with discrimination between internally and externally generated events, resulting in reality discrimination difficulties.

The primary objective of this study was to test whether dissociation mediates the relationship between childhood trauma and hallucination-proneness in a sample of psychotic patients with diagnoses in the schizophrenia-spectrum. In addition, this study examined whether dissociation is related to perturbed reality discrimination by comparing patients with and without pathological dissociative symptoms using an auditory signal detection task. Corollary analyses (correlational and between-group differences analyses) were also carried out to replicate previous findings which linked auditory hallucinations to childhood trauma, dissociative symptoms and perturbed reality discrimination.

5.3 Method

Participants

Forty-five patients with diagnoses in the schizophrenia spectrum (i.e. diagnoses of schizophrenia, schizoaffective disorder and delusional disorder, as confirmed by the referring clinicians or members of the patients' care teams) were recruited from inpatients and outpatients services in North Wales (UK). In addition, 20 healthy controls with no history of mental health difficulties or hallucinations were recruited through the Bangor University Community Research Panel. For the purpose of the between-group analyses, patients were divided into three subgroups according to their responses to the hallucinations items of the Positive and Negative Syndromes Scale (PANSS; Kay, Fiszbein, & Opler, 1987). The hallucinating patients group (n = 15) comprised participants with a score ≥ 3 on the hallucinatory behaviour item of PANSS (i.e. symptom present). The remitted hallucinators group (n = 14) comprised non-hallucinating patients (PANSS hallucinations score = 1; i.e. symptom absent) who suffered from auditory hallucinations in the past. Finally, the non-hallucinating patients group (n = 16) included participants who reported no life-time occurrence of hallucinatory experiences. Clinical and sociodemographic characteristics of the sample are reported in Table 5.1.

Between-group differences on the clinical and demographic variables were tested using analysis of variance (ANOVA) and Pearson's χ^2 test. There were no significant between-group differences for age, gender and premorbid IQ (as assessed by the Ammons Quick Test; Ammons & Ammons, 1962). Patients spent significantly less years in education compared to healthy controls, but there were no differences on education between the three clinical groups. Forty patients were taking antipsychotic

Table 5.1:

Clinical and sociodemographic characteristic of the sample

	Hallucinating	Remitted hallucinators	Non-hallucinating	Controls	F/ $\chi 2$
Age	45.6 (12.2)	39.4 (13.3)	48.3 (12.2)	39.5 (14.6)	$F(3, 62) = 1.93$
Quick Test	43.1 (4.1)	43.4 (5.0)	43.1 (5.1)	45.9 (3.3)	$F(3, 61) = 1.79$
Education (years)	13.6 (3.3)	13.7 (2.7)	11.9 (2.1)	16.1 (3.1)	$F(3, 62) = 6.87$ ***
Gender	Males = 6	Males = 7	Males = 11	Males = 11	$\chi 2(3) = 2.04$
Diagnosis	Schizophrenia = 13 Schizoaffective = 2	Schizophrenia = 10 Scizoaffective = 4	Schizophrenia = 11 Scizoaffective = 5 Delusional = 1	na	$\chi 2(4) = 3.29$

Note. * $p < .05$; ** $p < .01$; *** $p < .001$;

medication at the time of testing (13 hallucinating patients, 12 remitted hallucinators and 15 non-hallucinating patients).

Measures

The Positive and Negative Syndrome Scales (PANSS; Kay, et al., 1987)

An interview schedule comprising the positive and negative subscales of the Structured Clinical Interview for the PANSS was used to assess the presence and severity of positive and negative psychotic symptoms in the week preceding the interview. Each symptom is scored on a scale ranging from 1 (symptom absent) to 7 (extreme symptom severity). The PANSS subscales have good reliability and validity (Kay, Opler, & Lindenmayer, 1988).

The revised Launay-Slade Hallucination Scale (LSHS-R; Bentall & Slade, 1985b)

The LSHS-R is a widely used self-report measure of hallucination-proneness. The 12 items of the scale describe clinical and subclinical forms of auditory and

visual hallucinations. Participants are asked to rate the degree to which the content of each item applies to themselves on a 5-point Likert scale (1 = ''certainly does not apply'' to 5 = ''certainly applies''). The LSHS-R had excellent internal consistency in this sample (α = .91).

The Child Abuse and Trauma Scale (CATS; Sanders & Becker-Launsen, 1995)

The CATS is a self-report measure of the perceived stress and trauma experienced during childhood and adolescence. It comprises 38 items describing experiences of child sexual abuse, punishment/physical abuse, neglect/negative home environment and emotional abuse. Participants are required to estimate how frequently they were exposed to the abusive experiences described in each item on a 5-point Likert scale (0 = Never; 4 = Always). In this study, the CATS presented good internal consistency both at the total scale (α = .95) and at the subscales level (αs ranging between .73 and .92).

The Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986)

The DES is a self-report measure of dissociative symptoms and experiences. Participants are asked to estimate the frequency of 28 dissociative phenomena in their daily life using a 100mm visual analogue. Using taxometric analysis, Waller, Putnam and Carlson (Waller, Putman, & Carlson, 1996) identified an 8-item subset of the DES (known as the Dissociative Experiences Scale – Taxon; DES-T) used to estimate the probability that an individual belongs to the pathological dissociation taxon (Waller, et al., 1996; Waller & Ross, 1997). The DES and the DES-T had good internal consistency in this sample (α = .93 and α = .83, respectively).

The Quick Test (Ammons & Ammons, 1962)

The Quick Test was included as a measure of premorbid verbal intelligence. Participants are required to associate a list of 50 words of increasing difficulty to four

different line drawings. The test score is then calculated from the number of correct word-drawing associations before six consecutive incorrect responses.

The auditory signal detection task

An auditory SDT task previously employed to investigate the cognitive underpinnings of non-clinical hallucination-proneness (Barkus, et al., in press; Barkus, et al., 2007; Varese, et al., 2010) was used as a measure of reality discrimination. The task consisted of two 8-min blocks, comprising a total of 120 8-s epochs. Each epoch contained one 5-s burst of white noise and 3-s of silence. During 60% of the bursts of white noise, a 1-s androgynous voice was presented after 2-s. A third of the time the voice was clearly audible to participants; in the remaining epochs the voice was presented at auditory thresholds (auditory thresholds were estimated by prior testing using 10 pilot participants in the same age range of the experimental participants, i.e age range 18 – 65). Stimuli were presented through standard stereo headphones. After each burst of white noise, participants indicated whether they perceived a voice by pressing mouse buttons labelled ''Yes'' or ''No'' using their preferred hand. Four measures were obtained: hits (positive responses when the voice was present), false alarms (positive responses when the voice was absent), misses (negative responses when the voice was present), and correct rejections (negative responses when the voice was absent). From the relationship between hits and false alarms, measures of perceptual sensitivity (d') and response bias (β) were calculated using the computational methods described by Barkus *et al.* (2007). A d' value of zero indicates complete inability to discriminate between signals and background noise, whereas higher d' scores indicate better capacity to detect true signals. Conversely, any β score lower than 1 suggests a bias towards the detection of signals when no signal is present, whereas scores equal to 1 indicate no response bias.

Procedure

Participants were tested individually in a quiet room in the Bangor University School of Psychology, or in other appropriate facilities in inpatient and outpatient units in North Wales (UK). After informed consent had been obtained, participants underwent the PANSS, completed the Quick Test and were asked to fill in the LSHS-R and the DES. Participants were then asked to read a set of standardised instructions and completed the signal detection task. The task was described as a simple hearing test. At the completion of the task, participants were asked to fill in the CATS and were fully debriefed.

5.4 Results

5.4.1 Between-group differences on the PANSS and questionnaire measures and correlational analyses

Prior to mediation analysis, a series of one-way ANOVAs was carried out to examine between-group differences on the PANSS and questionnaire measures. Post-hoc comparisons were conducted using Tukey's HSD. Correlational analyses were also performed to examine the associations between DES, LSHS-R and CATS scores. All analyses involving the DES were carried out after excluding the DES hallucinations item to avoid any confound stemming from the overlapping content with hallucination-proneness.

Descriptive statistics for the PANSS and questionnaire measures are displayed in Table 5.2. The analyses of the PANSS revealed that all patients groups scored

Table 5.2:

Means and SD for the PANSS, questionnaire measure and SDT task performance

	Hallucinating	Remitted hallucinators	Non-hallucinating	Controls	F / $\chi 2$
Positive symptoms	18.36 (4.09)	11.07 (2.76)	12.06 (3.78)	7.30 (0.47)	F (3, 61) = 37.58 ***
Negative symptoms	12.85 (5.12)	9.71 (4.32)	10.03 (4.96)	7.25 (0.71)	F (3, 61) = 7.36 ***
Positive symptoms (without hallucinations)	14.21 (3.30)	9.86 (2.88)	11.06 (3.78)	6.30 (0.47)	F (3, 61) = 22.79 ***
LSHS-R	47.64 (6.40)	36.64 (10.34)	28.88 (8.67)	21.45 (6.95)	F (3, 61) = 30.74 ***
DES	42.59 (11.03)	26.06 (10.90)	23.93 (14.93)	14.86 (12.28)	F (3, 61) = 13.70 ***
CATS	63.93 (33.68)	43.92 (17.94)	46.19 (27.65)	23.35 (10.54)	F (3, 61) = 8.68 ***
Sexual abuse	7.07 (7.15)	1.69 (2.69)	2.93 (4.22)	0.40 (0.75)	F (3, 61) = 7.48 ***
Punishment	8.93 (3.39)	7.54 (3.20)	8.56 (4.50)	5.20 (2.37)	F (3, 61) = 4.43 **
Negative home environment	25.33 (14.68)	19.38 (7.95)	18.00 (11.82)	9.05 (5.33)	F (3, 61) = 7.46 ***
Emotional abuse	13.67 (7.84)	9.46 (4.84)	9.50 (7.18)	5.45 (3.05)	F (3, 61) = 5.57 **
β (Response bias)	.19 (.38)	.15 (.38)	.56 (.35)	.66 (.38)	F (3, 57) = 7.58 ***
d' (perceptual sensitivity)	1.05 (0.45)	1.07 (0.43)	1.40 (0.44)	1.87 (0.56)	F (3, 57) = 12.57 ***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$;

significantly higher than controls on positive symptoms (all ps < .01). Hallucinating patients presented significantly higher scores on the PANSS positive symptoms scale compared to the other patients groups (all ps < .001), whereas the remitted hallucinators vs non-hallucinating patients contrast was not significant (p = .80). To determine whether this result might be accounted for by differences on hallucinations scores, the analysis was also carried out after excluding the hallucinations item of the PANSS. The difference between the hallucinating and the other patient groups remained statistically significant (all ps < .05). In terms of negative symptoms, hallucinating patients scored significantly higher than participants with no history of mental health difficulties (p < .001). The comparison between the remitted hallucinators and healthy controls was not significant (p = .99), whereas the difference

between non-hallucinating patients and healthy controls approached statistical significance ($p = .07$). All pairwise comparisons carried out between the clinical groups were not significant, although a trend towards significance was observed for the hallucinating patients vs remitted hallucinators contrast ($p = .08$).

The results of the hallucination-proneness scores showed that all patient groups scored significantly higher than healthy controls (all ps $< .05$). Amongst the clinical groups, hallucinating patients had significantly higher LSHS-R scores than the other groups considered (all ps $< .01$). In addition, remitted hallucinators scored higher than the non-hallucinating patients ($p = .05$). The analysis of dissociation scores revealed that hallucinating patients had significantly higher DES scores compared to both clinical and healthy controls (all ps $< .01$). No other between-group differences reached statistical significance, although a trend was observed for the remitted hallucinators vs healthy controls contrast ($p = .06$).

The analysis of the childhood trauma measures revealed that both hallucinating and non-hallucinating patients scored significantly higher than healthy controls on the CATS ($p < .001$ and $p < .05$, respectively), whereas the comparison between remitted hallucinators and controls only approached statistical significance ($p = .08$). The three patients groups did not differ significantly from each other in terms of CATS total scores (all ps $> .05$). The analyses carried out at the subscale level showed that the hallucinating patients scored significantly higher than non-clinical controls on all CATS subscales (all ps $< .01$). In addition, non-hallucinating patients reported significantly higher levels of neglect and physical abuse compared to participants with no history of mental health difficulties (all ps $< .05$), whereas patients in the remitted hallucinators group scored higher than controls only on measures of neglect/negative home environment ($p < .05$). The three patients groups

did not differ from each other on physical abuse, neglect or emotional abuse (all *p*s > .05). However, hallucinating patients reported significantly more CSA compared to both remitted hallucinators ($p < .01$) and hallucinating patients ($p < .05$).

To examine the associations between LSHS-R, DES and CATS scores, two separate correlational analyses were conducted on both the aggregated sample of participants (i.e. including both psychiatric and non-clinical participants), and exclusively on the psychiatric patients sample (see Table 5.3). Hallucination-proneness was significantly associated with dissociation and CATS total scores in both the aggregated and psychiatric sample analyses. In the aggregated sample, hallucination-proneness was significantly related to all subscales of the CATS, whereas only the associations with CSA and neglect were statistically significant in the psychiatric subsample analysis. In the aggregated sample, significant associations were also found between dissociation and CATS total scores, CSA, neglect and emotional abuse. However, only the relationship with CATS total scores and with CSA were significant when the analysis was restricted to psychiatric patients.

5.4.2 Mediation analyses

The hypothesised mediating role of dissociation in the relationship between childhood trauma and hallucination-proneness was tested using the general approach to mediation analysis developed by Imai, Keele and Tingley (2010) This statistical approach provides a unified estimation procedure for mediation effects that can accommodate linear and nonlinear relationships, parametric and non-parametric models and different types of mediators and outcome variables (i.e. both continuous and dichotomous) without the need of individually tailored statistical models. The

Table 5.3:

Non-parametric correlations (Sperman's rho) between childhood trauma, dissociation and hallucination-proneness measures

	LSHS-R	DES	CATS total	Sexual abuse	Physical abuse	Neglect
Aggregated sample						
DES	.70 ***	-				
CATS total	.58 ***	.43 ***	-			
Sexual abuse	.52 ***	.35 **	.77 ***	-		
Physical abuse	.35 **	.24	.71 ***	.44 ***	-	
Neglect	.58 ***	.41 **	.95 ***	.70 ***	.55 ***	-
Emotional abuse	.49 ***	.38 **	.87 ***	.48 ***	.64 ***	.82 ***
Patient sample						
DES	.62 ***	-				
CATS total	.35 *	.32*	-			
Sexual abuse	.37 *	.31*	.72 ***	-		
Physical abuse	.07	.10	.65 ***	.32 *	-	
Neglect	.36 *	.23	.93 ***	.63 ***	.45 **	-
Emotional abuse	.29	.26	.85 ***	.35 *	.56 ***	.79 ***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$;

analysis was carried out using the "mediation" statistical package for R (Imai, Keele, Tingley, & Yamamoto, 2010). Point estimates for mediated, direct and total effects and their associated 95% CIs were estimated using the nonparametric inference algorithm detailed by Imai *et al.* with 1000 bootstrap resamples. Firstly, mediation analysis was employed to test whether the association between CATS and LSHS-R scores is mediated by dissociative tendencies. In addition, separate analyses were carried out using the four CATS subscales as independent variables to examine whether the hypothesised mediating role of dissociation could be ascribed to specific experiences of childhood trauma. The analyses were conducted both on the aggregated sample, and on the psychiatric patient sample alone.

Table 5.4:

Point estimates with their associated 95% CIs for the mediated, direct and total effects

Independent variable	Indirect effect	Direct effect	Total effect
Analysis of the total sample			
CATS scores	0.12 [0.06, 0.19]	0.12 [0.02, 0.22]	0.24 [0.13, 0.35]
Sexual abuse	0.65 [0.24, 1.07]	0.58 [-0.02, 1.12]	1.23 [0.68, 1.76]
Physical abuse	0.56 [-0.06, 1.21]	0.45 [-0.26, 1.18]	1.00 [0.14, 1.92]
Neglect	0.26 [0.11, 0.42]	0.30 [0.09, 0.48]	0.56 [0.32, 0.78]
Emotional abuse	0.43 [0.17, 0.72]	0.36 [-0.05, 0.79]	0.79 [0.27, 1.32]
Analysis of the patients sample			
CATS scores	0.11 [0.06, 0.17]	0.15 [0.07, 0.24]	0.26 [0.17, 0.35]
Sexual abuse	0.57 [0.24, 0.97]	0.77 [0.27, 1.20]	1.33 [0.92, 1.77]
Physical abuse	0.19 [-0.47, 0.86]	0.01 [-0.80, 0.83]	0.21 [-0.83, 1.31]
Neglect	0.13 [-0.03, 0.28]	0.22 [-0.02, 0.42]	0.35 [0.05, 0.61]
Emotional abuse	0.24 [-0.02, 0.54]	0.26 [-0.21, 0.73]	0.49 [-0.10, 1.08]

The results of the aggregated sample analysis (see Table 5.4) indicated that the relationship between CATS scores and hallucination-proneness was positively mediated by DES scores. Similar findings were obtained when the analysis was restricted to the patient sample. When focusing on specific types of trauma, dissociation significantly mediated the effect of sexual abuse on hallucination-proneness in both the aggregated and psychiatric sample analyses. In the aggregated sample, dissociation also mediated the relationship between neglect/negative home environment and hallucination-proneness, as well as the effect of emotional abuse on hallucination-proneness, although these effects were not significant when the analyses were performed exclusively within the patient sample.

5.4.3 Between-group differences on the signal detection task

Prior to examining the SDT data, four participants (two remitted hallucinators and two non-hallucinating patients) were dropped from the analysis as they reported hearing problems at the time of testing. Two one-way ANOVA were carried out on β

and d' scores in an attempt to replicate previous findings which linked auditory hallucinations to perturbed reality discrimination. The hallucinating and the remitted hallucinators groups presented significantly lower response bias scores compared to non-hallucinating patients and healthy controls (all $ps < .05$). Conversely, there were no significant differences on β scores between hallucinating patients and remitted hallucinators ($p = .99$), and between non-hallucinating patients and healthy controls with no history of mental illness ($p = .87$). The analysis of the perceptual sensitivity data indicated that all patients had significantly lower d' scores than controls (all $ps < .05$), but no significant between-group differences were observed for post-hoc comparisons between the psychotic patient groups (all $ps > .05$).

To investigate whether dissociation is directly related to perturbed reality discrimination, we examined the signal detection performance of patients with elevated levels of pathological dissociation compared to patients whose level of dissociation was non-pathological. The DES-T scores of participants in the patient groups were used to estimate their individual Bayesian probability of belonging to the pathological dissociation taxon. The analysis was carried out using the Excel adaptation of the SAS algorithm developed by Waller and Ross (1997) made available on the International Society for the Study of Trauma and Dissociation website (Perry, 2004). Following the cut-off proposed by Waller and Ross, participants with a Bayesian probability level > .90 were assigned to the pathological dissociation group ($n = 14$), whereas the remaining participants were assigned to the non-dissociative patient control group ($n = 31$). Between-group differences on hallucination-proneness and signal detection performance were examined using a series of Mann–Whitney U tests. The analysis of the hallucination-proneness data indicated that patients with pathological dissociative symptoms scored significantly higher than non-dissociative

patients on the LSHS-R ($M = 45.86$, $SD = 8.25$ and $M = 34.06$, $SD = 11.05$ respectively; $U = 90.00$, $z = 3.12$, $p < .01$). However, the two groups did not differ significantly in terms of β ($M = .27$, $SD = .38$ and $M = .32$, $SD = .42$ respectively; $U = 167.50$, $p > .05$) and d' scores ($M = 1.30$, $SD = 0.49$ and $M = 1.09$, $SD = .57$ respectively; $U = 155.00$, $p > .05$).

5.5 Discussion

Our results indicate that the relationship between childhood trauma and hallucination-proneness was positively mediated by dissociative tendencies. The mediational role of dissociation was particularly robust for experiences of sexual abuse relative to other types of trauma. Consistent with this, we found that hallucinating patients could be clearly distinguished from the other groups in terms of dissociation and the frequency of traumatic childhood sexual experiences. The results of the SDT task indicated that perturbed reality discrimination was primarily related to vulnerability to hallucinations and not dissociation. When patients belonging to the pathological dissociation group were compared to the non-dissociative patients, we found no significant differences in terms of signal detection performance. Conversely, patients in the hallucinating and remitted hallucinators groups had significantly lower response bias scores compared to non-hallucinating patients and healthy controls.

Overall, these findings corroborate recent accounts suggesting that the trauma-hallucinations link might be explained by dissociative processes (Anketell, et al., 2010; Moskowitz & Corstens, 2007) and are consistent with epidemiological and cross-sectional data suggesting an apparent specific association between CSA and hallucinations (Hammersley, et al., 2003; Read, et al., 2003; Read & Argyle, 1999;

Shevlin, Dorahy, & Adamson, 2007). However, the mechanism thorough which dissociation might promote hallucinations remains to be clarified. Recent evidence suggests that weakened cognitive inhibition may represent a prevailing cognitive concomitant of dissociation (Dorahy & Green, 2008; Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008). In some individuals this could be expressed by experiencing intrusive thoughts whilst in others it may promote the onset of auditory hallucinations. Other individual difference variations (possibly reality discrimination deficits) may account for the symptom which is expressed after the weakened cognitive inhibition. In keeping with this theory, recent empirical evidence has pointed to the importance of inhibitory processes in explaining auditory hallucinations as misattributed auditory mental representations that intrude into consciousness as a result of intentional inhibition deficits (Badcock, Waters, Maybery, & Michie, 2005; Waters, Badcock, Maybery, & Michie, 2003; Waters, Badcock, Michie, & Maybery, 2006). Further studies are required to determine whether these kinds of processes can explain the relationship observed between dissociation and hallucinations in this and previous studies.

With respect to SDT, our findings are consistent with previous patient studies (Bentall & Slade, 1985a; Vercammen, et al., 2008). The finding that reality discrimination is related to the hallucinations vulnerability rather than acute hallucinatory experiences is consistent with previous observations of impaired SDT performance in psychometric high-risk samples (Barkus, Smallman, et al., 2010; Barkus, et al., 2007; Bentall & Slade, 1985a; Varese, et al., 2010). This contrasts with the results from the DES, which showed that elevated dissociation was associated with current hallucinations (even though a trend suggesting higher dissociative tendencies in the remitted hallucinators compared to healthy controls was also

observed). Hence, the findings might be interpreted in terms of a two-hit model, in which impaired reality discrimination (perhaps resulting from neurophysiological dysfunctions such as reduced connectivity between the frontal cortex and the auditory cortex; Ford & Mathalon, 2005; Ford, Mathalon, Whitfield, Faustman, & Roth, 2002) is an enduring vulnerability factor, perhaps predating the onset of psychosis, but increased dissociation (possibly representing a sequela of traumatic experiences) triggers the actual onset of hallucinatory experiences.

One finding was unexpected and is perhaps inconsistent with this account. The relatively infrequent childhood maltreatment reported by the remitted hallucinators, and the lower level of dissociative tendencies observed in this group are apparently inconsistent with dissociative accounts of the origin of hallucinatory experiences. However, the present study focused exclusively on childhood trauma. Although early abuse and maltreatment is frequently regarded as the most prominent developmental antecedent of persistent dissociative tendencies, empirical evidence suggests that transient dissociative phenomena can be triggered by acute adult trauma and stressful life events (e.g. Cardena & Spiegel, 1993; C. A. I. Morgan et al., 2001). Given evidence suggesting that auditory hallucinations in the daily life of psychotic patients are predicted by increased levels of state dissociation (Varese, et al., 2011), future studies should consider the potential contribution of transient dissociation resulting from adult traumatic experiences on the vulnerability to hallucinations.

Several methodological limitations should be acknowledged. Childhood trauma was assessed using retrospective self-report measures. The use of these self rated measures in psychotic samples has been criticised because of concerns about memory inaccuracies and bias stemming from current symptoms (Bendall, Jackson, Hulbert, & McGorry, 2008; Morgan & Fisher, 2007). Although several studies

indicate that patients' reports of child abuse have good concurrent validity, convergent validity with other assessment methods (i.e. case notes) and adequate test-retest reliability over long periods of time (Darves-Bornoz, Lemperiere, Degiovanni, & Gaillard, 1995; Fisher et al., 2009; Goodman et al., 1999), future studies should ideally try to replicate our results using corroborated measures of abuse. The sample employed was modest in size, therefore limiting the generalizability and the statistical power of the present study. These findings should be therefore interpreted with caution, and should be replicated in larger patient samples. Finally, the correlational nature of our findings does not allow inferences about causality, and we acknowledge that alternative models linking trauma, hallucinations and dissociative tendencies might be fitted to these data. For example, it is possible that hallucinations cause dissociation. Future studies might resolve these issues by the judicious use of longitudinal data.

References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Allen, J. G., Coyne, L., & Console, D. A. (1997). Dissociative detachment relates to psychotic symptoms and personality decompensation. *Comprehensive Psychiatry, 38*(6), 327-334.

Altman, H., Collins, M., & Mundy, P. (1997). Subclinical hallucinations and delusions in nonpsychotic adolescents. *Journal of Child Psychology and Psychiatry, 38*(4), 413-420.

Ammons, R. B., & Ammons, C. H. (1962). The Quick Test (QT): Provisional manual. *Psychological Reports, 11*, 111-161.

Andrew, E. M., Gray, N. S., & Snowden, R. J. (2008). The relationship between trauma and beliefs about hearing voices: A study of psychiatric and non-psychiatric voice hearers. *Psychological Medicine, 38*, 1409-1417.

Anketell, C., Dorahy, M. J., Shannon, M., Elder, R., Hamilton, G., Corry, M., . . . O'Rawe, B. (2010). An exploratory analysis of voice hearing in chronic PTSD: Potential associated mechanisms. *Journal of Trauma and Dissociation, 11*(1), 93-107. doi: 10.1080/15299730903143600

Badcock, J. C., Waters, F. A. V., Maybery, M. T., & Michie, P. T. (2005). Auditory hallucinations: Failure to inhibit irrelevant memories. *Cognitive Neuropsychiatry, 10*(2), 125-136.

Barkus, E., Smallman, R., Royle, N., Barkus, C., Lewis, S., & Rushe, T. (2010). Auditory false perceptions are mediated by psychosis risk factors. *Cognitive Neuropsychiatry*.

Barkus, E., Stirling, J., & Cavill, J. (2010). Suggestibility, dissociation and positive schizotypy. *Clínica y Salud, 21*(1), 3-8. doi: 10.5093/cl2010v21n1a1

Barkus, E., Stirling, J., Hopkins, R., McKie, S., & Lewis, S. (2007). Cognitive and neural processes in non-clinical auditory hallucinations. *British Journal of Psychiatry, 191*(51), s76-s81.

Bendall, S., Jackson, H. J., Hulbert, C. A., & McGorry, P. D. (2008). Childhood trauma and psychotic disorders: A systematic, critical review of the evidence. *Schizophrenia Bulletin, 34*(3), 568-579. doi: 10.1093/schbul/sbm121

Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucinations. *Psychological Bulletin, 107*(1), 82-95.

Bentall, R. P., & Fernyhough, C. (2008). Social predictors of psychotic experiences: Specificity and psychological mechanisms. *Schizophrenia Bulletin, 34*(6), 1012-1020.

Bentall, R. P., & Slade, P. (1985a). Reality testing and auditory hallucinations: A signal detection analysis. *British Journal of Clinical Psychology, 24*(3), 159-169.

Bentall, R. P., & Slade, P. (1985b). Reliability of a scale measuring disposition towards hallucination: a brief report. *Personality and Individual Differences, 6*(4), 527-529. doi: 10.1016/0191-8869(85)90151-5

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability and validity of a dissociation scale. *Journal of Nervous and Mental Disease, 174*(12), 727-735.

Cardena, E., & Spiegel, D. (1993). Dissociative reactions to the San Francisco Bay Area earthquake of 1989. *Am J Psychiatry, 150*(3), 474-478.

Darves-Bornoz, J. M., Lemperiere, T., Degiovanni, A., & Gaillard, P. (1995). Sexual victimization in women with schizophrenia and bipolar disorder. *Social Psychiatry and Psychiatric Epidemiology, 30 (2)*, 78-84.

Ditman, T., & Kuperberg, G. R. (2005). A source-monitoring account of auditory verbal hallucinations in patients with schizophrenia. *Harvard Review of Psychiatry, 13*(5), 280-299.

Dorahy, M. J., & Green, M. (2008). Cognitive perspectives on dissociation and psychosis: Differences in the processing of threat? In A. Moskowitz, I. Schäfer & M. J. Dorahy (Eds.), *Psychosis, trauma and dissociation: Emerging perspectives on severe psychopathology* (pp. 191-207). Chichester, UK: Wiley-Blackwell.

Dorahy, M. J., Shannon, C., Seagar, L., Corr, M., Stewart, K., Hanna, D., . . . Middleton, W. (2009). Auditory hallucinations in dissociative identity disorder and schizophrenia with and without a childhood trauma history. *Journal of Nervous and Mental Disease, 197*(12), 892-898.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002a). Formation of delusional ideation in adolescents hearing voices: A prospective study. *American Journal of Medical Genetics (Neuropsychiatric Genetics), 114*, 913-920.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002b). Independent course of childhood auditory hallucinations: A sequential 3-year follow up study. *British Journal of Psychiatry, 181*(suppl 43), s10-s18.

Fisher, H. L., Craig, T. K., Fearon, P., Morgan, K., Dazzan, P., Lappin, J., . . . Morgan, C. (2009). Reliability and comparability of psychosis patients'

retrospective reports of childhood abuse. *Schizophrenia Bulletin*. doi: doi:10.1093/schbul/sbp103

Ford, J. M., & Mathalon, D. H. (2005). Corollary discharge dysfunction in schizophrenia: Can it explain auditory hallucinations? *International Journal of Psychophysiology, 58*(2-3), 179-189. doi: 10.1016/j.ijpsycho.2005.01.014

Ford, J. M., Mathalon, D. H., Whitfield, S., Faustman, W. O., & Roth, W. T. (2002). Reduced communication between frontal and temporal lobes during talking in schizophrenia. *Biological Psychiatry, 51*(6), 485-492. doi: 10.1016/s0006-3223(01)01335-x

Frith, C. (1992). *The cognitive neuropsychiatry of schizophrenia*. Hov, UK: Lawrence Erlbaum.

Giesbrecht, T., Lynn, S. J., Lilienfeld, S. O., & Merckelbach, H. (2008). Cognitive processes in dissociation: An analysis of the core theoretical assumptions. *Psychological Bulletin, 134*(5), 617-647. doi: 10.1037/0033-2909.134.5.617

Glicksohn, J., & Barrett, T. R. (2003). Absorption and hallucinatory experience. *Applied Cognitive Psychology, 17*(7), 833-849.

Goff, D. C., Brotman, A. W., Kindlon, D., Waites, M., & Amico, E. (1991). Self-report of childhood abuse in chronically psychotic patients. *Psychiatry Research, 37*(1), 73-80. doi: 10.1016/0165-1781(91)90107-Z

Goodman, L. A., Thompson, K. M., Weinfurt, K., Corl, S., Acker, P., Mueser, K. T., & Rosenberg, S. D. (1999). Reliability of reports of violent victimization and posttraumatic stress disorder among men and women with serious mental illness. *Journal of Traumatic Stress, 12*(4), 587-599. doi: 10.1023/a:1024708916143

Hammersley, P., Dias, A., Todd, G., Bowen-Jones, K., Reilly, B., & Bentall, R. P. (2003). Childhood trauma and hallucinations in bipolar affective disorder: preliminary investigation. *British Journal of Psychiatry, 182*(6), 543-547.

Holowka, D. W., King, S., Saheb, D., Pukall, M., & Brunet, A. (2003). Childhood abuse and dissociative symptoms in adult schizophrenia. *Schizophrenia Research, 60*(1), 87-90.

Honig, A., Romme, M., Ensink, B., Escher, S., Pennings, M., & DeVries, M. (1998). Auditory hallucinations: A comparison between patients and nonpatients. *Journal of Nervous and Mental Disease, 186*(10), 646-651.

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological Methods, 15*(4), 309-334. doi: 10.1037/a0020761

Imai, K., Keele, L., Tingley, D., & Yamamoto, T. (2010). Casual mediation analysis using R. In H. D. Vinod (Ed.), *Advances in Social Science Research Using R* (pp. 129-154). New York: Springer.

Johns, L. C., Nazroo, J. Y., Bebbington, P. E., & Kuipers, E. (2002). Occurrance of hallucinatory experiences in a community sample and ethnic variations. *British Journal of Psychiatry, 180*, 174-178

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin, 12*(2), 261-276.

Kilcommons, A. M., & Morrison, A. P. (2005). Relationships between trauma and psychosis: An exploration of cognitive and dissociative factors. *Acta Psychiatrica Scandinavica, 112*(5), 351-359.

Kilcommons, A. M., Morrison, A. P., Knight, A., & Lobban, F. (2008). Psychotic experiences in people who have been sexually assaulted. *Social Psychiatry and Psychiatric Epidemiology, 43*(8), 602-611.

Larøi, F., & Woodward, T. S. (2007). Hallucinations from a cognitive perspective. *Harvard Review of Psychiatry, 15*(3), 109-117.

Lawrence, C., Jones, J., & Cooper, M. (2010). Hearing voices in a non-psychiatric population. *Behavioural and Cognitive Psychotherapy, 38*(3), 363-373. doi: 10.1017/S1352465810000172

Mayer, J. L., & Farmer, R. F. (2003). The development and psychometric evaluation of a new measure of dissociative activities. *Journal of Personality Assessment, 80*(2), 185-196.

Merckelbach, H., & Muris, P. (2001). The causal link between self-reported trauma and dissociation: A critical review. *Behaviour Research and Therapy, 39*(3), 245-254. doi: 10.1016/S0005-7967(99)00181-3

Morgan, C., & Fisher, H. (2007). Environmental factors in schizophrenia: Childhood trauma - a critical review. *Schizophrenia Bulletin, 33*(1), 3-10. doi: 10.1093/schbul/sbl053

Morgan, C. A. I., Hazlett, G., Wang, S., Greer Richardson, E., Schnurr, P., & Southwick, S. M. (2001). Symptoms of dissociation in humans experiencing acute, uncontrollable stress: A prospective study. *American Journal of Psychiatry, 158*(8), 1239-1247.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Moskowitz, A., Barker-Collo, S., & Ellson, L. (2005). Replication of dissociation-psychosis link in New Zealand students and inmates. *The Journal of Nervous and Mental Disease, 193*(11), 722-727. doi: 10.1077/01.nmd.0000185895.47704.62

Moskowitz, A., & Corstens, D. (2007). Auditory hallucinations: Psychotic symptom or dissociative experience. *The Journal of Psychological Trauma, 6*(2), 35-63.

Moskowitz, A., Read, J., Farrelly, S., Rudegeair, T., & Williams, O. (2009). Are psychotic syptoms traumatic in origin and dissociative in kind? In P. Dell & J. O'Neil (Eds.), *Dissociation and dissociative disorders: DSM-V and beyond.* New York: Routledge.

Offen, L., Waller, G., & Thomas, G. (2003). Is reported childhood abuse associated with the psychopathological characteristics of patients who experience auditory hallucinations? *Child Abuse and Neglect, 27*, 919-927.

Perona-Garcelán, S. P., Cuevas-Yust, C., García-Montes, J. M., Pérez-Alvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., . . . Rodríguez-Martín, B. (2008). Relationship between self-focused attention and dissociation in patients with and without auditory hallucinations. *Journal of Nervous and Mental Disease, 196*(3), 190-197.

Perona-Garcelán, S. P., García-Montes, J. M., Cuevas-Yust, C., Pérez-Álvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., & Gómez-Gómez, M. T. (2010). A preliminary exploration of trauma, dissociation and positive psychotic symptoms in a Spanish sample. *Journal of Trauma and Dissociation, 11*(3), 284-292. doi: 10.1080/15299731003786462

Pope, C. A., & Kwapil, T. (2000). Dissociative experiences in hypothetically psychosis-prone college students. *Journal of Nervous and Mental Disease, 188*(8), 530-536.

Read, J., Agar, K., Argyle, N., & Aderhold, V. (2003). Sexual and physical abuse during childhood and adulthood as predictors of hallucinations, delusions and

thought disorder. *Psychology and Psychotherapy: Theory, Research and Practice, 76*, 1-22.

Read, J., & Argyle, N. (1999). Hallucinations, delusions and thought disorder among adult psychiatric inpatients with a history of child abuse. *Psychiatric Services, 50*(11), 1467-1472.

Read, J., Fink, P. J., Rudegeair, T., Felitti, V. J., & Whitfield, C. L. (2008). Child maltreatment and psychosis: A return to a genuinely integrated bio-psycho-social model. *Clinical Schizophrenia and Related Psychoses, 2*(3), 235-254.

Read, J., Goodman, L., Morrison, A. P., Ross, C. A., & Aderhold, V. (2004). Childhood trauma, loss and stress. In J. Read, L. R. Mosher & R. P. Bentall (Eds.), *Models of madness* (pp. 223-252). Hove: Routledge.

Read, J., Van Os, J., Morrison, A. P., & Ross, C. A. (2005). Childhood trauma, psychosis and schizophrenia: a literature review with theoretical and clinical implications. *Acta Neuropsychiatrica Scandinavica, 112*, 330-350.

Sanders, B., & Becker-Launsen, E. (1995). The measurement of psychological maltreatment: Early data on the Child Abuse and Trauma Scale. *Child Abuse and Neglect, 19*(3), 315-323.

Shelvin, M., Dorahy, M., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*, 222-228.

Shevlin, M., Dorahy, M. J., & Adamson, G. (2007). Childhood traumas and hallucinations: An analysis of the National Comorbidity Survey. *Journal of Psychiatric Research, 41*(3-4), 222-228.

Startup, M. (1999). Schizotypy, dissociative experiences and childhood abuse: Relationships among self-reported measures. *British Journal of Clinical Psychology, 38*, 333-344.

Thornton, K., Varese, F., Jackson, M. C., & Linden, D. E. J. (submitted). The relationship between metacognitive beliefs, auditory hallucinations and hallucination-related distress in clinical and non-clinical voice-hearers. *Manuscript submitted for publication.*

van Ijzendoorn, M. H., & Schuengel, C. (1996). The measurement of dissociation in normal and clinical populations: Meta-analytic validation of the Dissociative Experiences Scale (DES). *Clinical Psychology Review, 16*(5), 365-382.

van Os, J., Kenis, G., & Rutten, B. P. F. (2010). The environment and schizophrenia. *Nature, 468*, 203-212.

Varese, F., Barkus, E., & Bentall, R. P. (2010). Dissociative and metacognitive factors in hallucination-proneness when controlling for comorbid symptoms. *Cognitive Neuropsychiatry*. doi: 10.1080/13546805.2010.495244

Varese, F., Udachina, A., Myin-Germeys, I., Oorschot, M., & Bentall, R. P. (2011). The relationship between dissociation and auditory verbal hallucinations in the flow of daily life of patients with psychosis. *Psychosis: Psychological, Social and Integrative Approaches, 3*(1), 14-28. doi: 10.1080/17522439.2010.548564

Vercammen, A., De Haan, E. H. F., & Aleman, A. (2008). Hearing a voice in the noise: Auditory hallucinations and speech perception. *Psychological Medicine, 38*(8), 1177-1184.

Waller, N. G., Putman, F. W., & Carlson, E. B. (1996). Types of dissociation and dissociative types: A taxometric analysis of dissociative experiences. *Psychological Methods, 1*(3), 300-321.

Waller, N. G., & Ross, C. A. (1997). The prevalence and biometric structure of pathological dissociation in the general population: Taxometric and behavior genetic findings *Journal of Abnormal Psychology, 106*(4), 499-510.

Waters, F. A. V., Badcock, J. C., Maybery, M. T., & Michie, P. T. (2003). Inhibition in schizophrenia: Association with auditory hallucinations. *Schizophrenia Research, 62*, 275-280.

Waters, F. A. V., Badcock, J. C., Michie, P. T., & Maybery, M. T. (2006). Auditory hallucinations: Intrusive thoughts and forgotten memories. *Cognitive Neuropsychiatry, 11*(1), 65-83.

Whitfield, C. L., Dube, S. R., Felitti, V. J., & Anda, R. F. (2005). Adverse childhood experiences and hallucinations. *Child Abuse and Neglect, 29*, 797-810.

Yoshizumi, T., Murase, S., Honjo, S., Kaneko, H., & Murakami, T. (2004). Hallucinatory experiences in a community sample of Japanese children. *Journal of the American Academy of Child & Adolescent Psychiatry, 43*(8), 1030-1036.

Chapter 6

Conclusions

The four investigations included in the present thesis addressed a number of empirical questions relevant to the theoretical understanding of the psychological underpinnings of hallucinatory experiences. Each of the sections included in the present Chapter will provide an integrative summary of the findings pertaining to the three main research topics covered in this doctoral dissertation (i.e. the reality discrimination model, the metacognitive beliefs model and the dissociation-hallucination link) in relation to other recent research findings. In addition, directions for future research and (when relevant) the clinical implications of the current findings will be discussed.

6.1 Reality discrimination and hallucination-proneness

The findings of the present thesis provide further corroboration to the reality discrimination model of hallucinatory experiences. The results of Chapters 2 and 5 indicated that hallucination-prone individuals (i.e. hallucinating patients and nonclinical participants with high scores on the LSHS-R) could be clearly distinguished from non-prone controls (i.e. patients with no history of hallucinations, and students not prone to hallucinations) in terms of signal detection performance. In both studies, hallucination-proneness was specifically related to greater bias towards the detection of signal, but not to perceptual sensitivity deficits, a finding which is entirely consistent with previous findings in clinical (Bentall & Slade, 1985) and nonclinical samples (Barkus et al., in press; Barkus, Stirling, Hopkins, McKie, & Lewis, 2007; Rankin & O'Carroll, 1995).

The current findings also suggest that signal detection difficulties might represent an enduring vulnerability associated with hallucination-proneness rather than other psychological complaints. The analogue study presented in Chapter 2 used a factorial design to test whether reality discrimination abnormalities could be uniquely attributed to the predisposition to experience hallucinations rather than cognitive intrusions, a symptom dimension which frequently covaries with hallucination-proneness (Jones & Fernyhough, 2006, 2009; Morrison & Baker, 2000). In this study, lower beta scores were specifically associated with hallucination-proneness, but not with intrusive thinking. In addition, the clinical study presented in Chapter 5 revealed that signal detection difficulties represent a trait disposition towards hallucinatory experiences rather than a correlate of acute hallucinations. Lower response bias scores were in fact observed in both hallucinating patients and remitted hallucinators (i.e. patients without current hallucinations who suffered from auditory hallucinations in the past) compared to patients with no history of hallucinations. These results suggest that reality discrimination difficulties are specifically associated to hallucination-proneness in clinical samples (a finding perhaps not surprising considering the evidence from studies which also documented reality discrimination difficulties in non-clinical hallucination-prone individuals), and may represent an enduring vulnerability to experience auditory hallucinations. This latter finding is at variance with the results of previous verbal self-monitoring studies which found that the misattribution of self-generated material in psychosis is more related to current symptoms rather than representing a trait vulnerability to auditory hallucinations (Johns, Gregg, Allen, & McGuire, 2006). The reasons for these discrepant findings are unclear. Even though some reviewers have proposed that evidence from both self-monitoring and signal detection studies could reflect common

deficits in the misattribution mechanisms which may underlie hallucinatory experiences (e.g. Ditman & Kuperberg, 2005), it is possible that the performance in these tasks is influenced by independent mechanisms. Verbal self-monitoring accounts of auditory hallucinations (Frith, 1987, 1992) assume that the misattribution of internally generated speech primarily reflects disruption of the intention to produce verbal output (both external and inner speech), a phenomena that at the neurophysiologic level has been described in terms of corollary discharge failures (Ford & Mathalon, 2005; Ford, Mathalon, Whitfield, Faustman, & Roth, 2002). Hence, the evidence from verbal self-monitoring studies is believed to reflect deficits in bottom-up processing (Johns, et al., 2006). Conversely, signal detection theory offers a framework in which the origin of hallucinations is conceptualised in terms of decision-making biases (Bentall, 1990; Bentall & Slade, 1985). The studies that employed signal detection tasks may therefore be more informative of the contribution of top-down influences in the formation of hallucinatory experiences. Further experimental research is required to examine the relationship between these bottom-up and top-down factors, as well as determining their relative importance in the formation of auditory verbal hallucinations. This issue could be also clarified through the systematic examination of the consistency of the available findings of self-monitoring and signal detections studies using meta-analytic methods. A meta-analytic synthesis of the experimental studies which examined the association between hallucination-proneness and the misattribution of internally generated information using source-monitoring, self-monitoring and signal detection tasks is currently underway (Evans, Varese, & Bentall, in preparation), and might help to clarify this issue.

Overall, the findings from the investigations presented in this thesis support the notion that signal detection abnormalities may be a prominent underpinning of hallucination-proneness. The observation of signal detection abnormalities in non-clinical adults in this and previous investigations (Barkus, et al., 2007; Bentall & Slade, 1985; Rankin & O'Carroll, 1995), as well as in adolescents samples (Barkus, et al., in press) suggest that perturbed reality discrimination represents an enduring vulnerability which may precede the onset of psychotic illness. Nonetheless, further research is needed to further explore the specificity of this cognitive bias to the formation of hallucinatory experiences. Even though we demonstrated that in a non-clincial sample signal detection difficulties were related to hallucination-proneness rather than cognitive intrusions, more research is required to determine whether perturbed reality discrimination can be specifically ascribed to hallucinations rather than other positive symptoms of psychosis, in particular delusions. As shown by the two clinical studies included in this thesis, the discrimination between the specific predictors of these two symptoms may be constrained by the large comorbidity between hallucinations and delusions observed in clinical samples. In the studies reported in Chapters 4 and 5, hallucinating patients reported significantly more positive symptoms than non-hallucinating patients. Similarly, momentary reports of auditory hallucinations have been linked to increased delusional ideation in both the present and other ESM studies (Oorschot et al., submitted). Future studies might therefore benefit from the recruitment of hallucinating and non-hallucinating groups diversified in terms of delusional symptoms, so that factorial designs could be employed to examine the symptom-specific associations of signal detection difficulties. In a similar way, the recruitment of non-clinical voice hearers (i.e. individuals not meeting diagnostic criteria for psychiatric disorder who nonetheless

experience hallucinations which are topographically and phenomenologically similar to those experienced by patients; e.g. Honig et al., 1998; Thornton, Varese, Jackson & Linden, submitted) may help to substantiate the specificity of this cognitive bias to hallucinatory experiences.

6.2 Rethinking the relationship between hallucinations and metacognitive beliefs

Regarding the often assumed association between hallucination-proneness and maladaptive meta-cognitive beliefs, the meta-analytic syntheses included in this dissertation found limited support for the associations between maladaptive metacognitive beliefs and hallucinations. As discussed in Chapter 3, although metacognitive beliefs were strongly related to hallucination-proneness in analogue studies, these associations might have been artificially inflated by the failure to control for other symptom dimensions which had been linked to elevated MCQ scores in previous research. Furthermore, the analyses carried out on clinical studies found only modest associations between auditory hallucinations the metacognitive factors of the MCQ. Most notably, the effect of several factors of the MCQ was statistically negligible, including the effects of negative beliefs about thoughts in general and negative beliefs about the uncontrollability and danger of thoughts, which might be regarded from a theoretical perspective as the factors most pertinent to the metacognitive beliefs account of hallucinations proposed by Morrison et al. (1995).

A related cluster of findings has helped to clarify the relationship between hallucinations and dysfunctional metacognitive beliefs when controlling for symptom dimensions that frequently covary with hallucination-proneness in clinical and non-clinical samples. In Chapter 2, the metacognitive factors of the MCQ-30 were mostly

unrelated to hallucination-proneness after the effect of comorbid paranoia and intrusive thinking had been taken into account. The confounding effect of comorbid symptoms was also examined using meta-analytic methods in Chapter 3. The findings from the meta-analyses carried out on 14 studies in which it was possible to control for a number of covariates (anxiety, depression, intrusive thoughts and psychotic symptoms other than hallucinations) indicated that the associations between metacognitive beliefs and hallucination-proneness decreased dramatically once the effect of comorbid symptoms had been accounted for. When the results from these studies were aggregated, the effect of metacognitive beliefs was, at best, of small magnitude. In contrast, moderate-to-large associations were estimated in studies for in which it was not possible to control for comorbid symptoms.

Similar findings were also observed in different studies included in this thesis which examined the association between hallucinations and other constructs which overlap with a number of metacognitive factors of the MCQ, such as experiential avoidance (Hayes et al., 2004) and several facets of the Five Factors Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietmeyer, & Toney, 2006; Baer et al., 2008). Specifically, after controlling for paranoid ideation and intrusive thoughts, hallucination-proneness was only related to those FFMQ subscales arguably assessing dissociative tendencies and self-focus (i.e. acting with awareness and observing), but not to measures of negative appraisal and the arbitrary control of thoughts (i.e. the non-judgements subscale of the FFMQ). Similarly, the results from the ESM study reported in Chapter 4 revealed that experiential avoidance did not predict auditory hallucinations after controlling for the effect of concurrent paranoia.

An additional cluster of findings suggest that intrusive thoughts and maladaptive metacognitive beliefs are more robustly associated to paranoia rather

than hallucination-proneness, therefore challenging the validity of the cognitive model of Morrison et al. (1995). In Chapter 2, we found that anxious-depressive intrusive thoughts were more robustly associated to paranoid ideation than hallucination-proneness. In addition, paranoia was significantly predicted by MCQ scores after controlling for the effect of cognitive intrusions and hallucination-proneness. These results are perhaps not surprising in the light of the growing empirical evidence in support of cognitive accounts which link paranoia to dysfunctional strategies for avoiding negative thoughts about the self (e.g. the attributional model of persecutory delusions proposed by Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Udachina et al., 2009; Udachina, Varese, Oorschot, Myin-Germeys, & Bentall, submitted). Despite evidence suggesting that metacognitive beliefs might be regarded as a non-specific correlate of several psychological complaints (see sections 3.2.5 and 3.5.1), it will be worthwhile to further explore the nature of these apparent symptom specific associations. As indicated by the results of this thesis, future studies will benefit from efforts to avoid confounds stemming from the interrelations between different symptoms.

Taken as a whole, the studies of this dissertation offer limited support to the cognitive model proposed by Morrison et al. (1995), and suggest that maladaptive metacognitive beliefs (and similar constructs) might not be causally related to hallucinations. These results however, do not undermine the importance that metacognitive beliefs may have in individuals with psychotic experiences. A number of recent studies have suggested that metacognitive beliefs, although not directly involved in the aetiology of hallucinations, could influence the appraisal and subsequent psychological distress associated with these experiences. For example, Brett et al. (2009), found that MCQ scores (in particular negative beliefs about the

importance of controlling thoughts) significantly predicted psychological distress resulting from the experience of psychotic-like anomalies. More recently, Thornton, Varese, Jackson and Linden (submitted) examined the association between metacognitive beliefs, auditory hallucinations and hallucination-related distress in a sample of clinical voice hearers (i.e. psychiatric patients with auditory verbal hallucinations), nonclinical voice-hearers (i.e. individuals not meeting diagnostic criteria for psychiatric illness who nonetheless experience frequent auditory verbal hallucinations) and nonclinical participants with no lifetime occurrence of hallucinatory experiences. Clinical voice-hearers scored significantly higher than both non-clinical groups on two metacognitive factors of the MCQ (negative beliefs about uncontrollability and danger, and negative beliefs about need for control), whereas no significant differences were observed between the two non-clinical groups. Consistent with the findings of Brett et al., regression analyses also indicated that negative beliefs about the importance of controlling thoughts significantly predicted hallucination-related distress in the two hallucinating groups.

Given the evidence suggesting an association between metacognitive beliefs and hallucination-related distress, metacognitive beliefs should be studied further as potential determinant of psychological distress and need for care in hallucination-prone individuals. As discussed in Chapter 4, the findings from earlier studies into the apparent relationship between metacognitive beliefs and hallucinations have lead to speculation about the possible implementation of cognitive-behavioural interventions focusing on the modification of dysfunctional metacognitive beliefs (e.g. Wells, 2000) as a potential treatment for these symptoms (Aleman & Larøi, 2008; Lobban, Haddock, Kinderman, & Wells, 2002). As recent findings offer little support to the often presumed causal role of metacognitive beliefs in the genesis of hallucinations, it

follows that such metacognitive interventions may not be theoretically justified if the aim is to reduce symptoms. The observation that metacognitive beliefs might be implicated in the distress resulting from these experiences provides, on the other hand, offers a rationale for the application of metacognitive focused interventions for the reduction of hallucination-related distress, which may be, for some patients, a more important target for intervention than symptom-reduction (Smith et al., 2010). This approach is compatible with contemporary conceptualizations of the goals of Cognitive Behaviour Therapy for auditory verbal hallucinations (Pérez-Alvarez, García-Montes, Perona-Garcelán, & Vallina-Fernández, 2008; Smith, et al., 2010; Tai & Turkington, 2009), which emphasize the importance of promoting change in the patients' relationships with their own thoughts and experiences, rather than focusing exclusively on the reduction of symptom. Metacognitive therapy might be therefore integrated with other recently developed techniques aimed at promoting acceptance of thoughts and modification of the relationship with voices, such as Acceptance and Commitment Therapy and mindfulness-based approaches, which have shown promising results in recent studies with hallucinating patients (Chadwick, Hughes, Russell, Russell, & Dagnan, 2009; Chadwick, Newman Taylor, & Abba, 2005; Gaudiano & Herbert, 2006a, 2006b; Newman Taylor, Harper, & Chadwick, 2009; Valmaggia & Morris, 2010).

6.3 Dissociation and its relationship to hallucinations and hallucination-proneness

Three separate studies included in this dissertation (Chapters 2, 4 and 5) have clarified the association between hallucinations and dissociative tendencies.

Consistent with the overarching theme of this dissertation, these studies have examined the specificity of this relationship when controlling for the comorbidity with symptom dimensions frequently associated with hallucinations. Furthermore, they also examined the dissociation-hallucinations link in the context of early experiences which could promote hallucinations-proneness, as well as daily life factors (i.e. stress) which have been linked to dissociative states and hallucinations in previous studies. A final cluster of analyses examined the relationship between dissociative experiences and the cognitive underpinning of hallucinatory phenomena, in an attempt to uncover the psychological mechanisms that may account for this association.

Regarding the consistency and specificity of the dissociation-hallucination link, these studies have found evidence of a strong association between hallucinations and dissociative tendencies in both analogue and clinical samples. The robustness of this relationship was demonstrated by the findings of the regression analyses reported in Chapters 2 and 4, which indicated that dissociation survived as a significant predictor of nonclinical hallucination-proneness (i.e. Chapter 2) and of daily-life reports of auditory hallucinations (i.e. Chapter 4) even after controlling for the effect of comorbid symptoms (paranoid and intrusive thinking; and concurrent paranoid beliefs, respectively). There is also evidence that this association might be symptom-specific. In Chapter 2, dissociation was in fact specifically related to hallucination-proneness, but not to paranoia and intrusive thoughts, once the covariation between these symptom dimensions had been accounted for. Hence, this finding suggest that dissociative tendencies might be more robustly associated with hallucinations rather than other psychotic symptoms, a finding consistent with previous clinical and non-

clinical studies (e.g. Altman, Collins, & Mundy, 1997; Escher, Romme, Buiks, Delespaul, & Van Os, 2002a, 2002b; Perona-Garcelán et al., 2010).

Consistent with recent attempts to explain the trauma-hallucinations link in terms of dissociative processes (Moskowitz & Corstens, 2007; Moskowitz, Read, Farrelly, Rudegeair, & Williams, 2009), the findings outlined in Chapter 5 suggest that dissociation positively mediates the relationship between childhood trauma and hallucination-proneness, an effect that is particularly robust for experiences of child sexual abuse relative to other types of childhood adversity. Furthermore, Chapter 4 has provided evidence suggesting that the impact of dissociative states on hallucinations-vulnerability is influenced by concurrent stress. These findings indicated that hallucinating patients may be particularly prone to experience dissociative states in response to daily-life stressors, and that in turn dissociation is more predictive of auditory hallucinations under high stress compared to lower stress.

In terms of underlying mechanisms, the current findings offer little support for a direct association between reality discrimination and dissociative tendencies. Despite initial findings suggesting an apparent relationship between perturbed reality discrimination and dissociation-like experiences in non-clinical participants (Chapter 2), the hypothesised association between dissociative symptoms and the capacity to discriminate between internally generated mental events and external perceptions was not supported by the findings of a subsequent study. The results outlined in Chapter 5, in fact, indicated that signal detection abnormalities are primarily related to hallucination-proneness rather than pathological dissociative symptoms. Despite this negative result, the observation that current hallucinations are associated with elevated dissociation (therefore suggesting that dissociation is specifically related to presence of current hallucinations rather than hallucinations-proneness) could be

interpreted as consistent with a two-hit model in which in which perturbed reality discrimination represents an enduring vulnerability factor (see sections 5.5 and 6.1), and increased dissociation constitute the proximal cause that might trigger hallucinations.

Further research is therefore required to clarify the mechanisms through which dissociative tendencies may promote the formation of hallucinatory experiences. As discussed in Chapter 5, recent cognitive accounts have proposed that dissociative states are accompanied by cognitive inhibition failures, especially in relation to processing of threatening information (Dorahy & Green, 2008; Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008). In parallel, increasing evidence has pointed at the importance of inhibition processes in the aetiology of hallucinatory (Badcock, Waters, Maybery, & Michie, 2005; Waters, Badcock, Maybery, & Michie, 2003; Waters, Badcock, Michie, & Maybery, 2006). Waters et al. (2006) have recently proposed that hallucinations arise from mental representations which intrude into consciousness due to defective intentional inhibition processes. Within a reality discrimination framework, cognitive events of this kind might be particularly susceptible to external misattribution due to their perceived uncontrollability and the absence of cognitive effort associated with these experiences (Bentall, Baker, & Havers, 1991; Bentall & Fernyhough, 2008; Johnson, Hashtroudi, & Lindsay, 1993).

The current findings concerning the relationship between dissociation and hallucinations can be perhaps explained within a single explanatory framework which is schematically represented Figure 6.1. Consistent with the aforementioned findings, the model presented in Figure 6.1 assumes that reality discrimination is central to the process of misattribution of internally generated cognitive events, whereas concurrent

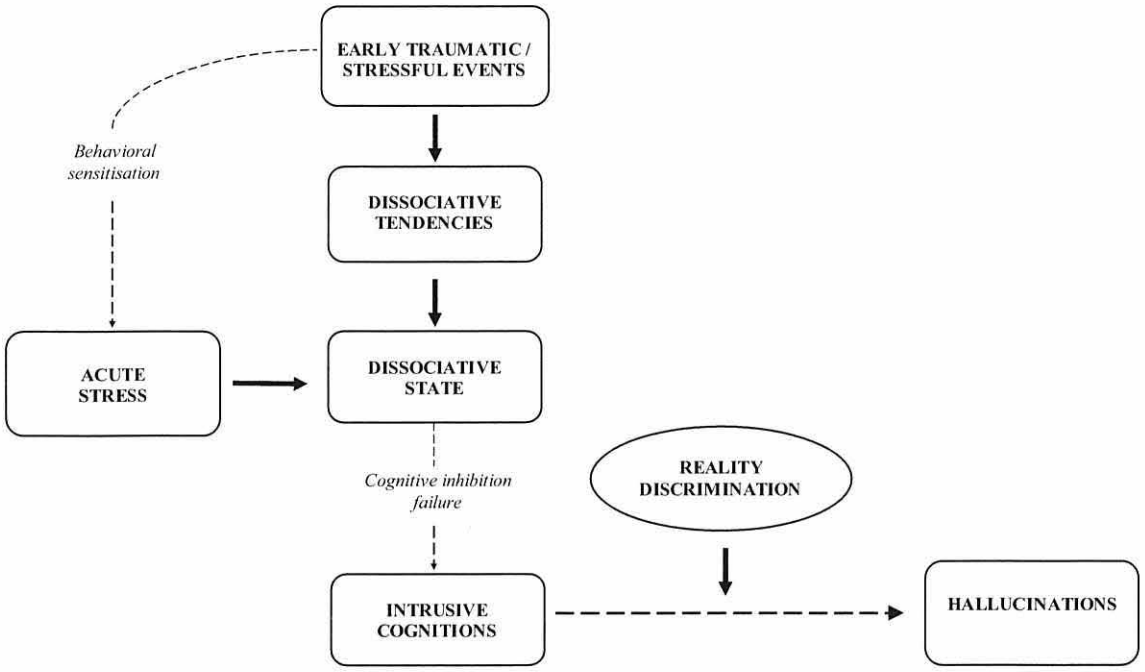

Figure 6.1: *Tentative explanatory model of the relationship between dissociation and hallucinatory experiences*

dissociation might precipitate the experience of hallucinations due to concomitant processes believed to generate intrusive cognitions. Consistent with findings from this thesis as well as previous investigations (Holowka, King, Saheb, Pukall, & Brunet, 2003; van Ijzendoorn & Schuengel, 1996) the experience of traumatic events (especially during childhood) may result in an enduring vulnerability to dissociative phenomena. This vulnerability is expressed in the experience of dissociative states which are triggered when individuals are exposed to stressful experiences, a process which could also be influenced by other indirect consequences of trauma, such increased sensitivity to daily life stressors (a process known as behavioral sensitization; Glaser, van Os, Portegijs, & Myin-Germeys, 2006; Lardinois, Lataster, Mengelers, Van Os, & Myin-Germeys, in press; Myin-Germeys & van Os, 2007). As dissociation may be accompanied by cognitive inhibition difficulties, the experience of dissociative states could lead to uncontrollable intrusive cognitions, which might be

then misattributed to external sources due to pre-existing reality discrimination abnormalities. This model (although probably not exhaustive) may provide a provisional framework in which to understand the trauma-dissociation-hallucinations link, as well as a tentative description of the putative processes which might account for this association Future research should be conducted to corroborate the key components of the proposed model. In addition, the proposed model could be informed by further research into the mechanisms believed to be involved in specific types of dissociative phenomena. It has been recently proposed that the unitary conceptualization of dissociation adopted in the current and previous investigations may not provide a satisfactory explanation of the qualitative diversity among the different experiences that are frequently attributed to dissociation (Brown, 2006; Holmes et al., 2005). For example, Holmes et al. argued that dissociation might be regarded as a multifaceted rather unitary construct and that at least two qualitatively distinct classes of dissociative phenomena can be distinguished, namely dissociative detachment (which encompasses derealisation, depersonalisation and similar experiences characterised by a sense of separation or detachment from everyday experiences) and compartmentalisation experiences (such as experiences of dissociative amnesia). Consistent with this qualitative distinction, a small number of published studies which used independent measures to assess differ types of dissociative experiences have found particularly strong associations between hallucinations and experiences of absorption, depersonalisation and derealisation (Kilcommons & Morrison, 2005; Morrison & Petersen, 2003; Perona-Garcelán et al., 2008). These findings suggest that hallucinations may be particularly related to experiences of dissociative detachment rather than compartmentalisation. The cognitive mechanisms which distinguish these classes of dissociative experiences are,

as yet, poorly understood and the findings of future studies on these phenomena may be highly informative for the development of an exhaustive account of the link between dissociative experiences and hallucinations.

From a clinical perspective, the findings of this PhD adds to the increasing evidence suggesting that dissociative experiences are common in patients with psychotic illness (Schäfer, Aderhold, Fryberger, & Spitzer, 2008). The high prevalence of dissociative symptoms among psychotic patients underscores the need of evaluating the possible traumatic origin of these experiences, and of offering psychological interventions aimed to target these potentially disabling experiences in this clinical population. The evidence for a (possibly causal) relationship between dissociative states and the onset of hallucinatory experiences may also inform the development of specifically tailored therapeutic techniques aimed at promoting a reduction of absorption and dissociative tendencies. As mentioned in Chapter 4, a promising candidate can be found in the Attention Training Technique (Wells, 1990), an intervention technique developed to encourage metacognitive control of attention which has shown promising results in initial studies with hallucinating patients (Valmaggia, Bouman, & Schuurman, 2007; Valmaggia & Morris, 2010; Wells, 2007).

6.4 Limitations and strengths of the current studies

The detailed discussion of the limitations of each of the current studies is included in each relevant chapter. Despite these studies being vulnerable to a number of shortcomings, the findings are complemented by the methodological strengths of other investigations also included in the thesis. The main limitation of Cha pter 2 was its exclusive focus on nonclinical participants selected using self-report measures of

hallucination-proneness. However, the results of following clinical (Chapters 4 and 5) and meta-analytic studies (Chapter 3) have largely corroborated the findings of this analogue investigation. A number of studies included in this dissertation have examined the dissociation-hallucination link using measures of acting-with-awareness rather than other validated measures of dissociative tendencies (Chapters 2 and 4). Despite the previously discussed shortcomings of this approach (sections 4.5 and 6.3), the findings from Chapter 4 have indicated that acting-with-awareness is robustly associated with dissociation as assessed by widely used self-report measures of dissociative experiences (i.e. the Dissociative Experiences Scale; Bernstein & Putnam, 1986). Similarly the findings of the studies that examined the association between hallucinations and dissociation measures (Chapter 5) are largely comparable to the results obtained from studies that used acting-with-awareness measures (cf. Michal et al., 2006). Finally, the limitations of the cross-sectional questionnaire studies included in this dissertation are counterbalanced by the use of the experience sampling method in Chapter 4, which found results that are largely comparable to the findings of other studies included in this thesis.

6.5 Final remarks

In summary, the findings of this dissertation have clarified (to an extent) the allegedly specific relationship between hallucinations and perturbed reality discrimination, and have provided further support for the importance of dissociative factors which may mediate the impact of life experiences on the vulnerability to hallucinations. In the present Chapter, the findings from these studies have been integrated to provide a tentative explanatory framework of the relationship between

trauma, dissociative tendencies and cognitive determinants of hallucinatory experiences. Furthermore, the findings of the studies included in this doctoral thesis have also helped to re-evaluate the relationship between maladaptive metacognitive beliefs and hallucinatory experiences, which, as discussed previously, might be more implicated in processes of appraisal of hallucinatory experiences rather than playing a casual role in their formation.

References

Aleman, A., & Larøi, F. (2008). *Hallucinations: The science of idiosyncratic perception*. Washington, DC: American Psychological Association.

Altman, H., Collins, M., & Mundy, P. (1997). Subclinical hallucinations and delusions in nonpsychotic adolescents. *Journal of Child Psychology and Psychiatry, 38*(4), 413-420.

Badcock, J. C., Waters, F. A. V., Maybery, M. T., & Michie, P. T. (2005). Auditory hallucinations: Failure to inhibit irrelevant memories. *Cognitive Neuropsychiatry, 10*(2), 125-136.

Baer, R. A., Smith, G. T., Hopkins, J., Krietmeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietmeyer, J., Sauer, S., . . . Williams, J. M. G. (2008). Construct validity of the Five Factors Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329-342.

Barkus, E., Smallman, R., Royle, N., Barkus, C., Lewis, S., & Rushe, T. (in press). Auditory false perceptions are mediated by psychosis risk factors. *Cognitive Neuropsychiatry*.

Barkus, E., Stirling, J., Hopkins, R., McKie, S., & Lewis, S. (2007). Cognitive and neural processes in non-clinical auditory hallucinations. *British Journal of Psychiatry, 191*(51), s76-s81.

Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucinations. *Psychological Bulletin, 107*(1), 82-95.

Bentall, R. P., Baker, G. A., & Havers, S. (1991). Reality monitoring and psychotic hallucinations. *British Journal of Clinical Psychology, 30*, 213-220.

Bentall, R. P., Corcoran, R., Howard, R., Blackwood, N., & Kinderman, P. (2001). Persecutory delusions: A review and theoretical integration. *Clinical Psychology Review, 21*(8), 1143-1192.

Bentall, R. P., & Fernyhough, C. (2008). Social predictors of psychotic experiences: Specificity and psychological mechanisms. *Schizophrenia Bulletin, 34*(6), 1012-1020.

Bentall, R. P., & Slade, P. (1985). Reality testing and auditory hallucinations: A signal detection analysis. *British Journal of Clinical Psychology, 24*(3), 159-169.

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability and validity of a dissociation scale. *Journal of Nervous and Mental Disease, 174*(12), 727-735.

Brett, C. M. C., Johns, L. C., Peters, E. P., & McGuire, P. K. (2009). The role of metacognitive beliefs in determining the impact of anomalous experiences: A comparison of help-seeking and non-help-seeking groups of people

Brown, R. J. (2006). Different types of "dissociation" have different psychological mechanism. *Journal of Trauma and Dissociation, 7*(4), 7-28. doi: 0.1300/J229v07n04_02 experiencing psychotic-like anomalies. *Psychological Medicine, 39*, 939-950.

Chadwick, P., Hughes, S., Russell, D., Russell, I., & Dagnan. (2009). Mindfulness groups for distressing voices and paranoia: A replication and randomized feasibility trial. *Behavioural and Cognitive Psychotherapy, 37*, 403-412.

Chadwick, P., Newman Taylor, K., & Abba, N. (2005). Mindfulness groups for people with psychosis *Behaviourla and Cognitive Psychotherapy, 33*, 351-359.

Ditman, T., & Kuperberg, G. R. (2005). A source-monitoring account of auditory verbal hallucinations in patients with schizophrenia. *Harvard Review of Psychiatry, 13*(5), 280-299.

Dorahy, M. J., & Green, M. (2008). Cognitive perspectives on dissociation and psychosis: Differences in the processing of threat? In A. Moskowitz, I. Schäfer & M. J. Dorahy (Eds.), *Psychosis, trauma and dissociation: Emerging perspectives on severe psychopathology* (pp. 191-207). Chichester, UK: Wiley-Blackwell.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002a). Formation of delusional ideation in adolescents hearing voices: A prospective study. *American Journal of Medical Genetics (Neuropsychiatric Genetics), 114*, 913-920.

Escher, S., Romme, M., Buiks, A., Delespaul, P., & Van Os, J. (2002b). Independent course of childhood auditory hallucinations: A sequential 3-year follow up study. *British Journal of Psychiatry, 181*(suppl 43), s10-s18.

Evans, M., Varese, F., & Bentall, R. P. (in preparation). The external misattribution of self-generated material and hallucination-proneness: A meta-analysis of the experimental literature.

Ford, J. M., & Mathalon, D. H. (2005). Corollary discharge dysfunction in schizophrenia: Can it explain auditory hallucinations? *International Journal of Psychophysiology, 58*(2-3), 179-189. doi: 10.1016/j.ijpsycho.2005.01.014

Ford, J. M., Mathalon, D. H., Whitfield, S., Faustman, W. O., & Roth, W. T. (2002). Reduced communication between frontal and temporal lobes during talking in schizophrenia. *Biological Psychiatry, 51*(6), 485-492. doi: 10.1016/s0006-3223(01)01335-x

Frith, C. (1987). The positive and negative symptoms of schizophrenia reflect impairments in the perception and initiation of action. *Psychological Medicine, 17*(3), 631-648. doi: 10.1017/S0033291700025873

Frith, C. (1992). *The cognitive neuropsychiatry of schizophrenia*. Hov, UK: Lawrence Erlbaum.

Gaudiano, B. A., & Herbert, J. D. (2006a). Acute treatment of patients with psychotic symptoms using Acceptance and Commitment Therapy: Pilot results. *Behaviour Research and Therapy, 44*, 415-437.

Gaudiano, B. A., & Herbert, J. D. (2006b). Believability of hallucinations as a potential mediator of their frequency and associated distress in psychotic inpatients. *Behavioural and Cognitive Psychotherapy, 34*(497-502).

Giesbrecht, T., Lynn, S. J., Lilienfeld, S. O., & Merckelbach, H. (2008). Cognitive processes in dissociation: An analysis of the core theoretical assumptions. *Psychological Bulletin, 134*(5), 617-647. doi: 10.1037/0033-2909.134.5.617

Glaser, J. P., van Os, J., Portegijs, P. J., & Myin-Germeys, I. (2006). Childhood trauma and emotional reactivity to daily life stress in adult frequent attenders of general practitioners. *Journal of Psychosomatic Research, 61*(2), 229-239. doi: 10.1016/j.jpsychores.2006.04.014

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., . . . McCurry, S. M. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record, 54*, 553-578.

Holmes, E. A., Brown, R. J., Mansell, W., Pasco Fearon, R., Hunter, E. C. M., Frasquilho, F., & Oakley, D. A. (2005). Are there two qualitatively distinct froms of dissociation? A review and some clinical implications. *Clinical Psychology Review, 25*(1), 1-23. doi: 10.1016/j.cpr.2004.08.006

Holowka, D. W., King, S., Saheb, D., Pukall, M., & Brunet, A. (2003). Childhood abuse and dissociative symptoms in adult schizophrenia. *Schizophrenia Research, 60*(1), 87-90.

Honig, A., Romme, M., Ensink, B., Escher, S., Pennings, M., & DeVries, M. (1998). Auditory hallucinations: A comparison between patients and nonpatients. *Journal of Nervous and Mental Disease, 186*(10), 646-651.

Johns, L. C., Gregg, L., Allen, P., & McGuire, P. K. (2006). Impaired verbal self-monitoring in psychosis: effects of state, trait and diagnosis. *Psychological Medicine, 36*(4), 465-474. doi: 10.1017/S0033291705006628

Johns, L. C., & McGuire, P. K. (1999). Verbal self-monitoring and auditory hallucinations in schizophrenia. *Lancet, 353*, 469-470.

Johns, L. C., Rossell, S., Frith, C., Ahmad, F., Hemsley, D., Kuipers, E., & McGuire, P. K. (2001). Verbal self-monitoring and auditory verbal hallucinations in patients with schizophrenia. *Psychological Medicine, 31*, 705-715.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114*(1), 3-28.

Jones, S. R., & Fernyhough, C. (2006). The role of thought suppression and metacognitive beliefs in proneness to auditory verbal hallucinations in a non-clinical sample. *Personality and Individual Differences, 41*(8), 1421-1432.

Jones, S. R., & Fernyhough, C. (2009). Rumination, reflection, intrusive thoughts, and hallucination-proneness: Towards a new model. *Behaviour Research and Therapy, 47*(1), 54-59.

Kilcommons, A. M., & Morrison, A. P. (2005). Relationships between trauma and psychosis: An exploration of cognitive and dissociative factors. *Acta Psychiatrica Scandinavica, 112*(5), 351-359.

Lardinois, M., Lataster, T., Mengelers, R., Van Os, J., & Myin-Germeys, I. (in press). Childhood trauma and increased stress sensitivity in psychosis. *Acta Psychiatrica Scandinavica*. doi: 10.1111/j.1600-0447.2010.01594.x

Lobban, F., Haddock, G., Kinderman, P., & Wells, A. (2002). The role of metacognitive beliefs in auditory hallucinations. *Personality and Individual Differences, 32*(8), 1351-1363.

Michal, M., Beutel, M. E., Jordan, J., Zimmermann, M., Wolters, S., & Heidenreich, T. (2007). Depersonalization, mindfulness, and childhood trauma. *Journal of Nervous and Mental Disease, 195*(8), 693-696. doi: 10.1097/NMD.0b013e3181f4492

Morrison, A. P., & Baker, C. A. (2000). Intrusive thoughts and auditory hallucinations: A comparative study of intrusions in psychosis. *Behaviour Research and Therapy, 38*(11), 1097-1106.

Morrison, A. P., Haddock, G., & Tarrier, N. (1995). Intrusive thoughts and auditory hallucinations: A cognitive approach. *Behavioural and Cognitive Psychotherapy, 23*(3), 265-280.

Morrison, A. P., & Petersen, T. (2003). Trauma, metacognition and predisposition to hallucinations in non-patients. *Behavioural and Cognitive Psychotherapy, 31*(3), 235-246.

Moskowitz, A., & Corstens, D. (2007). Auditory hallucinations: Psychotic symptom or dissociative experience. *The Journal of Psychological Trauma, 6*(2), 35-63.

Moskowitz, A., Read, J., Farrelly, S., Rudegeair, T., & Williams, O. (2009). Are psychotic syptoms traumatic in origin and dissociative in kind? In P. Dell & J. O'Neil (Eds.), *Dissociation and dissociative disorders: DSM-V and beyond.* New York: Routledge.

Myin-Germeys, I., & van Os, J. (2007). Stress-reactivity in psychosis: Evidence for an affective pathway to psychosis. *Clinical Psychology Review, 27*(4), 409-424. doi: 10.1016/j.cpr.2006.09.005

Newman Taylor, K., Harper, S., & Chadwick, P. (2009). Impact of mindfulness on cognition and affect in voice hearing: Evidence from two case studies. *Behavioural and Cognitive Psychotherapy.*

Oorschot, M., Lataster, T., Thewissen, V., Bentall, R. P., Delespaul, P., & Myin-Germeys, I. (submitted). Temporal dynamics of visual and auditory hallucinations in psychosis. *Manuscript submitted for publication.*

Pérez-Alvarez, M., García-Montes, J. M., Perona-Garcelán, S. P., & Vallina-Fernández, O. (2008). Changing the realtionship with voices: New therapeutic perspectives for treating hallucinations. *Clinical Psychology & Psychotherapy, 15*(1), 75-85.

Perona-Garcelán, S. P., García-Montes, J. M., Cuevas-Yust, C., Pérez-Álvarez, M., Ductor-Recuerda, M. J., Salas-Azcona, R., & Gómez-Gómez, M. T. (2010). A preliminary exploration of trauma, dissociation and positive psychotic

symptoms in a Spanish sample. *Journal of Trauma and Dissociation, 11*(3), 284-292. doi: 10.1080/15299731003786462

Rankin, P. M., & O'Carroll, P. J. (1995). Reality discrimination, reality monitoring and disposition towards hallucination. *British Journal of Clinical Psychology, 34*(4), 517-528.

Schäfer, I., Aderhold, V., Fryberger, H. J., & Spitzer, R. L. (2008). Dissociative symtpoms in schizophrenia. In A. Moskowitz, I. Schäfer & M. J. Dorahy (Eds.), *Psychosis, tauma and dissociation: Emerging perspectives on severe psychopathology* (pp. 149-163). Chichester, England: Wiley-Blackwell.

Smith, B., O'Sullivan, B., Watson, P., Onwumere, J., Bebbington, P., Garety, P., . . . Kuipers, E. (2010). Individual Cognitive Behavioural Therapy of auditory-verbal hallucinations. In F. Larøi & A. Aleman (Eds.), *Hallucinations: A guide to treatment and management* (pp. 41-60). Oxford: Oxford University Press.

Tai, S., & Turkington, D. (2009). The evolution of cognitive behaviour therapy for scizophrenia: Current practice and recent developments. *Schizophrenia Bulletin, 35*(5), 865-873.

Thornton, K., Varese, F., Jackson, M. C., & Linden, D. E. J. (submitted). The relationship between metacognitive beliefs, auditory hallucinations and hallucination-related distress in clinical and non-clinical voice-hearers. *Manuscript submitted for publication.*

Udachina, A., Thewissen, V., Myin-Germeys, I., Fitzpatrick, C., O'Kane, A., & Bentall, R. P. (2009). Understanding the relationships between self-esteem, experiential avoidance and paranoia: Structural equation modelling and experience sampling studies. *Journal of Nervous and Mental Disease, 197*(9), 661-668.

Udachina, A., Varese, F., Oorschot, M., Myin-Germeys, I., & Bentall, R. P. (submitted). Dynamics of self-esteem in "Poor-me" and "Bad-me" paranoia. *Manuscript submitted for publication.*

Valmaggia, L. R., Bouman, T. K., & Schuurman, L. (2007). Attention training with auditory hallucinations: A case study. *Cognitive and Behavioural Practice, 14*(2), 127-133. doi: 10.1016/j.cbpra.2006.01.009

Valmaggia, L. R., & Morris, M. (2010). Attention Training Technique and Acceptance and Commitment Therapy for distressing auditory hallucinations. In F. Larøi & A. Aleman (Eds.), *Hallucinations: A guide to treatment and management* (pp. 123-142). Oxford: Oxford University Press.

van Ijzendoorn, M. H., & Schuengel, C. (1996). The measurement of dissociation in normal and clinical populations: Meta-analytic validation of the Dissociative Experiences Scale (DES). *Clinical Psychology Review, 16*(5), 365-382.

Waters, F. A. V., Badcock, J. C., Maybery, M. T., & Michie, P. T. (2003). Inhibition in schizophrenia: Association with auditory hallucinations. *Schizophrenia Research, 62*, 275-280.

Waters, F. A. V., Badcock, J. C., Michie, P. T., & Maybery, M. T. (2006). Auditory hallucinations: Intrusive thoughts and forgotten memories. *Cognitive Neuropsychiatry, 11*(1), 65-83.

Wells, A. (1990). Panic disorder in association with relaxation induced anxiety: An attentional training approach to treatment. *Behavior Therapy, 21*(3), 273-280.

Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester, England: John Wiley & Sons.

Wells, A. (2007). The attention training technique: Theory, effects and a metacognitive hypothesis on auditory hallucinations. *Cognitive and Behavioural Practice, 14*(2), 134-138. doi: 10.1016/j.cbpra.2006.01.010