School of Population Health

Faculty of Health Sciences

Trauma-Related Voices:
Understanding Mechanisms of Maintenance and Change

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.
This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.
The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number HRE2020-0333, HRE2019-0525, and HRE2020-0265 (see Appendix A).

Signature:

Date: 24th February 2023

Acknowledgement of Country

We acknowledge that Curtin University works across hundreds of traditional lands and custodial groups in Australia, and with First Nations people around the globe. We wish to pay our deepest respects to their ancestors and members of their communities, past, present, and to their emerging leaders. Our passion and commitment to work with all Australians and peoples from across the world, including our First Nations peoples are at the core of the work we do, reflective of our institutions' values and commitment to our role as leaders in the Reconciliation space in Australia.

Acknowledgements

Thank you to my supervisory team, whose knowledge, expertise, and encouragement have been invaluable. Pete, your enthusiasm for research and clinical work is incredibly motivating and inspiring. Thank you for all the support that you provide to early career researchers and clinicians, and for encouraging me, supporting me through all the ups and downs, and for quietly tolerating my unnecessary adventures down literary rabbit holes. Georgie, your passion is infectious and your work as a scientist-practitioner has helped shape my own career ambitions. Lynne, I am very lucky to have had the opportunity to work with you - thank you for helping me to realise how much I enjoy qualitative research.

I am thankful to the Australian Government awarding me the Research Training Program Scholarship that funded this research. Thank you to my co-authors and research assistants for all their valuable contributions to this project.

I am grateful for both my parents, who are both incredibly supportive human beings. Thank you to my mum for being infectiously optimistic, taking care of my basic needs when I wasn't, putting up with my antics, and passing on her tenaciousness. Thank you to my dad for his sharing invaluable philosophies and wisdoms, consistently and uncompromisingly offering support, and for teaching me to enjoy a challenge. Thank you to Finn for literally everything – I don't even know where to begin – perhaps with your endless supply of useless "Finn facts". Thank you to my brother, grandfather, Annie and Ted, Kate, Lexy, Ebonnie, and everyone else who has fed, watered, walked me, or helped keep me sane in other ways.

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List of Abbreviations

APA	American Psychiatric Association
CBT	Cognitive behaviour therapy
CBTp	Cognitive behaviour therapy for psychosis
CFI	Comparative fit index
CI	Confidence intervals
CR	Conditioned response
C-Reps	Contextual-based representations
CS	Conditioned stimulus
DASS-21	Depression, Anxiety, Stress Scales-21
DEMO	Dissociative Experiences Measure Oxford
DSM-5	Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition
EMA	Ecological momentary analysis
ICD-11	11th edition of the International Classification of Diseases
ImRs	Imagery rescripting
M	Mean
M_{change}	Mean change
MI	Modification indices
ML	Maximum likelihood
MUSEQ	Multi-modal Unusual Sensory Experiences Questionnaire
n	Sample size
N	Total sample size
P	Participant
PDS-5	PTSD Diagnostic Scale for DSM-5
PERCI	Perth Emotion Regulation Competency Inventory
PERCI-N	Perth Emotion Regulation Competency Inventory – negative-emotion regulation composite
PTSD	Post-traumatic stress disorder
RMSEA	Root mean square error of approximation
SAAM	State Anxiety Attachment Scale
SAAM-I	State Anxiety Attachment Scale – insecure attachment subscale
SD	Standard deviation
S-Reps	Sensation-based representations
SRMR	Standardised root mean square residual
TLI	Tucker-Lewis index

TRV model	Trauma-related voices model
UPEs	Unusual perceptual experiences
US	Unconditioned stimulus

Abstract

Voices are a transdiagnostic symptom that occurs across a range of psychological disorders and within non-clinical populations (de Leede-Smith & Barkus, 2013; Larøi et al., 2012). There is robust evidence of a relationship between trauma and voices (Bailey et al., 2018; Hardy et al., 2005). Comorbid post-traumatic stress disorder (PTSD) symptoms and voices are common (Buswell et al., 2021; Shinn et al., 2020) and most trauma-affected voice hearers experience trauma-related voices, whereby the content of voices is directly or indirectly linked to past trauma experiences (Hardy et al., 2005; Paulik et al. 2019; Peach et al., 2020). A mechanism is a process or event that is responsible for maintaining or producing change in a specific outcome (Kazdin, 2007) and existing cognitive behavioural theories of PTSD and voices do not adequately explain the mechanisms that maintain trauma-related voices, as current psychological treatments based on these theories are ineffective in treating voices and PTSD symptoms in trauma-affected voice hearers (Brand et al., 2018; Thomas et al., 2014). Thus, to develop more effective treatments for trauma-affected voice hearers, there is a need to understand the mechanisms that underlie trauma-related voices. The overarching aim of this thesis was to increase understanding of the mechanisms of maintenance and change that may underlie different types of voices in trauma-affected people.

The first two studies in this thesis aimed to identify and conceptualise potential mechanisms of trauma-related voices. The first study involved an extensive narrative review of existing theories of PTSD (*n* = 10), the broader positive symptoms of psychosis (*n* = 4), and voices (*n* = 2) to identify mechanisms that are common across both sets of symptoms, unique to PTSD, and unique to positive symptoms (including voices). The results of this review identified 21 mechanisms that were common (*n* = 6) or unique to PTSD (*n* = 6) and positive symptoms (*n* = 9), and that no existing model included all 21 mechanisms. The second theory development study presents the Trauma-Related Voices (TRV) model, which was developed by combining all 21 mechanisms and outlining the theorised directional relationships, interactions, and feedback loops between different mechanisms. The TRV model outlines multiple pathways to different types of trauma-related voices (indirect versus direct) and identifies mechanisms that may be specific to indirect versus direct voices, or maintain trauma-related voices more generally. Consequently, the TRV model generates novel hypotheses beyond those that can be made by existing models of PTSD and positive symptoms. This study concludes with a comprehensive future research agenda that identifies the need for multiple types of

evidence to test and verify various components within the TRV model. This research agenda informed the remaining studies in this thesis.

The third study systematically reviewed evidence for the associations between mechanisms with the TRV model, voices (and broader hallucinations), and PTSD symptoms. The review reported the comparative strength of mechanistic associations with PTSD symptoms versus voices, and differences in the strength of association between mechanism measures and voices between groups with PTSD versus without PTSD, and between mechanism measures and PTSD symptoms between groups with voices versus without voices. The studies included in this review (*n* = 9) examined 12 different mechanisms and found preliminary evidence that dissociation, self-concept clarity, peri-traumatic dissociation, appraisals, thought suppression, and post-traumatic avoidance are associated with both sets of symptoms. The results suggest that there are large number of mechanisms within the TRV model that have not been specifically examined in past studies and that most studies excluded participants who did not meet full diagnostic criteria for PTSD or schizophrenia, or who had comorbidities, which may limit the generalisability of these findings to transdiagnostic voice hearing populations with diverse trauma and voice hearing symptoms.

The fourth quantitative survey study addressed the limitations of past studies by examining the associations between potential mechanisms, diverse trauma experiences, and a spectrum of unusual perceptual experiences (UPEs; including voices) in an unselected university sample (*N* = 528). As the TRV model suggests that complex interactions between mechanisms may explain trauma-related voices, path analysis was used to model the theorised associations between a combination of potential mechanisms (negative affect, insecure attachment, emotion regulation deficits, and dissociation), and the direct and indirect effects from trauma to the frequency of UPEs via these mediators. This model was an excellent fit to the data and accounted for 37.1% of variance in UPE frequency, and all direct (βs = .14-.61) and indirect pathways (βs = .01-.08) were significant (*p*s <.001). These findings provide preliminary evidence for this subset of relationships within the TRV model and suggest that insecure attachment may link trauma to emotion regulation deficits and negative affect, which are linked to UPE frequency via dissociation. There is a need to examine these associations in clinically distressed samples with trauma-related voices.

Current psychological treatments are ineffective in treating voices and PTSD symptoms in trauma-affected voice hearers (Brand et al., 2018; Thomas et al., 2014), however, imagery rescripting (ImRs) has been associated with large reductions in trauma-

related voices and PTSD symptoms (Ison et al., 2014; Paulik, Steel, et al., 2019; Clarke et al., 2022). The fifth study aimed to replicate and extend past ImRs studies by examining the impact of ImRs on potential mechanisms in the TRV model: self-compassion, emotional self-efficacy, dissociation, and cognitive reappraisal and expressive suppression emotion regulation strategies. ImRs was associated with reductions in the severity of trauma-related voices, PTSD symptoms, and dissociation, and increases in self-compassion and emotional self-efficacy, which were medium to very large (*d*s 0.41 – 2.23). Whilst these findings provide some evidence for these factors in the TRV model, there is a need for studies to gather stronger evidence of temporality and causality, to understand how these factors may interact to maintain voices, and how ImRs modifies these factors.

The final qualitative study aimed to uncover insights into mechanisms of trauma-related voices and how ImRs may influence such mechanisms by exploring voice hearers' explanations of voices and experiences of change throughout ImRs. Semi-structured interviews explored relationships between trauma and voices, and experiences of change and stability throughout ImRs in a transdiagnostic sample (*N* = 10) who underwent 10-18 weekly ImRs sessions. Thematic analysis was used to develop themes. Two themes captured explanations of voices, which suggested voices may have counterproductive protective functions. Three themes captured psychological experiences during ImRs, which reflected concepts such as freedom to experience emotions, and experiences of justice, closure, and grieving. Three themes described the outcomes of ImRs, reflecting concepts such as increased confidence, coping, perceived safety, and voices becoming less powerful. These findings suggest trauma-related voices may have underlying protective functions and ImRs may support emotional expression, adaptive trauma re-appraisals, and improve self-worth and coping self-efficacy. These change processes may overlap with elements of the TRV model and may have clinical implications in ImRs and other treatments for trauma-affected voice hearers.

This thesis has produced an integrative transdiagnostic trauma-related voices model that generates novel hypotheses that extend on existing theories. The TRV model was used to develop a comprehensive agenda for future research that may inform more effective treatments for trauma-related voices. The studies in this thesis provided a mixture of cross-sectional, prospective, and qualitative evidence that provides preliminary support for a subset of factors within the TRV model. Together, the findings indicate that insecure attachment, beliefs about the self, emotion regulation processes, and dissociation may be important factors that underlie trauma-related voices. Furthermore, the results of this

thesis provide support for transdiagnostic conceptualisation of voices and continuum models of trauma and UPEs, and evidence that ImRs is a safe and effective treatment for trauma-related voices and PTSD symptoms for voice hearers with a range of disorders and comorbidities. Based on the findings across these studies, future research is needed to test the larger structure of the TRV model and gather stronger evidence of temporality of change between mechanisms and voices, to examine the association between trauma-related voices and specific types of insecure attachment, dissociation, and emotion regulation processes, and to directly compare the effectiveness of ImRs versus other trauma-focussed interventions.

Author's Note

This is a hybrid thesis that includes chapters comprised of studies that have been accepted or are under review for publication. Minor editing of chapters comprising published and under review studies has been undertaken to ensure formatting and spelling (e.g., Australian) is consistent across the thesis chapters. The reference lists from individual chapters have been combined to reduce repetition.

List of Publications

The following publications were completed during candidature and are related to the thesis topic, but do not appear as part of the thesis.

1. This study was published (Appendix B).
   Strachan, L. P., Hyett, M. P., & McEvoy, P. M. (2020). Imagery rescripting for anxiety disorders and obsessive-compulsive disorder: Recent advances and future directions. *Current Psychiatry Reports, 22*(4), 17-17. https://doi.org/10.1007/s11920-020-1139-4

The following publications are included as part of this thesis.

1. Study 1 (Chapter 2) has been published (Appendix C);
   Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). A narrative review of psychological theories of post-traumatic stress disorder, voice hearing, and other psychotic symptoms. *Clinical Psychology & Psychotherapy, 29*(6), 1791-1811. https://doi.org/10.1002/cpp.2754
2. Study 2 (Chapter 3) is under review for publication (Appendix D);
   Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). *The trauma-related voices model: An integration of auditory verbal hallucinations and posttraumatic stress* [Manuscript submitted for publication]. School of Population Health, Curtin University
3. Study 4 (Chapter 5) is under review for publication (Appendix E);
   Strachan, L. P., Paulik, G., Preece, D., & McEvoy, P. M. (2022). *Pathways from trauma to unusual perceptual experiences: Modelling the roles of insecure attachment, negative affect, emotion regulation, and dissociation* [Manuscript submitted for publication]. School of Population Health, Curtin University.
4. Study 6 (Chapter 7) is under review for publication (Appendix F);
   Strachan, L. P., Paulik, G., Roberts, L., & McEvoy, P. M. (2022). *Voice hearers' explanations of trauma-related voices and processes of change throughout imagery rescripting: A qualitative exploration* [Manuscript submitted for publication]. School of Population Health, Curtin University.

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Conference Presentations

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2020, May 11). Trauma-related voice hearing: Understanding mechanisms of maintenance and change [3-minute thesis presentation]. Mark Liveris Research Student Seminar, Faculty of Health Sciences, Curtin University, Bentley, Western Australia, Australia. https://news.curtin.edu.au/events/mark-liveris-student-research-seminar/

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2020, November 10 - 11). *Post-traumatic stress symptoms, voice hearing, and associated psychological mechanisms of maintenance and change: A systematic review* [3-minute thesis presentation]. Early Career Hallucinations Research, Australia and New Zealand Group Conference 2020, Melbourne, Australia. https://echr.group/anz-2020/

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2021, October 28 - 30). *Post-traumatic stress symptoms, voice hearing, and associated psychological mechanisms of maintenance and change: A systematic review* [Poster presentation]. Australian Association for Cognitive and Behaviour Therapy 41st Annual Conference 2021, Perth, Australia. https://www.aacbt.org.au/national-conference-2021/

Strachan, L. P., Paulik, G., Preece, D., McEvoy, P. M. (2022, October 13 - 15). *Pathways from trauma to unusual perceptual experiences: Modelling the roles of insecure attachment, negative affect, emotion regulation, and dissociation* [Paper presentation]. Australian Association for Cognitive and Behaviour Therapy 42nd Annual Conference 2022, Melbourne, Australia. https://www.aacbt.org.au/national-conference-2022/

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Chapter 1: Introduction to Thesis

Voices (auditory verbal hallucinations) are the most common type of unusual perceptual experience (UPE; Chaudhury, 2010) and involve perception of a voice when an external source of that voice is not present (Upthegrove et al., 2016). Unlike other forms of inner dialogue, voices are perceived to be egodystonic (Cuevas-Yust, 2014) and are often assumed to be a symptom that is primarily associated with psychotic spectrum disorders. However, voices are experienced in a range of non-psychotic disorders (McCarthy-Jones, 2012) and by people with no history of mental illness (Baumeister et al., 2017; Liszen et al., 2022). Voices can cause significant psychological distress and psychosocial impairment (Alonso et al., 2018), and comorbid PTSD symptomology is associated with more severe psychopathology, neurocognitive and functional impairment, and poorer quality of life (Lysaker & LaRocco, 2008; Seow et al., 2016), and poorer responsiveness to antipsychotic pharmacological treatments (Mørkved et al., 2022; Verdoux et al., 2022) amongst people with psychotic spectrum disorders.

There is robust evidence of relationships between trauma and voices (Bailey et al., 2018; Hardy et al., 2005). The prevalence of voices in post-traumatic stress disorder (PTSD), and borderline personality and dissociative identity disorder, which are commonly linked to trauma, are comparable to the prevalence rates in psychotic spectrum disorders (Anketell et al., 2010; Brewin & Patel, 2010; Kingdon et al., 2010; Lim et al., 2016; Niemantsveriet et al., 2017; Sar & Ozturk, 2008; Shinn et al. 2020). The characteristics of voices (e.g., loudness, frequency) are also similar across diagnostic groups (Moskowitz et al., 2017). An estimated 78 to 97% of voice hearers report a history of trauma, 16 to 21.5% have a diagnosis of PTSD (de Bont et al., 2015; Hardy et al., 2016; Tolmeijer et al., 2021), and two-thirds report that their trauma experiences were linked to the onset of their voices (Escher et al., 2004). Furthermore, 57.5% to 73% of trauma-affected voice hearers experience *trauma-related voices*, whereby traumatic experiences influence the phenomenology of voices indirectly (themes from trauma experiences are present in the content of voices) or directly (voices repeat comments of past perpetrators; Hardy et al., 2005; Peach et al., 2021).

Researchers have likened trauma-related voices to the re-experiencing symptoms of PTSD (Compean & Hamner, 2019; Morrison et al., 2003), which involve recurrent, unwanted, involuntary mental images related to one's trauma (American Psychiatric Association [APA], 2013), and can occur across all sensory modalities (Holmes et al., 2008). A mechanism is a process or event that is responsible for maintaining or producing change in a specific outcome (Kazdin, 2007) and the mechanisms of trauma-related voice

hearing have historically been explained via cognitive models of PTSD (Steel & Holmes, 2005). However, whilst cognitive behaviour therapies (CBT) that target the mechanisms of PTSD outlined in these models effectively treat PTSD symptoms, they are ineffective at treating voices (Brand et al., 2018). Furthermore, CBT that broadly targets mechanisms of positive symptoms (i.e., hallucinations, delusions, and disorganised cognition) has inconsistent effectiveness in treating voices (Paulik, Hayward, et al., 2019; Thomas et al., 2014). These findings emphasise the need for more effective psychological treatments for trauma-affected voice hearers. However, existing models of PTSD and positive symptoms are insufficient for explaining trauma-related voices, so improving our understanding the mechanisms that underlie these voices is important for developing more targeted and efficacious treatments.

Aims and Outline of the Thesis

The overarching aim of this thesis is to increase understanding of the mechanisms of maintenance and change that may underlie different types of voices in trauma-affected individuals. To achieve this aim, the objectives of this thesis are to review existing literature to identify potential mechanisms, conceptualise how these mechanisms may explain trauma-related voices, examine existing evidence for these mechanisms, and address key gaps in the literature by examining the relationships between potential mechanisms, voices, and PTSD symptoms in trauma-affected individuals. These objectives were addressed in six studies. The aims of each study are outlined below, along with information about the linkages between studies, and authorship statements are available in Appendix H. Figure 1.1 indicates the location of this chapter within the overall structure of this thesis.

Chapter 2 (Study 1)

This narrative review study aimed to identify potential mechanisms of trauma-related voices by reviewing existing stand-alone models of PTSD and voices (and other positive symptoms). This study provides a definition of trauma-related voices, a literature review of the relationship between trauma and voices, a narrative review of existing models of PTSD and voices, and a summary of mechanisms that identifies which mechanisms unique to models of PTSD versus voices and which are common across both sets of symptoms. The review concludes with an overview of the strengths and limitations of existing models, which suggests that to generate novel hypotheses beyond those that can be made by stand-alone models, there is a need to integrate and explain the interactions between mechanisms of PTSD and voices. The results of this chapter

provided the rationale for chapter three (study 2). Chapter two is published in the peer-reviewed journal, Clinical Psychology and Psychotherapy.

Chapter 3 (Study 2)

This aim of this theory development study was to address the limitations of existing models of PTSD and voices in explaining trauma-related voices. This study presents the Trauma-related Voices (TRV) model, which was developed by integrating the mechanisms from stand-alone models of PTSD and voices (and other positive symptoms) identified in chapter two (study 1). The TRV model integrates the unique and common mechanisms from stand-alone models and models the interactions between individual mechanisms and outlines multiple mechanistic pathways from trauma to voices. Thus, the TRV model identifies novel hypotheses that can be used to guide future research that may inform more effective treatments for trauma-affected voice hearers. This study provides a detailed future research agenda, which guided the design of the remaining studies in this thesis. Chapter three is under review for publication with a peer-reviewed journal.

Chapter 4 (Study 3)

This systematic review aimed to summarise evidence for the relationship between the mechanisms of trauma-related voices identified in the TRV model, PTSD symptoms, and voices. As PTSD symptoms and voices are considered dimensional constructs, this review included studies that recruited samples with clinical levels of PTSD or voices, as well as other clinical and non-clinical samples with symptoms of PTSD or voices. The review compared the strength of associations between each mechanism and voices, versus PTSD symptoms, and differences in the strength of association between mechanism measures and voices between groups with PTSD versus without PTSD, and between mechanism measures and PTSD symptoms between groups with voices versus without voices. The results of this study provided some evidence for a subset of individual factors within the TRV model and identified key areas for future research. This study is currently prepared for submission to a peer-reviewed journal.

Chapter 5 (Study 4)

This quantitative survey study aimed to gather further evidence for the structure of the TRV model by cross-sectionally examining a subset of key associations in a non-clinical sample. This study modelled the pathways from diverse trauma experiences to the frequency of multi-sensory unusual perceptual experiences (including voices) via a combination of four key factors in the TRV model. The results of this study provided preliminary cross-sectional evidence for a subset of relationships in the TRV model and supported the rationale for future prospective studies using clinical samples. Thus, these

findings supported the rationale for chapter six (study 5). Chapter five is under review with a peer-reviewed journal.

Chapter 6 (Study 5)

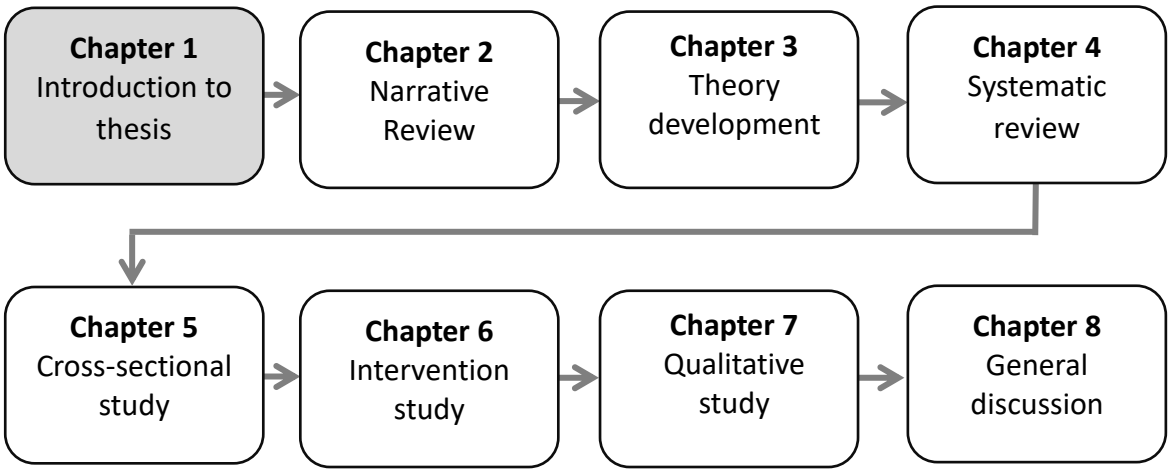
Imagery rescripting (ImRs) is a mental imagery technique that aims to change the meaning of memories that are linked to current psychological problems (Arntz, 2012). There is preliminary evidence that ImRs is associated with large reductions in voices and PTSD symptoms (Ison et al., 2014; Paulik, Steel, et al., 2019), which suggests that compared to existing CBT treatments, ImRs may more effectively manipulate mechanisms of trauma-related voices. This intervention study aimed to replicate and extend past ImRs studies by prospectively exploring the impact of ImRs on voices, PTSD symptoms, and four mechanisms from the TRV model within a clinical sample with trauma-related voices. This study is currently prepared for submission to a peer-reviewed journal.

Chapter 7 (Study 6)

This qualitative study aimed to explore voice hearers' explanations of their trauma-related voices and experiences of change throughout ImRs. In doing so, this study sough to identify voice hearers' insights into potential mechanisms of trauma-related voices and how ImRs may manipulate these mechanisms. The findings from this study map onto several elements within the TRV model and are consistent with the findings from chapter six. Additionally, the findings from this study uncovered additional detail about key factors within the TRV model, which may be tested in future qualitative studies and lead to model refinement. Chapter seven is under review with a peer-reviewed journal.

Figure 1.1

Flow Diagram of Thesis Structure: Chapter One



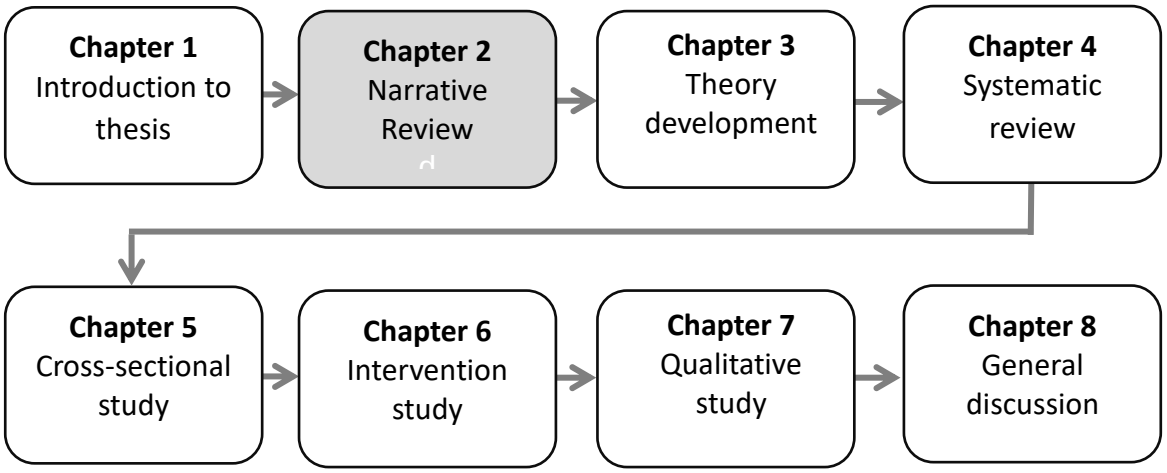
Chapter 2 (Study 1): A Narrative Review of Psychological Theories of Post-traumatic Stress Disorder, Voices, and Other Psychotic Symptoms

Introduction to Chapter 2

Understanding the mechanisms that underlie PTSD symptoms and broader "psychotic-like" symptoms may be an important first step in identifying potential mechanisms of trauma-related voices. Chapter two (study 1) provides a narrative review of key theories of PTSD and positive symptoms (including voices) that identifies and explains how different mechanisms maintain voices and PTSD symptoms. Theoretical differences and similarities between models were examined by summarising and categorising mechanisms as being unique to PTSD or voices, or common to both sets of symptoms. This study emphasised that existing models are insufficient in explaining trauma-related voices, which provided the rationale for the development of a novel theory of trauma-related voices in chapter three (study 2). This chapter is published in the peer-reviewed journal, Clinical Psychology and Psychotherapy (citation below). Figure 2.1 indicates the location of this chapter within the overall structure of this thesis.

Figure 2.1

Flow Diagram of Thesis Structure: Chapter Two



Citation for Chapter 2

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). A narrative review of psychological theories of post-traumatic stress disorder, voice hearing, and other psychotic symptoms. *Clinical Psychology & Psychotherapy, 29*(6), 1791-1811. https://doi.org/10.1002/cpp.2754

Introduction

Voice hearing (auditory verbal hallucinations) is the most common type of unusual perceptual experience, whereby an individual hears a voice(s) when the source of that voice is not directly present (Upthegrove et al., 2016). Unlike other forms of inner dialogue (e.g., repetitive negative thinking), voice hearing is not perceived by the individual as being self-generated (Upthegrove et al., 2016). Although voice hearing is typically associated with psychosis and psychotic disorders, it is also associated with a range of other mental illnesses, such as post-traumatic stress disorder (PTSD), depression, anxiety disorders, personality disorders, dissociative disorders, and neurological conditions (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019). Voice hearing is also reported amongst psychologically healthy individuals (Baumeister et al., 2017). Approximately 20% of voice hearers do not meet criteria for psychological disorder (Johns et al., 2002) and 10 – 28% of the general population report hearing a voice at some point in their lives (de Leede-Smith & Barkus, 2013; Sommer et al., 2010). Consequently, researchers have highlighted the need to study psychotic-like symptoms, such as voice hearing, separately from psychotic diagnoses (Carpenter, 2016; Murray, 2017).

Voice hearing can be associated with significant psychological distress and psychosocial impairment (Alonso et al., 2018), and people who hear voices frequently report a history of trauma (de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016). The presence of PTSD symptoms amongst people with a psychotic disorder is common and is associated with an increased severity of psychotic symptoms and suicidality, as well as poorer social functioning, treatment engagement and adherence, and therapeutic benefit from psychological and pharmacological treatments (Hassan & De Luca, 2015; Schneeberger et al., 2014; Seow et al., 2016; Trotta et al., 2015). Furthermore, there is often a link between trauma and the content of voices; *direct voices* repeat phrases spoken by perpetrators of trauma and the content of *indirect voices* is thematically similar to past trauma (Hardy et al., 2005).

Although there are theoretical models that explain voice hearing and PTSD symptoms separately, and trauma-informed models of voice hearing, there is currently no integrative theory to guide research into the mechanisms that maintain different types of trauma-related voice hearing. A mechanism is a process that is causally related to change in a particular outcome and multiple mechanisms may be operating, and interacting with each other, at any one time (Kazdin, 2007). Identifying and understanding the psychological mechanisms that maintain trauma-related voice hearing, and interactions between mechanisms, is critical for the development of effective psychological treatments.

The aim of this review is to identify potential psychological mechanisms that may underlie trauma-related voice hearing and will be presented in three sections. The first section will describe the relationship between trauma and voice hearing and present the rationale for reviewing theoretical models of PTSD and positive symptoms (including voices). In the second section, models of PTSD and positive symptoms will be reviewed to examine how our understanding of post-traumatic stress and voice hearing within the psychotic spectrum may inform our understanding of trauma-related voice-hearing outside the psychotic spectrum. Mechanisms that are unique or common to each set of symptoms will be summarised. The third section will discuss the key contributions and limitations of theories reviewed in section two, and will suggest future research directions based on these observations.

The Relationship Between Trauma and Voice Hearing

Whilst researchers have recently acknowledged the need to study discrete psychotic-like symptoms (Carpenter, 2016; Murray, 2017), there is limited research on voice hearing experiences specifically, and most research has been conducted using samples with psychotic disorders and focuses on positive symptoms more generally. However, preliminary evidence suggests that, at least for some people, trauma has a causal role in voice hearing (Hardy et al., 2019; Varese et al., 2012). Compared to the general population, people with psychotic disorders are four to six times more likely to have experienced victimisation trauma (physical, emotional, and sexual abuse, and physical and/or emotional neglect; de Vries et al., 2019; Matheson et al., 2013) and childhood sexual abuse is most strongly related to voice hearing (Bailey et al., 2018). Approximately 70 - 75% of voice hearers report a history of trauma (de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016) and there is a 20-fold increase in the risk of developing schizophrenia spectrum disorder in the year following a diagnosis of a traumatic stress disorder (Okkels et al., 2017).

It is perhaps not surprising then, that 16.0 – 21.5% of voice hearers meet diagnostic criteria for PTSD (de Bont et al., 2015; Hardy et al., 2016), which is elevated compared to the 3.9 – 5.6% prevalence rates within the general population (Koenen et al., 2017), and many more experience clinically significant PTSD symptoms that do not meet full diagnostic criteria for PTSD (Hardy et al., 2019). Furthermore, phenomenological studies have found evidence for trauma-related voice hearing; approximately 57.5% of voice hearers report indirect associations between the content of their voices and past trauma and 12.5% report a combination of indirect and direct associations (Hardy et al., 2005). Although 42.5% perceived no apparent link between their trauma and voices (Hardy et al.,

2005), anecdotal evidence indicates people often become aware of associations between their voices and trauma during therapy as they gain a more complete understanding of their symptoms.

There is symptomatic overlap between PTSD and the positive symptoms of psychosis (Morrison et al., 2003). Cognitive intrusions, commonly known as re-experiencing symptoms, involve recurrent, unwanted, involuntary memories, dreams, and other mental images related to one's trauma (APA, 2013; Wells & Matthews, 1994). Dissociation describes an altered state of consciousness whereby feelings, thoughts, and experiences become disintegrated and disrupt normal perception and memory. Dissociation is conceptualised as having two distinct components; detachment, which refers to a sense of separation from reality (e.g., derealisation), and compartmentalisation, which refers to the perceived separation of different aspects of current experience and mental processes (e.g., dissociative amnesia). Both cognitive intrusions and dissociation are key diagnostic features of PTSD but do not form part of the diagnostic criteria for psychotic disorders (APA, 2013). However, people with schizophrenia spectrum disorder who hear voices experience significantly more intrusions compared to both healthy controls and people with schizophrenia spectrum disorder who do not hear voices (Morrison & Baker, 2000), and dissociative reactions are commonly reported by people with psychotic disorders (Moskowitz et al., 2005; Ross, 2007; Vogel et al., 2013). Furthermore, people diagnosed with PTSD report high rates of positive symptoms (Butler et al., 1996; Sautter et al., 1999). However, this may be due to the considerable phenomenological similarities between PTSD and psychosis symptoms (see Seedat et al., 2003). For example, an individual experiencing a PTSD flashback may feel disconnected from reality, and experience emotions and enact behaviours consistent with a past traumatic event, which suggests that flashbacks have properties similar to those of psychosis-related hallucinations and disorganised behaviour (i.e., responding in a way that does not fit the current situation; APA, 2013; Seedat et al., 2003).

PTSD-related hyperarousal, hypervigilance, and paranoia share similar qualities to delusions associated with psychotic disorders (particularly persecutory delusions) and both disorders are associated with sleep disturbances (APA, 2013; Reeve et al., 2015). These findings have led some researchers to theorise that the positive symptoms associated with psychotic disorders may be complex forms of PTSD re-experiencing or dissociation (Moskowitz & Corstens, 2008; Read et al., 2003). Moreover, voice hearing specifically has been conceptualised as a dissociative experience, whereby dissociative processes result

in a person perceiving trauma-related memory intrusions as an egodystonic voice (Longden et al., 2012).

The Need for an Integrative Theoretical Approach to Trauma-Related Voice Hearing

Historically, trauma-related voice hearing has been explained via cognitive models of PTSD (Steel et al., 2005), which suggest that normal encoding is disrupted during highly traumatic events, thereby causing memories of trauma to be encoded with limited contextual information. Intrusive de-contextualised trauma memories may be misinterpreted by the individual to be disturbing external stimuli from the present (i.e., malevolent voices), rather than distressing memories (Morrison, 2001; Steel et al., 2005). However, whilst this conceptualisation may explain direct trauma-voice associations, most trauma-affected voice hearers who report a link between their trauma and voices report an indirect trauma-voice association (Hardy et al., 2005), which suggests that voice-hearing experiences are different to PTSD intrusion symptoms, at least for those with indirect trauma-voice associations.

Berry and Bucci (2016) suggest that indirect voices may occur due to a tendency to dissociate in response to trauma-related or self-critical thoughts, whereby normal perceptual and memory processes are disrupted and cause an individual to perceive such thoughts as egodystonic voices. Hardy's (2017) model of post-traumatic stress in psychosis suggests that indirect voices occur when an individual experiences dissociative detachment during the construction of novel mental imagery (i.e., generation of mental perceptions across all sensory modalities) that is informed by trauma-informed personal semantic memory (i.e., beliefs that are informed by a memory; Hackmann et al., 1998), thereby causing the individual to hear voices that are thematically linked to past trauma.

PTSD symptoms in trauma-affected voice hearers are currently treated using cognitive behavioural treatments (CBT), which are based on cognitive models of PTSD that are theorised to re-contextualise trauma memories, or via eye movement desensitisation and reprocessing treatment, which was not developed from an established theory (Shapiro, 1989). Whilst these treatments effectively reduce trauma symptoms, they have shown limited effectiveness in reducing voice hearing and psychosis symptoms (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017). On the other hand, preliminary evidence suggests that imagery rescripting, a novel intervention that uses mental imagery techniques to modify the meaning of distressing memories, effectively reduces post-traumatic stress, unwanted memory intrusions, voice hearing frequency, voice-related distress, and negative affect amongst voice hearers (Ison et al., 2014; Paulik et al., 2019). Together, these findings suggest that there may be commonalities and differences in the

mechanisms that underlie PTSD and voice hearing experiences. Additionally, compared to traditional CBT interventions, it may be that interventions such as imagery rescripting may more effectively target the psychological mechanisms common to both sets of symptoms or may simultaneously target multiple mechanisms that are unique to each set of symptoms. There is currently no established theory of trauma-related voice hearing that explains these findings. As a first step towards developing an integrative theory that could provide a more comprehensive explanation of the aetiology, maintenance, and modification of trauma-affected voice-hearing, established models of PTSD and positive symptoms (including trauma-informed models of voices) will now be reviewed before common and unique mechanisms across the models are outlined.

Overview of Key Theoretical Models of Post-Traumatic Stress Disorder

Behavioural Models of Post-Traumatic Stress Disorder

Theories of Associative Fear-Learning

Classical conditioning is a key underlying process in associative fear-learning theories. The unconditioned feared stimulus that is central to the person's trauma experience (e.g., being assaulted by a tall man at night) is paired with neutral stimuli (e.g., tall men and dark environments). As a result, previously neutral stimuli become conditioned stimuli that produce conditioned responses that are similar to those produced by the unconditioned stimulus (e.g., fear; Lissek & van Meurs, 2015). Fear conditioning can be altered via extinction, whereby an individual acquires new learning; conditioned responses to conditioned stimuli decline with repeated exposure to those stimuli in the absence of the unconditioned stimuli and/or aversive outcomes (Lissek & van Meurs, 2015). The main tenet of associative fear-learning models is that PTSD is the result of extinction failure, whereby a person's conditioned fear response to non-threatening stimuli does not decline with repeated non-aversive exposures to conditioned stimuli (Lissek & van Meurs, 2015).

There are several theories of how conditioning and extinction processes establish and maintain PTSD symptoms (for a review, see Lissek & van Meurs, 2015). Competition theory (for a review, see Bouton, 2004) suggests that extinction learning does not erase original fear-conditioning, but outcompetes the original fear-acquisition learning; extinction is only successful if the extinction learning is stronger than the fear-acquisition learning (see Figure 2.2). Individuals with PTSD may have (a) hyper-conditionability, whereby heightened fear acquisition learning results in strongly acquired fear-based learning (Orr et al., 2000), and/or (b) inhibitory learning deficits that impair their ability to inhibit fear-based learning in favour of extinction learning (Jovanovic & Ressler, 2010). Others have

suggested that people who are predisposed to anxiety may find conditioned responses distressing enough that they serve as unconditioned stimuli, which causes normal extinction processes to be inhibited and instead, repeated fear responses during extinction learning may strengthen reactivity to conditioned stimuli (Eysenck, 1979).

Mowrer (1947) suggests that PTSD involves a two-stage learning process, and that the second stage is primarily responsible for extinction failure. The first stage involves classical conditioning, which leads the person to develop a repertoire of conditioned stimuli that produce a conditioned fear response. The second stage involves the person actively avoiding and escaping conditioned stimuli to alleviate distress, which leads to negative reinforcement; the reduction in distress increases the likelihood of future avoidance, which thwarts opportunities for extinction learning. Others have suggested that people with PTSD have an inability to suppress fear when presented with safety cues and as extinction relies on fear-inhibition, people who fall into this category experience extinction failure (Jovanovic & Ressler, 2010).

Contrary to the theory of hyper-conditionability, the associative-learning deficits model suggests that people with PTSD have difficulty identifying realistic associations between unconditioned and associated stimuli, which leads to difficulties identifying real danger cues within their environment (Grillon, 2002). Consequently, these deficits may lead people to associate the unconditioned trauma stimulus with the general environment in which the trauma occurred, which may lead to generalised contextual anxiety and a chronic state of arousal. Furthermore, people with PTSD may over-generalise, whereby they readily associate neutral stimuli to conditioned stimuli, which results in fear responses to safe stimuli that are seemingly unrelated to the traumatic event (Grillon, 2002).

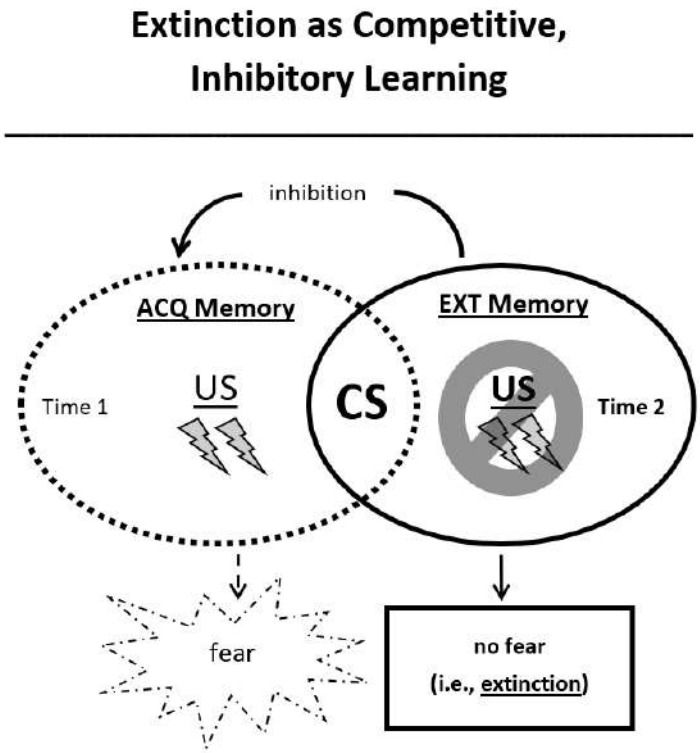
Theories of Non-Associative Fear-Learning

Non-associative fear-learning theories conceptualise PTSD as changes in a person's reactivity to fear-relevant stimuli due to problematic habituation and sensitisation processes (for a review, see Lissek & van Meurs, 2015). Habituation describes a gradual decline in autonomic and psychological arousal after repeated exposure to fear-inducing stimuli (Groves & Thompson, 1970). Failure to habituate, whereby individuals' experience persistent startle responses to non-threatening stimuli, may maintain hyperarousal symptoms of PTSD. In contrast to habituation, sensitisation describes the process of a person experiencing increasing autonomic and psychological reactivity with repeated exposure to fear-related stimuli (Groves & Thompson, 1970). Sensitisation is suggested to result from previous activation of a person's fear system, which results in the fear system

becoming hyper-sensitive to new, unusual, or fear-relevant stimuli (Lissek & van Meurs, 2015).

Figure 2.2

Competition Theory



Note. In this example, the acquisition memory is associated with the pairing of an unconditioned stimulus (US; e.g., being assaulted) with a neutral stimulus, which becomes a conditioned stimulus (CS; e.g., tall men) that produces a conditioned response (CR; e.g., fear). Encoding of the extinction memory occurs due to subsequent repeated exposure to the CS in the absence of the US (e.g., non-aggressive/threatening tall men). Future exposures to the CS result in a competition between the activation of the two memories. Extinction learning occurs when the extinction memory outcompetes the acquisition memory, thereby inhibiting the CR. From “Learning Models of PTSD: Theoretical Accounts and Psychobiological Evidence”, by S. Lissek & B. van Meurs, 2015, *International Journal of Psychophysiology, 98,* p. 597 (https://doi.org/10.1016/j.ijpsycho.2014.11.006). Copyright 2014 by Elsevier. Reprinted with permission.

Schema-Based and Social-Cognitive Models of Post-Traumatic Stress Disorder

Model of Stress Response

Schema theorists (see Rafaeli et al., 2011; Young, 2006) suggest that information, knowledge and beliefs about oneself, others, and the world is organised in the mind as units of knowledge called schemas, and that people make meaning of new information using their schemas, which influence their emotional, cognitive, and behavioural responses to such information. Horowitz (1983, 1986, 2011) explains PTSD symptoms using two general “response modes” to stress. First, intrusion symptoms are the result of a

failure to integrate traumatic experiences into their pre-existing schematic network. Horowitz (1983) proposes that people have a *completion tendency*, which involves a propensity to assimilate new information (e.g., trauma), as well as the meaning of such information, into pre-existing schemas, and that people possess a bias toward preserving existing schematic structures. Should the trauma or the meanings that individuals assign to the trauma conflict with existing schemas, the person may experience *completion failure*, which results in a normative stress response. Furthermore, the individual will continue to experience intrusion symptoms until they successfully integrate the trauma information into their schematic network.

The individual may engage in a second response mode to defend against distressing intrusions. This response mode involves *defence mechanisms*, such as numbing, denial, repression, and avoidance that reduce the stress response by keeping the traumatic information out of conscious awareness. Horowitz (1983) describes PTSD symptoms as an oscillation between these two response modes while the individual processes the trauma information. Processing of trauma involves slow schematic change and PTSD symptoms resolve once traumatic experience is integrated within the schematic network.

Shattered Assumptions Theory

The shattered assumptions theory (Janoff-Bulman, 1989; Janoff-Bulman & Frantz, 1997; Janoff-Bulman & Frieze, 1983) conceptualises PTSD symptoms as the result of schematic change. This theory outlines three positive and rigid schematic assumptions: the world is meaningful (e.g., people get what they deserve), the world is benevolent (e.g., people are more good than not), and the self is worthy (e.g., I am good, so bad things could never happen to me). These three assumptions are proposed to afford the individual a feeling of invulnerability and that the world is predictable, which produces a sense of safety and security. However, should an individual be unable to integrate new negative experiences into these pre-existing schemas, their assumptions are “shattered”. Therefore, trauma can lead to rapid and overwhelming schematic change that causes feelings of extreme vulnerability, defencelessness, and distress. The more strongly a person holds these three basic assumptions, or if these assumptions have never been challenged before, the more sudden and shattering their schematic change will be. However, this theory has been challenged due to evidence that demonstrates people with multiple traumas, whose positive schemas should have already undergone schematic change, are more likely to experience PTSD symptoms (see Brewin & Holmes, 2003). In response, Janoff-Bulman suggested that people with more positive assumptions may recover faster

than those with a trauma history, or that people with past trauma may not have integrated trauma information into their schematic structures and, therefore, new trauma information would continue to be “shattering” (Janoff-Bulmann, 1992, as cited in Brewin & Holmes, 2003). According to the shattered assumptions theory, individuals may engage coping strategies, such as denial, self-blame, and intrusions symptoms, which aid the re-construction of their schematic structure.

Social Cognitive Theory

Benight and Bandura’s (2004) social cognitive theory states that unhelpful self-schemas, specifically in relation to perceived self-efficacy, underlie PTSD symptoms. Self-efficacy describes one’s perceived ability to manage their own functioning, but when considered in the context of traumatic experiences, describes an individual’s ability cope with the trauma and its sequelae, which shapes their cognitive, affective, and behavioural responses to trauma. Benight and Bandura (2004) propose several ways in which self-efficacy shapes trauma responses. First, self-efficacy can impact attentional and evaluative processes; those who have lower self-efficacy are likely to be vigilant toward potential threats and amplify the severity of risk associated with those threats. Second, self-efficacy can affect how people respond to perceived threats; people with low self-efficacy are less likely to try to control their environment to reduce their distress and are more likely to experience heightened emotional reactivity or attempt to avoid and/or escape threatening stimuli. Third, individuals with low self-efficacy may struggle to control their thoughts, emotions, and behaviours in response to threatening stimuli. As such, people with low self-efficacy are more likely to have intrusion symptoms and re-experience the emotional and behavioural aspects of trauma.

Information Processing Models of Post-Traumatic Stress Disorder

Dual Representation Theory

According to the dual representation theory of PTSD (Brewin et al., 1996; Brewin & Holmes, 2003), trauma is processed emotionally within two memory systems. The first system involves conscious processing, whereby a traumatic event is integrated into long-term autobiographical memory. These memories were originally called “verbally accessible memories” because they can be both voluntarily and involuntarily retrieved, verbalised and updated. However, Brewin et al.’s (2010) revised model, which integrates the original model with neurobiological models of memory and imagery, refers to these memories as “contextual-based representations” (C-Reps). C-Reps contain information about the context and events that occurred prior to, during, and following trauma, as well as the individual’s appraisal of the meaning of a trauma (Brewin et al., 2010; Brewin & Holmes,

2003). C-Reps may include primary emotions that occurred during the event (e.g., fear), as well as secondary emotions about the perceived meaning of a trauma that are retrospectively generated (e.g., guilt or shame; Brewin & Holmes, 2003). Heightened arousal during trauma limits an individual's capacity to process large amounts of information (Brewin & Holmes, 2003), which, combined with attentional biases toward highly threatening aspects of the trauma, can result in fragmented and poorly contextualised C-Reps (Brewin et al., 1996; Brewin & Holmes, 2003). The second system involves unconscious processing of the physiological, motor, and sensory information associated with the trauma (Brewin et al., 1996). These memories are inflexible and cannot be retrieved intentionally. Instead, these memories are involuntarily accessed when the individual is exposed to internal (thoughts or bodily sensations) or external stimuli that match elements of the trauma (Brewin & Holmes, 2003). As they are comprised of mental representations of sensory information, they are difficult to verbalise (Brewin & Holmes, 2003) and, therefore, were labelled "situationally accessible memories" and later, in the revised model, "sensation-based representations" (S-Reps).

According to Brewin and colleagues (1996; 2010), PTSD is the result of a lack of integration between C-Reps and S-Reps (see Figure 2.3). When an individual is exposed to situational reminders of a trauma, highly detailed sensory, motor, physiological, and emotional features (S-Reps) are automatically activated in the absence of temporal and contextual information (C-Reps). Consequently, rather than recollecting a trauma memory, the individual re-experiences the memory as if it were occurring in real-time along with the distressing affective, motor, physiological, and sensory experiences associated with the original memory (i.e., flashbacks or nightmares).

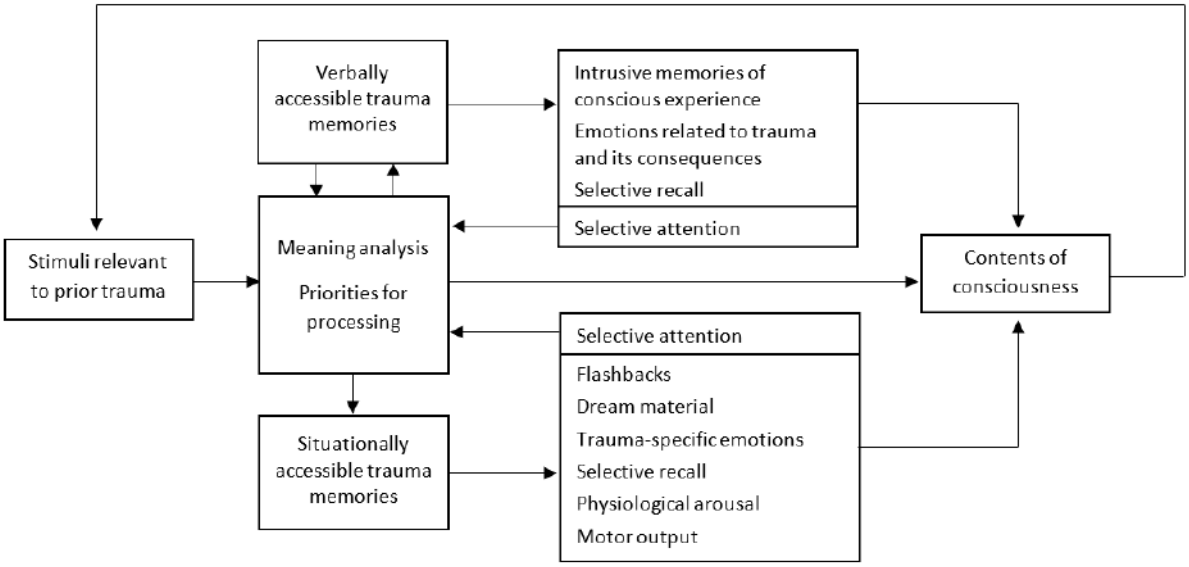
Fear Network Account of Emotional Processing

The fear network account of emotional processing (Foa & Kozak, 1986; Foa et al., 1989) suggests that feared stimuli are embedded in long-term memory within a "fear network" (Foa & Kozak, 1986). Fear networks contains information about (a) feared and associated stimuli, (b) cognitive, behavioural, and physiological reactions to feared stimuli, and (c) the associations between feared stimuli and responses (i.e., meanings about trauma and trauma responses). Foa and Kozak (1986) suggest that PTSD symptoms result from a pathological, change-resistant fear network comprised of excessive stimuli and response information, and heightened associations between elements that do not accurately reflect reality. When a person encounters an element of their fear network (e.g., dark outside) within their environment, the entire fear network becomes activated and triggers the survival response prescribed by that network (see Figure 2.4). Consequently,

pathological fear networks produce strong emotional and behavioural responses to non-threatening stimuli (i.e., re-experiencing). Furthermore, avoidance and numbing symptoms are conceptualised as coping strategies that reduce the likelihood the fear network will be activated and, therefore, prevent re-experiencing symptoms (Foa et al., 1989). Additionally, hyperarousal symptoms may reflect lower-level activation of the fear network (Foa et al., 1989).

Figure 2.3

The Dual Representation Theory of Post-Traumatic Stress Disorder



Note. From “A Dual Representation Theory of Posttraumatic Stress Disorder,” by C. R. Brewin, T. Dalgleish, & S. Joseph, 1996, *Psychological Review*, *103*, p. 676 (https://doi.org/10.1037/0033-295X.103.4.670). Copyright 1996 by American Psychological Association. First developed by Brewin (1989). Reprinted with permission.

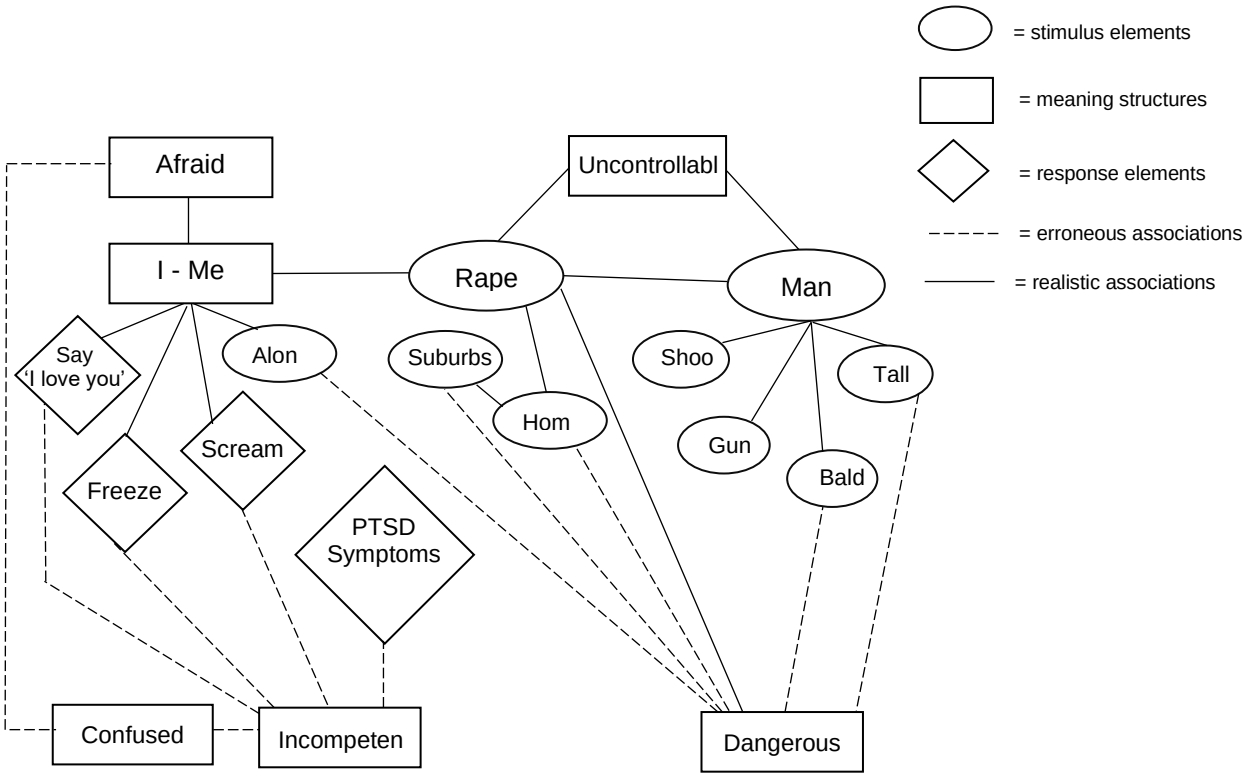
Integrated Models of Post-Traumatic Stress Disorder

Emotional Processing Theory

Emotional processing theory extends on the fear network account of emotional processing in several ways (Brewin & Holmes, 2003; Dalgleish, 2004). The revised theory incorporates additional information about pre-trauma beliefs and information available prior to, during, and after the trauma, as well as negative appraisals of one’s responses during and after trauma (see Figure 2.5.; Brewin & Holmes, 2003). There are three key components to emotional processing theory that interact to produce PTSD symptoms. Two of these components involve mental representations and one involves post-traumatic reactions.

Figure 2.4

A Fear Network Account of Emotional Processing: A Pathological Fear Network Following Rape



Note. From "Cognitive Approaches to Posttraumatic Stress Disorder: The Evolution of Multirepresentational Theorizing," by T. Dalgleish, 2004, *Psychological Bulletin, 130,* p. 237 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Foa and Rothbaum (1998). Reprinted with permission.

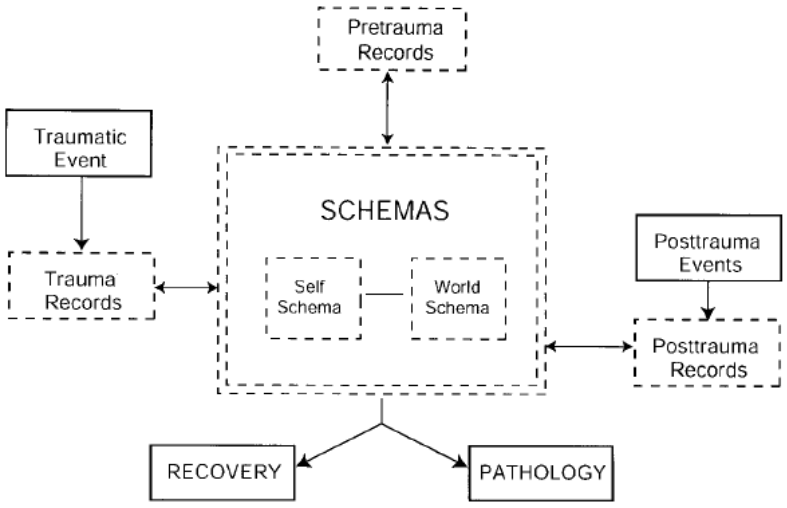
The first component involves memory records, which include pre-trauma memories, the trauma memory itself, and post-trauma memories (Dalgleish, 2004). Memory records are akin to "fear networks", however, they have several extensions. First, biased information processing during encoding is acknowledged as producing disorganised memory records (Foa & Riggs, 1993, as cited in Dalgleish, 2004). Second, it is acknowledged that numerous, erroneous, and vague associations between trauma and non-trauma stimuli are recorded within memory records, which accounts for the widespread perception of danger amongst traumatised individuals (Foa & Rothbaum, 1998). Finally, memory records include physiological and behavioural survival response elements (e.g., dissociation) that may have been unsuccessful in preventing the trauma, which have led the individual to develop a sense of incompetence (Foa & Rothbaum, 1998).

Like earlier schema-based models of PTSD (Horowitz, 1986; Janoff-Bulman, 1989), the second component of emotion processing theory suggests that traumatic events violate pre-existing positive schemas, which results in intrusion and avoidance symptoms (Dalgleish, 2004). However, while the shattered assumptions theory did not explain why people with a trauma history have increased vulnerability to PTSD (Dalgleish, 2004), emotional processing theory suggests that when people with a trauma history experience a new trauma, their negative schemas, which were shaped by past trauma, become activated, leading to distress and survival responses (Foa & Rothbaum, 1998).

The third component of emotional processing theory involves a variety of post-traumatic reactions to the self and others, and subsequent negative appraisals of such reactions (Dalgleish, 2004). Heightened emotional responses may lead to maladaptive appraisals such as “I am weak”, particularly if the person’s pre-existing self-schemas reflect incompetence. In turn, appraisals of post-traumatic responses may develop new, or strengthen existing, negative schemas about the world and the self (Rauch & Foa, 2006).

Figure 2.5

Model of Emotional Processing Theory: Emotional Processing of Trauma



Note. From “Cognitive Approaches to Posttraumatic Stress Disorder: The Evolution of Multirepresentational Theorizing,” by T. Dalgleish, 2004, *Psychological Bulletin, 130,* p. 245 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Foa and Rothbaum (1998). Reprinted with permission.

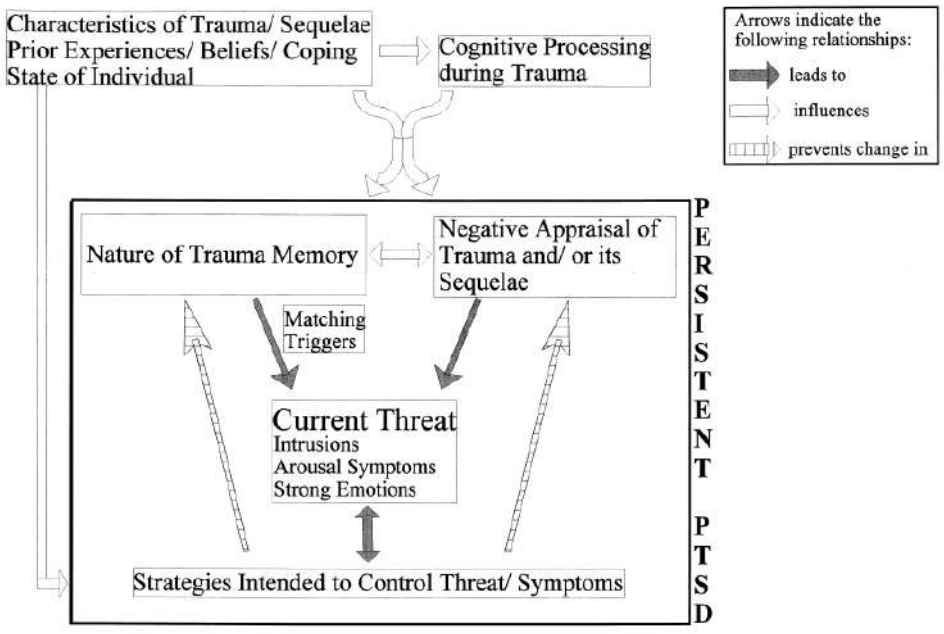
A Cognitive Model of Post-Traumatic Stress Disorder

Integrated models of PTSD amalgamate tenets from learning, schema-based, and information processing theories. In doing so, they address some of the limitations of earlier models (for a review, see Dalgleish, 2004) and provide a more comprehensive account of

PTSD. Ehlers and Clarks' (2000) cognitive model of post-traumatic stress disorder suggests that impaired cognitive processing during trauma, which may be attributed to dissociative reactions at the time of trauma (peri-traumatic dissociation), combined with pre-existing beliefs about trauma, its sequelae, and oneself, influence the development of PTSD symptoms. The authors suggest that the central characteristic of PTSD is a sense of current threat, which is maintained by two key cognitive processes. First, idiosyncratic negative appraisals about the meaning of a trauma and its sequelae perpetuate a sense of current threat. Individuals may overgeneralise the probability of the event reoccurring (e.g., nowhere/nobody is safe) and negatively appraise their behaviour in relation to the trauma (e.g., I deserved this), and these appraisals keep the threat "alive". Second, impaired memory encoding during trauma leads to the trauma memory being fragmented and poorly integrated into long-term memory, which makes it difficult for the individual to accurately position the memory in time and place, link the memory to preceding and proceeding information, and to other autobiographic memories. However, strong associative learning occurs and exposure to trauma-associated stimuli causes strong emotional reactions (see Figure 2.6).

Figure 2.6

A Cognitive Model of PTSD



Note. From "A Cognitive Model of Posttraumatic Stress Disorder," by A. Ehlers & D. M. Clark, 2000, *Behaviour Research and Therapy, 38,* p. 321 (https://doi.org/10.1016/S0005-7967(99)00123-0). Copyright 2000 by Elsevier. Reprinted with permission.

Schematic, Propositional, Analogical, and Associative Representational Systems Model (SPAARS)

The SPAARS model outlines four types of mental representations that operate concurrently to produce PTSD symptoms (Dalgleish, 2004; Power & Dalgleish, 2008; Power & Dalgleish, 1999). First, schematic representations (i.e., schemas) contain abstract and general knowledge about the self, the world, and others. Second, propositional representations comprise language-based representations of events and their associated meanings, and are similar to C-Reps in the dual-representation theory (Brewin et al., 1996). Third, like S-Reps (Brewin et al., 1996), analogue representations comprise non-verbal mental images, which can occur across all sensory modalities. Finally, associative representations, which are similar to Foa et al.'s (1986) fear network, link information between the other three levels of mental representation (see Figure 2.7).

Information from events are stored in each representational format and information processing is proposed to be hierarchical in nature; schematic processing is a higher level of processing and integrates information from lower levels (analogue and propositional) to construct a whole and coherent meaning of autobiographical events (Dalgleish, 2004). Dominant schematic representations are proposed to orchestrate the storage of new information, as well as the activation and/or inhibition of information within lower-level representations. Information that is congruent with schematic representations is easily assimilated into the representational system, while incongruent information is more difficult to assimilate and more likely to be inhibited.

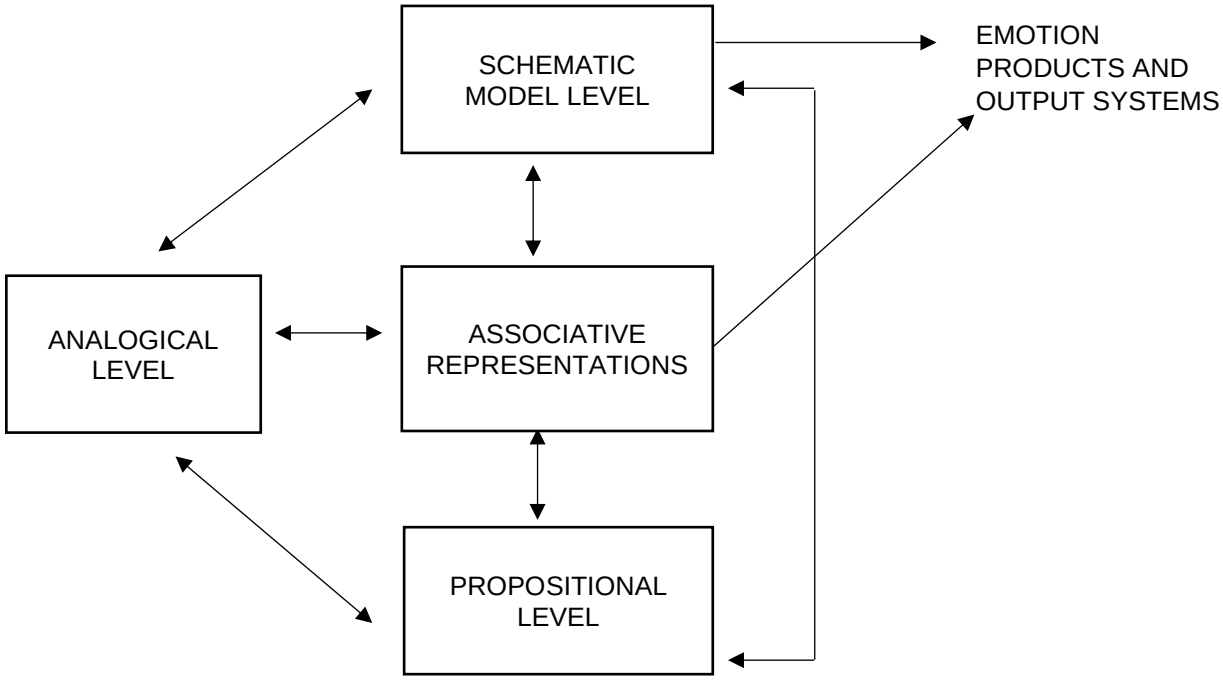
There are two routes of emotion generation within the SPAARS model (Dalgleish, 2004; Power & Dalgleish, 1999). The first route involves appraisals of an event and/or reactions to that event at a schematic representational level. The second route is automatic and involves associative representations. Here, information within various representational formats become activated as a result of past activations and associations between representational formats. Propositional representations generate emotion via associative representations, which link propositional representations to schematic representations. Once generated, emotions (e.g. fear) trigger a "response mode" for that specific emotion, whereby various corresponding elements within the larger representational system that is associated with that emotion (e.g., fear) become activated.

According to the SPAARS model, trauma causes intense appraisal-driven emotion activation (Dalgleish, 2004). Trauma-related information that is incongruent with schematic representations is repeatedly appraised while the individual attempts to assimilate the trauma information into their schematic representations. Continued appraisal leads to

chronic low-level activation of the fear mode (hyperarousal) and to trauma-related information remaining active in one's mind (intrusion symptoms). Continued fear mode activation and the associated re-configuration of the representational system leads to cognitive processing biases, whereby re-experiencing symptoms are triggered by selective attention and cognitive processing biases. Until the traumatic event is successfully assimilated, the distinct representational components of that event remain highly cohesive. As such, stimuli that resemble part of the trauma experience can quickly activate the entire trauma memory, leading to flashbacks.

Figure 2.7

The SPAARS Model



Note. From "Cognitive Approaches to Posttraumatic Stress Disorder: The Evolution of Multirepresentational Theorizing," by T. Dalgleish, 2004, *Psychological Bulletin, 130,* p. 248 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Power and Dalgleish (1997). Reprinted with permission.

Overview of Key Theoretical Models of Voice Hearing and other Positive Symptoms

Historically, neurobiological theories of positive symptoms have dominated the voice hearing literature (Tarrier & Taylor, 2014). However, alternative models have emerged due to accumulating evidence that social and cognitive factors can precipitate and maintain psychotic episodes (Bucci & Tarrier, 2010; Tarrier & Taylor, 2014).

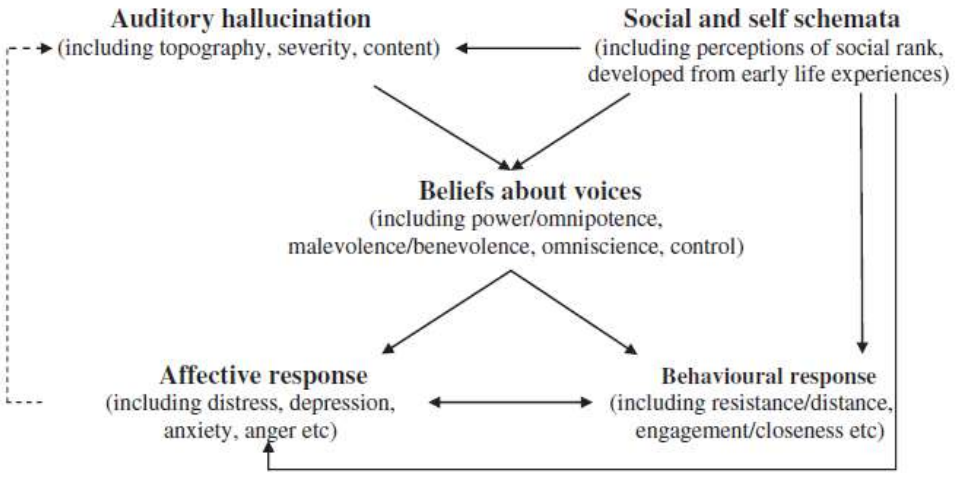
A Cognitive Approach to Voices

A key assumption of the cognitive approach to voices model is that voice hearing itself is not pathological (Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994).

Instead, negative evaluative beliefs about one's voices can produce distress, and one's affective and behavioural response to voices (e.g., unhealthy engagement with voices, compliance, unhealthy avoidance) can shape future appraisals and, therefore, future voice hearing experiences. Paulik (2012) extended this model to include the role of social schema in governing one's relationship with their voices (see Figure 2.8). A person's early interpersonal experiences (e.g., childhood trauma) shapes their social and self-schemas and, therefore, their typical pattern of interpersonal responding more generally. If we conceptualise voice hearing as a form of interpersonal exchange, these schemas may shape one's beliefs about their voices, as well as their behavioural responses to voices.

Figure 2.8

A Cognitive Model of Auditory Hallucinations



Note. From "The Role of Social Schema in the Experience of Auditory Hallucinations: A Systematic Review and a Proposal for the Inclusion of Social Schema in a Cognitive Behavioural Model of Voice Hearing," by G. Paulik, 2012, *Clinical Psychology and Psychotherapy, 19,* p. 469 (https://doi.org/10.1002/cpp.768). Copyright 2011 by John Wiley & Sons. Reprinted with permission.

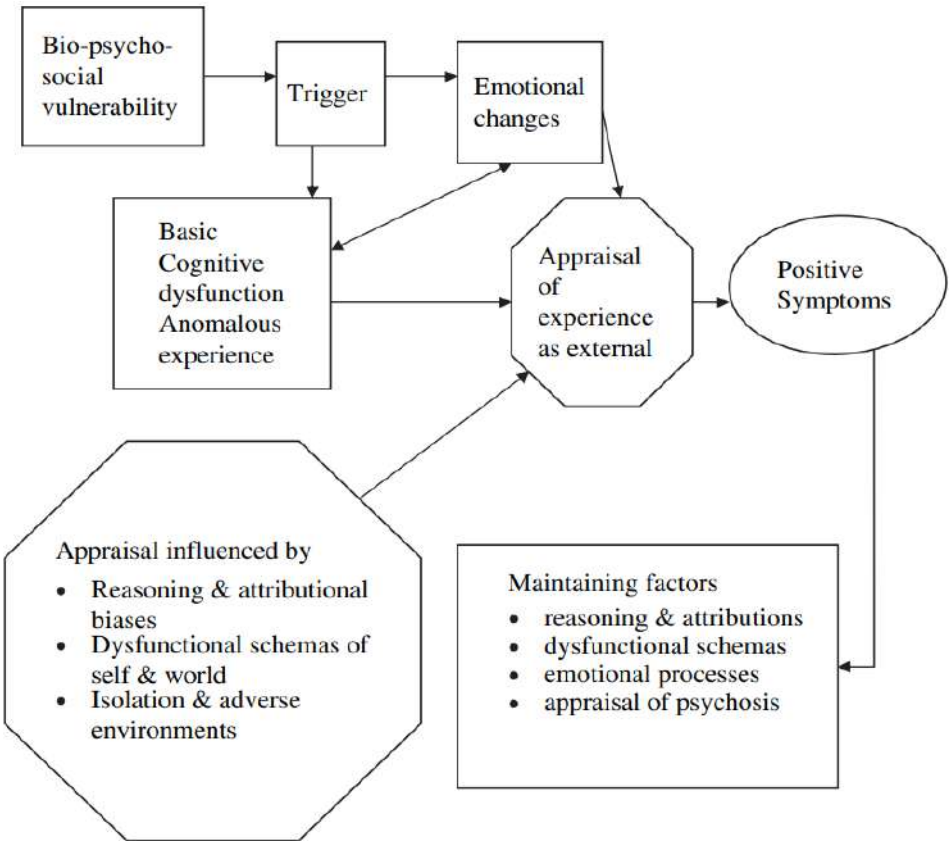
A Cognitive Model of the Positive Symptoms of Psychosis

Garety et al. (2001) developed a cognitive model of psychosis (Figure 2.9) and proposed that unusual perceptual experiences themselves are not necessarily pathological, however, it is the misattribution of such symptoms as being externally generated that causes distressing positive symptoms (Bucci & Tarrier, 2010; Kuipers et al., 2006). Garety et al. (2001) outline four key cognitive factors that increase the likelihood that misattributions will maintain positive symptoms. First, reasoning and attribution processes may maintain external attributions. These include an external attribution style (the tendency to attribute the cause of experiences to external factors), as well as

information gathering biases such as “jumping to conclusions” (makes judgements without all the facts), poor theory of mind (lack of ability to attribute mental states to oneself), belief inflexibility (a lack of willingness to consider alterative explanations), and belief confirmation bias (the tendency to interpret new information as evidence for existing erroneous beliefs). Second, dysfunctional schemas about the world (e.g., the world is dangerous), others (e.g., others are hostile) and self (e.g., I am weak) can increase the likelihood of negative content in positive symptoms, which in turn strengthen dysfunctional schemas. Third, negative emotions increase the likelihood that people will attribute their positive symptoms to external, threatening sources. Finally, people with low insight into their positive symptoms may be less likely to challenge unhelpful appraisals of their positive symptoms.

Figure 2.9

A Cognitive Model of Positive Symptoms of Psychosis



Note. From “Cognitive, Emotional, and Social Processes in Psychosis: Refining Cognitive Behavioural Therapy for Persistent Positive Symptoms,” by E. Kuipers et al., 2006, *Schizophrenia Bulletin, 32,* p. S25 (https://doi.org/10.1093/schbul/sbl014). Copyright 2006 by Oxford University Press. Reprinted with permission.

A Meta-cognitive Model of Psychosis

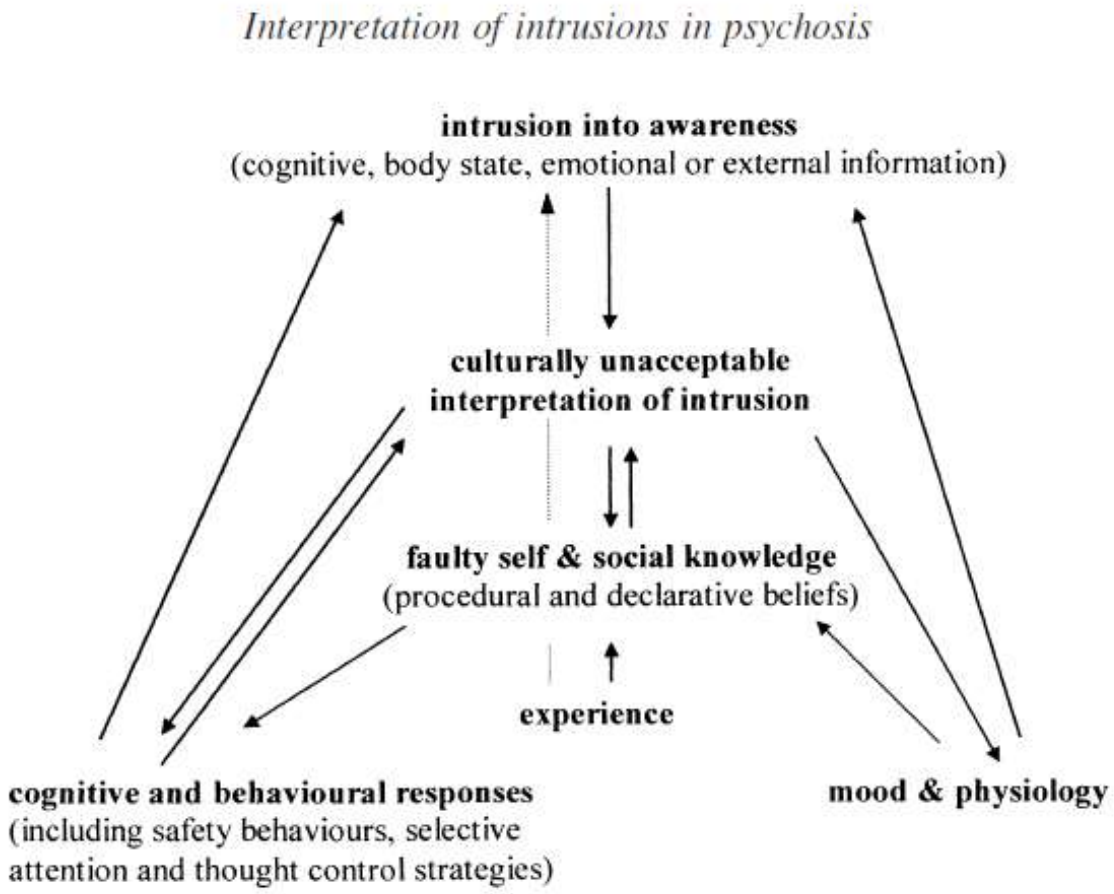
According to Morrison's (2001) meta-cognitive model (Figure 2.10), positive symptoms start as relatively normal intrusions and fall into three categories: external stimulus information, cognitive state information, and body state information (Wells & Matthews, 1994). Morrison (2001) suggests that positive symptoms only become problematic if they are misinterpreted to be threatening and to have originated from an external source, which generates a cycle of negative affect, intrusive cognitions, and distressing positive symptoms.

Morrison (2001) outlines three broad factors that maintain this cycle of positive symptoms: faulty social- and self-knowledge, maladaptive cognitive and behavioural responses to voices, and mood and physiology. Theory of mind deficits may limit one's ability to recognise that others' mental states are distinct from their own. External attribution bias may contribute to external attributions about negative thoughts, whilst impaired ability to recognise one's own mental states and intention to act may contribute to the perception that intrusive cognitions are alien. Selective attention to threatening information (i.e., hypervigilance) and unhelpful reasoning processes, such as "jumping to conclusions" and confirmation bias, prevent consideration of information that disconfirms maladaptive beliefs. Unhelpful meta-cognitive beliefs about positive symptoms (e.g., the voice is warning me of unseen threats) and negative meta-cognitive beliefs (e.g., the voice is dangerous) may increase distress and the likelihood that the individual may engage in unhelpful cognitive and behavioural coping strategies.

To reduce the distress associated with voices, individuals may develop coping behaviours that perpetuate positive symptoms by preventing the individual from disconfirming their (mis)interpretations about intrusions (Morrison, 2001). Hypervigilance maintains a sense that intrusions are dangerous, whilst thought control attempts can increase intrusions. Additionally, safety behaviours (e.g., yelling at the voice to prevent oneself from doing what the voice says) can prevent disconfirmation of negative beliefs (e.g., my voice is dangerous). Finally, these cognitions and maladaptive coping strategies can perpetuate negative affect, which in turn, impairs one's ability to engage in healthy reasoning processes and increases the likelihood of faulty information processing. Furthermore, negative affect may be interpreted as evidence of threat, which increases the likelihood of perceived threats manifesting in the form of intrusive cognitions.

Figure 2.10

A Meta-cognitive Model of Psychosis



Note. From "The Interpretation of Intrusions in Psychosis: An Integrative Cognitive Approach to Hallucinations and Delusions," by A. P. Morrison, 2001, *Behavioural and Cognitive Psychotherapy*, *29*, p. 261 (https://doi.org/10.1017/S1352465801003010). Copyright 2001 by British Association for Behavioural and Cognitive Psychotherapies. Reprinted with permission.

A Coping-Recovery Model of Psychotic Symptoms

Tarrier and colleagues (2006; 2014) developed the coping-recovery model (see Figure 2.11) and suggest that positive symptoms are the product of dynamic interactions between various internal and external factors. Internal factors can be biological or psychological and be inherited or acquired. Internal factors include cognitive deficits (e.g., cognitive inflexibility), maladaptive attitudes, information processing biases (e.g., source monitoring and reasoning biases), as well as heightened arousal and emotion regulation deficits. Once the activation of psychotic symptoms has occurred, the individual makes meaning of such symptoms. These appraisals can be primary, which involve immediate feelings of threat, or secondary, which involve mood disturbance, post-traumatic stress, or anxiety. Primary and secondary appraisals maintain symptoms in two ways. First, should the hallucinations be appraised as true, the individual may develop maladaptive beliefs

about their symptoms (e.g., my voices are dangerous) and act upon those beliefs in a manner that causes them to confirm (or fail to disconfirm) this belief. This experience-belief-action-confirmation cycle perpetuates symptoms. Second, appraisals produce short-term cognitive, emotional, and behavioural responses that perpetuate symptoms via several pathways. These responses further increase arousal, are fed back through the same faulty cognitive and affective processes that triggered the onset of initial symptoms and exacerbate external stressors. For example, a person may believe voices are warning them that others want to harm them, which creates a sense of threat and psychological distress. The individual may experience heightened arousal, which they cannot regulate effectively. Pre-existing maladaptive attitudes and cognitive deficits may lead to continued faulty information processing and emotion regulation dysfunction. The individual may cope with distress by behaving aggressively towards others, which may cause social conflict that is interpreted as confirmation of persecution. Furthermore, these responses can lead to longer-term negative outcomes, such as social withdrawal, social isolation, disability, and stigma, which further exacerbate internal and external stressors.

Overview of Trauma-Informed Models of Voice Hearing

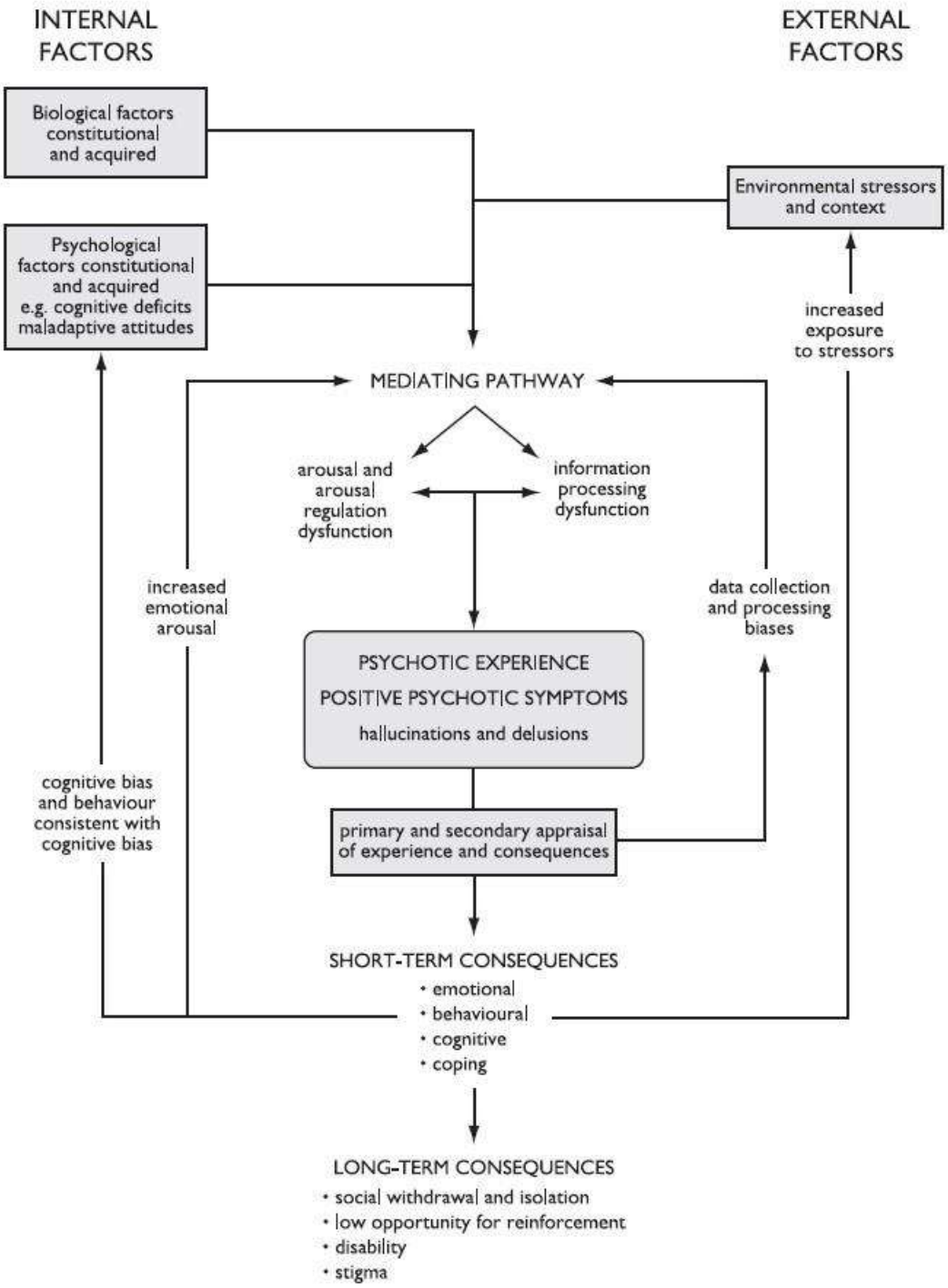
Cognitive Attachment Model of Voices

The cognitive attachment model (Figure 2.12) is one of only two known theoretical models of voice hearing that provide a more detailed explanation of the role that trauma plays in the development of voice hearing experience and the relationship between trauma and the content of voices (Berry & Bucci, 2016; Berry et al., 2017). The model comprises both a vulnerability model and a distress/maintenance model (Berry et al., 2017). This model identifies appraisals as a key maintaining factor but incorporates concepts from early attachment theory and dissociation (Berry & Bucci, 2016; Berry et al., 2017).

Insecure attachment style is a key process in both the vulnerability and maintenance components of the model (Berry & Bucci, 2016; Berry et al., 2017). Attachment refers to the emotional bond an individual has with significant others, and an individual's attachment style is heavily influenced by their early relationships with caregivers as these interactions shape one's internal working models (mental representations) of the self, others, and relationships (Bowlby, 1982). Internal working models guide attention, affect memory and interpretations of events, shape expectations about future interactions, and influence how a person regulates negative affect (Mikulincer & Shaver, 2005). Consequently, problematic attachment can lead to interpersonal and psychological difficulties. Insecure attachment is associated with unhealthy early

Figure 2.11

A Coping Recovery Model of Psychotic Symptoms



Note. From A Cognitive-Behavioural Case Formulation Approach to the Treatment of Schizophrenia, in *Case Formulation in Cognitive Behaviour Therapy* (p. 176), by N. Tarrier, 2006, Routledge. Copyright 2006 by Taylor & Francis. Reprinted with permission.

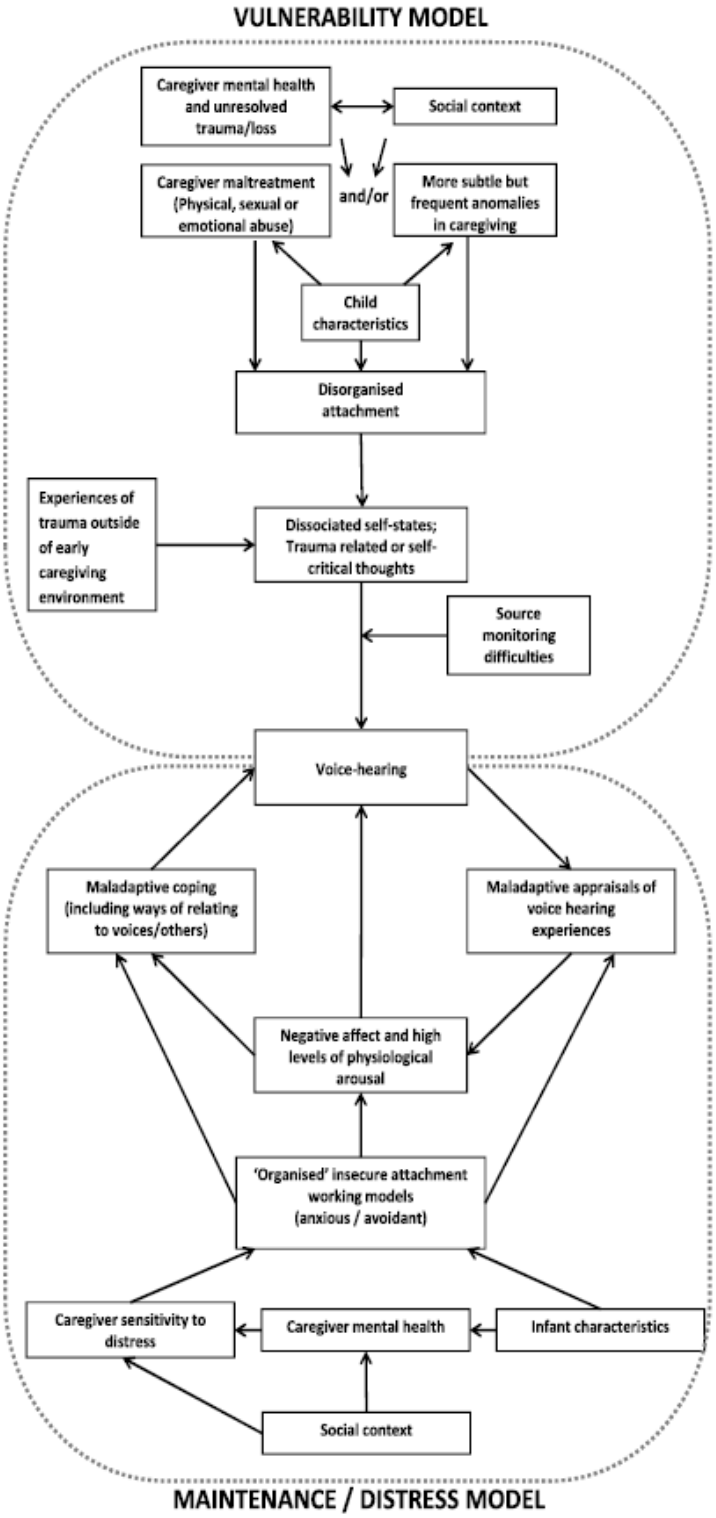
relationships (e.g., abuse or neglect), characterised by negative beliefs about the self and/or others, and is associated with poor social functioning and emotion regulation (Shaver & Mukulincer, 2012).

Other key concepts identified in this model are source monitoring and dissociation (Berry & Bucci, 2016; Berry et al., 2017). Source monitoring is a cognitive process that allows people to discriminate between internally and externally generated perceptions, and identify the source of such perceptions (Berry et al., 2017). Dissociation refers to altered states of consciousness and perception characterised by a separation from reality (i.e., detachment) and a disconnection between current experiences and mental processes (i.e., compartmentalisation; Berry et al., 2017). The model suggests that an individual who has developed disorganised attachment as the result of abuse or other caregiving inconsistencies may dissociate in response to subsequent trauma-related memories or trauma-related and/or self-critical cognitions. That is, in the context of past trauma, voices may be dissociated trauma-related intrusive memories or dissociated components of the self that are mistakenly interpreted as external events. Source monitoring deficits increase the risk that these dissociated cognitions will be interpreted as originating from an external source and, therefore, trauma-related and self-critical thoughts will be perceived as externally generated voices.

Insecure attachment styles may drive maladaptive ways of coping with voice hearing experiences and interpersonal stress, which perpetuate voice hearing experiences. People with anxious attachment (desire for closeness) may be more inclined to seek out and engage with their voices, whilst people with avoidant attachment (desire for emotional distance and mistrust in others) may believe their voices are malevolent and attempt, but ultimately fail, to suppress them (Goldstone et al., 2012; Hayward et al., 2014). People with disorganised attachment (exhibiting both anxious and avoidant attachment) may oscillate between engaging and suppressing their voices. Furthermore, maladaptive appraisals of voice hearing experiences, driven by insecure attachment beliefs, may exacerbate negative affect and physiological arousal, which increases the likelihood of future voice hearing.

Figure 2.12

The Cognitive Attachment Voice-Hearing Model



Note. From "Cognitive Attachment Model of Voices: Evidence Base and Future Implications", by K. Berry, F. Varese, & S. Bucci, 2017, *Frontiers in Psychiatry, 8,* p. 4 (https://doi.org/10.3389/fpsyt.2017.00111). Copyright 2017 by The Authors. Reprinted with permission.

A Model of Posttraumatic Stress in Psychosis

Hardy (2017) developed a model of posttraumatic stress in psychosis (Figure 2.13) and suggests that childhood trauma produces neurodevelopmental changes that affect stress sensitivity and increase the risk that an individual will adopt unhelpful patterns of emotion regulation. Traumatised individuals may fluctuate between sympathetic (e.g., hypervigilance and avoidance) and parasympathetic (e.g., dissociation) nervous system activation to regulate distressing emotions. As these patterns of emotion regulation shape an individual's typical manner of relating to others, they have been likened to attachment styles (Hesse, 2008).

Additionally, Hardy (2017) refers to three aspects of autobiographical memory that contribute psychotic experiences; episodic memory (i.e., contextual information), perceptual memory (i.e., egocentric, sensory-perceptual information), and personal semantic memory (i.e., beliefs that are informed by a memory). Hardy (2017) outlines two forms of cognitive intrusions in psychosis, anomalous intrusions and trauma memory intrusions, which produce three different voice hearing experiences (see McCarthy-Jones, Thomas, et al., 2014; McCarthy-Jones, Trauer, et al., 2014); hypervigilance (i.e., no trauma-voice association), inner speech (i.e., indirect), and dissociative autobiographical (i.e., direct) voice hearing. An important and unique advantage of Hardy's (2017) model is the capacity to explain voices that (a) have no obvious association to past traumas, (b) are indirectly related to past traumas, and (c) are directly related to past traumas.

Voices with No Obvious Association with Past Trauma Voice Associations

Hypervigilance may be experienced by trauma-affected individuals and involves a heightened expectation of and sensitivity to threat, which can cause an individual to falsely perceive threats (e.g., distressing voices) from non-threatening stimuli (McCarthy-Jones, Thomas, et al., 2014). Hardy (2017) suggests that hypervigilance voice hearing may be the result of sympathetic nervous system sensitisation and habitual dissociation. Sensitisation reduces the threshold for threat detection, which causes heightened perception of danger from non-threatening external (e.g., distant sounds) or internal (e.g., somatic pain) stimuli and leads to anomalous intrusions (e.g., voices). Habitual dissociative detachment as an emotion regulation strategy may result in contextually disintegrated sensory-perceptual information intruding into consciousness. These types of intrusions may explain voice content that has no clear link to past trauma.

Voices with Indirect Associations with Past Trauma

Another driver of anomalous intrusions involves mental imagery (across all sensory modalities) related to current and future goals, whereby mental imagery is perceptually

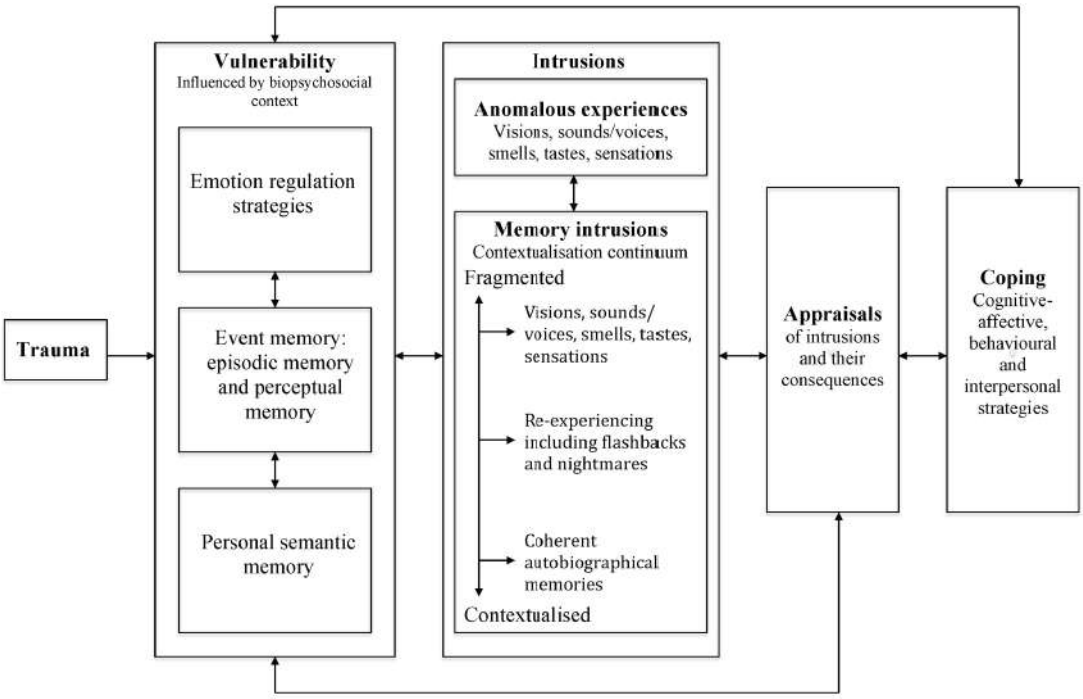
and affectively consistent with one's personal semantic and perceptual memory representations (Hardy, 2017). That is, mental imagery generated by a traumatised individual may comprise trauma-related perceptual information (e.g., racing heart) and appraisals (e.g., others are cruel, I am weak), although the individual may not be aware of the link between their mental imagery and past trauma. Thus, distressing trauma-informed mental images, coupled with dissociative attachment, may lead to *inner speech voice hearing* (McCarthy-Jones, Thomas, et al., 2014; McCarthy-Jones, Trauer, et al., 2014), whereby voices are thematically related to past trauma.

Voices with Direct Associations with Past Trauma

Hardy (2017) suggests that in the context of trauma, perceptual memories are encoded with greater detail, whilst episodic memories are encoded with limited contextual information, and the nature of trauma memory intrusions varies depending on the degree in which memories are contextually integrated. At the less severe end of the continuum, *re-experiencing memory intrusions* (i.e., PTSD flashbacks) occur in the context of highly detailed perceptual memory and inhibited episodic memory, as the individual has some awareness of the link between intrusions and past trauma memories. At the more severe

Figure 2.13

A Model of Posttraumatic Stress in Psychosis



Note. From "Pathways from Trauma to Psychotic Experiences: A Theoretically Informed Model of Posttraumatic Stress in Psychosis" by A. Hardy, 2017, *Frontiers in Psychology*, *8,* p. 5 (https://doi.org/10.3389/fpsyg.2017.00697). Copyright 2017 by The Author. Reprinted with permission.

end of the continuum are fragmented memory intrusions, which involve retrieval of perceptual memories in the absence of any episodic information. People who experience these intrusions have less awareness of the link to past trauma and report hearing voices that recount past experiences, rather than intrusive memories.

Hardy's (2017) model outlines other maintaining factors. Appraisals of intrusions are likely to be consistent with personal semantic memory and can maintain voice hearing frequency and distress. For example, appraisals of the intrusion itself (e.g., voice is evil) or the consequences of intrusion (I am too weak to cope) can generate distress. Coupled with emotion regulation deficits, this distress can trigger maladaptive coping strategies, such as stress sensitivity (hyperarousal), negative reactivity, threat-focussed processing, sleep disruption, rumination, avoidance, numbing, and dissociation, which perpetuate problematic autobiographical memory representations that increase intrusions.

Comparison of Models

The reviewed models comprise vulnerability and mechanistic factors that are common across models of PTSD and voice hearing, and unique to each set of symptoms. Shared and unique vulnerability factors and mechanisms are summarised below.

Vulnerability Factors

The biopsychosocial vulnerability factors related to PTSD and voices are largely common across both sets of symptoms. Genetic and biological factors may contribute to the development of psychological vulnerabilities that are theorised to be involved in both PTSD and voice hearing. Temperamental factors may increase hypervigilance, arousal, and negative affect (Ehlers & Clark, 2000; Hardy et al., 2016; Tarrier, 2006), as well as cognitive dysfunction and inflexibility (e.g., information processing, attribution, and reasoning biases, and source- and self-monitoring difficulties; Brewin & Holmes, 2003; Ehlers & Clark, 2000; Garety et al., 2001; Kuipers et al., 2006; Morrison, 2001; Tarrier, 2006). Furthermore, vulnerability to PTSD may be increased due to excessively low or high inhibitory control over emotions and cognitions, which may increase the risk that an individual may struggle to integrate traumatic information into their schematic network (Horowitz, 2011).

Negative caregiving experiences and life events may increase vulnerability to psychological factors that are theorised to be involved in both sets of symptoms. Caregiving inconsistencies, abuse, and neglect contribute to the development of insecure attachment styles (Berry et al., 2017). These caregiving experiences, as well as social disadvantage and poor social support (Berry et al., 2017; Dalgleish, 2004; Ehlers & Clark, 2000; Kuipers et al., 2006), may also increase the risk of maltreatment and the

development of negative schemas (Berry et al., 2017; Brewin & Holmes, 2003; Ehlers & Clark, 2000; Horowitz, 2011; Janoff-Bulman, 1989; Kuipers et al., 2006; Paulik, 2012), heightened stress sensitivity and negative affectivity (Benight & Bandura, 2004; Hardy, 2017; Kuipers et al., 2006), the use of maladaptive emotion regulation strategies (Berry et al., 2017; Hardy et al., 2016), poor coping skills (Benight & Bandura, 2004; Hardy, 2017; Horowitz, 2011), and a tendency to negatively appraise information (Dalgleish, 2004; Ehlers & Clark, 2000; Horowitz, 2011; Kuipers et al., 2006).

Mechanisms of Maintenance and Change

This review identified six mechanisms that are unique to models of PTSD, nine that are unique to models of voice hearing (and other positive symptoms), and six that are common across both sets of symptoms. These mechanisms are summarised below in Table 2.1. Only one model explained different types of trauma-related voice hearing (Hardy, 2017), which suggested that mental imagery and dissociative processes are specific to indirect trauma-related voice hearing, whilst memory intrusions are specific to direct trauma-related voice hearing.

The Contributions and Limitations of Theoretical Models

Past reviews have detailed the various theoretical strengths and limitations of the PTSD theories reviewed in this paper (Brewin & Homes, 2003; Dalgleish, 2004), but this is the first review of theories of voices (and other positive symptoms). Integrative models of PTSD include mechanisms outlined in earlier stand-alone models of PTSD, and therefore provide more comprehensive accounts with augmented explanatory power (Brewin & Holmes, 2003; Dalgleish, 2004; Ehlers & Clarks, 2000). Except for the Meta-cognitive Model of Psychosis (Morrison, 2001), there is less mechanistic overlap between theories of voice hearing compared to models of PTSD. Nevertheless, key theoretical commonalities exist between models and overall, unusual perceptual experiences are theorised to be normal and only become pathological when maladaptive appraisals of such experiences generate distress (Garety et al., 2001; Morrison, 2001; Paulik, 2012; Tarrier et al., 2006; 2014).

As distressing voices are commonly experienced outside the psychotic spectrum, researchers have acknowledged the need to conceptualise psychotic-like symptoms, such as voice hearing, as distinct from psychotic disorders and other psychotic-like symptoms (Carpenter, 2016; Murray, 2017). However, of the six models of positive symptoms that were reviewed, only three are specific to voices (Berry & Bucci, 2016; 2017; Paulik, 2012; Hardy, 2017), which suggests that a lack of symptom specificity is a key limitation of

Table 2.1

A Summary of Shared and Unique Mechanisms

	Models of PTSD										Models of Positive Symptoms				Traua-informed Models of Voices	
	Associative Learning Theory	Non-Associative Learning Theory	Model of Stress Response	Shattered Assumptions Theory	Social Cognitive Theory	A Dual Representation Theory of PTSD	Fear Network Account of Emotional Processing	A Cognitive Model of PTSD	Emotional Processing Theory	The SPAARS Model	A Cognitive Approach to Voices	A Cognitive Model of the Positive Symptoms of Psychosis	A Meta-Cognitive Model of Psychosis	A Coping-Recovery Model of Psychosis	The Cognitive Attachment Model of Psychosis	A Model of Posttraumatic Stress in Psychosis
Mechanisms Unique to Models of PTSD																
Conditioning	✓															
Extinction failure	✓	✓														
Habituation failure		✓							✓							
Fear inhibition failure	✓															
Over-generalisation / excessive associative learning	✓						✓	✓	✓	✓						
Failure to assimilate / accommodate trauma into schematic network			✓	✓						✓						

Mechanisms Unique to Models of Positive Symptoms																
Faulty reasoning, information processing, source monitoring, intention to act identification											✓	✓	✓		✓	
Negative affect										✓	✓	✓	✓		✓	✓
Meta-cognitive beliefs											✓	✓	✓		✓	
Social knowledge deficits / theory of mind												✓				✓
Thought control												✓				
Maladaptive coping (e.g., responding to voices)										✓		✓				✓
Emotion dysregulation													✓		✓	✓
Insecure attachment															✓	✓
Hypervigilance / attention biases												✓				✓
Mechanisms Common to Models of PTSD and Positive Symptoms																
Dissociation								✓							✓	✓
Stress sensitisation	✓															✓
Appraisals of trauma / voices		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Negative schemas (self, others, world)							✓	✓		✓			✓		✓	✓
Low self-efficacy / mastery / coping beliefs / sense of competence				✓				✓			✓					
Memory storage, consolidation, and retrieval deficits					✓		✓	✓			✓					✓

models of positive symptoms. This theoretical limitation may explain, in part, the inconsistent evidence for the efficacy of psychological interventions that are based on models of broader positive symptoms, such as CBT for psychosis (CBTp), in treating psychotic-like symptoms (Johns et al., 2019). Studies typically use a composite CBTp approach that targets multiple theorised mechanisms within diagnostically heterogeneous samples, which may obscure the relative role of each mechanism in producing change in distinct symptoms (Johns et al., 2019). Furthermore, individually tailored CBTp that targets the mechanisms theorised to underlie specific symptoms (e.g., challenges power beliefs to treat command voices) are associated with larger effects (d = .44 to d = .49; e.g., Lincoln & Peters, 2019; van der Gaag et al., 2014) than composite CBTp interventions for positive symptoms (d = .33 to d = .40*;* e.g., Jauhar et al., 2014; Pfammatter et al., 2006). Furthermore, preliminary evidence shows that individually tailored CBTp administered to transdiagnostic samples of voices hearers in naturalistic settings show even larger effects in both voice frequency (d = 1.13) and voice-related distress (d = 1.35; Paulik et al., 2019).

Stand-alone models of PTSD and positive symptoms are insufficient in explaining the comorbidity and symptomatic overlap between PTSD and voice hearing (de Bont et al., 2015; Morrison et al., 2003; Hardy et al., 2016). Of the three models that are specific to voices, only two models explain voices with a trauma-informed approach. A key contribution of Berry and Bucci's (2016) model is that it explains how "subtle" traumatic and/or inconsistent childhood experiences, which may not meet diagnostic criteria for PTSD (Criterion A, APA, 2013), may lead to trauma-related voice hearing via insecure attachment and dissociative coping. However, this model does not explain pathways to different types of trauma-related voice hearing.

Hardy's (2017) model is the only model that outlines specific mechanistic processes associated with each type of voice hearing. Another key strength of this model is its comprehensive incorporation of mechanisms from models of both sets of symptoms. However, the model suggests that memory interventions should be prioritised in the treatment of trauma-related voice hearing with an additional focus on addressing maladaptive coping and beliefs. However, the model does not clearly account for why existing PTSD treatments that aim to re-contextualise trauma memories and/or modify trauma-beliefs have shown limited effectiveness in reducing distressing voices compared to PTSD symptoms (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017). It may be that other mechanistic processes (e.g., information processing errors) interact with those emphasised by Hardy (2017) to explain how voice hearing differs from other trauma intrusions. As such, Hardy's (2017) model is a valuable clinical tool for complex case

formulation, but integration of additional processes is required to generate novel research hypotheses beyond those that could made from stand-alone models of PTSD and/or positive symptoms.

Conclusion and Future Directions

This review revealed that there is considerable symptomatic and mechanistic overlap between PTSD and positive symptoms. These findings suggest that careful assessment of voices in clients with post-traumatic stress, and of post-traumatic stress in voice hearers, may reveal clinically relevant information that can aid accurate case conceptualisation and treatment planning. Furthermore, individualised psychological treatments that target the common mechanisms identified in this review, such as appraisals, negative schemas, and disrupted memory processes, may be most broadly effective for symptoms experienced by trauma-affected voice hearers.

This review identified two trauma-informed models of voice hearing that extend on stand-alone models of PTSD and positive symptoms, which offer unique perspectives on trauma-related mechanisms (Berry & Bucci, 2016), explanations for variations in symptom expression (direct versus indirect voices), and a comprehensive consideration of psychological mechanisms gleaned from theories of both PTSD and positive symptoms (Hardy, 2017). However, trauma-informed models offer limited scope for novel hypotheses beyond those that can be made from stand-alone models. Future research is needed to test the relationship between theorised mechanisms identified in these models within samples of trauma-affected voice hearers with direct and indirect (or both) trauma-related voices. Such research should use transdiagnostic samples and psychometric measures of voice hearing (rather than positive symptoms more generally) to investigate voices as a distinct symptom, separate to psychotic-spectrum disorders and other psychotic-like symptoms.

Perhaps most importantly, future research should first extend on trauma-informed models of voice hearing to further refine and integrate the common and unique mechanisms identified in this review by elaborating the theorised *interactions* and *pathways* between such mechanisms, for both direct and indirect voices. Whilst such efforts may increase theoretical complexity of this phenomenon, added specificity about the directionality of relationships will support the generation of unique hypotheses about mechanistic relationships across different types of voices, thereby aiding development of a robust, theory-informed research agenda from which enhanced interventions could be developed.

Chapter 3 (Study 2): An Integrative Model of Trauma-Related Voices

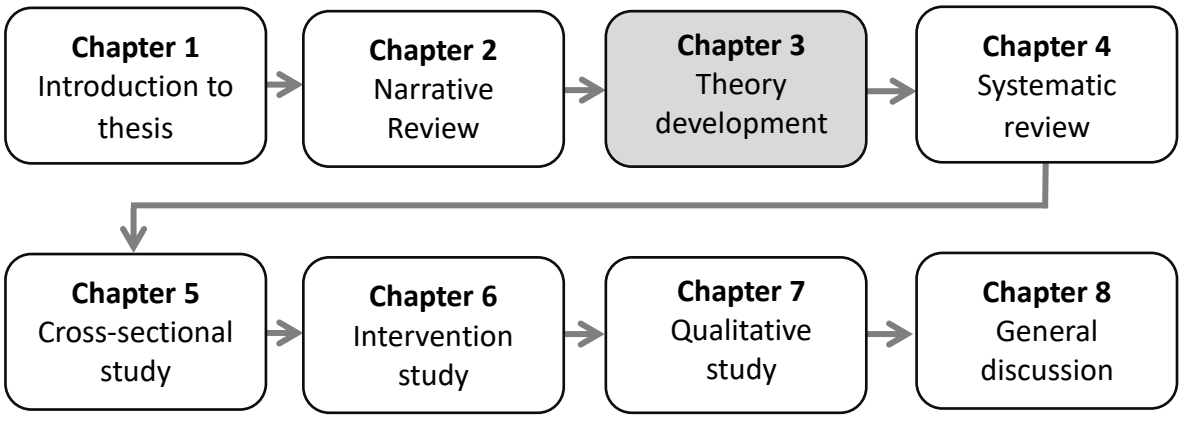
Introduction to Chapter 3

Chapter two identified 21 potential mechanisms of trauma-related voices and that no existing model includes all these mechanisms. Although there was theoretical overlap across models of PTSD and positive symptoms, existing models lack the theoretical and symptomatic specificity to explain the similarities and differences between trauma-related voices, non-trauma-related voices, and PTSD symptoms. Chapter two proposed that to generate novel hypotheses about trauma-related voices there is a need to understand the interactions between different mechanisms and how they relate to different types of voices.

The results of chapter two provided the rationale for the current model-development chapter, which presents the trauma-related voices (TRV) model. The TRV model integrates all 21 shared and unique mechanisms from chapter two, explains the processes, interactions, and feedback loops between these mechanisms, identifies which mechanisms may be specific to different types of voices, and outlines multiple pathways to different types of trauma-related voices. Thus, the TRV model generates novel hypotheses that can guide future research into the mechanisms of trauma-related voices. Chapter three presents a comprehensive future research agenda, which is based on the TRV model and informed the design of the remaining studies in this thesis. Chapter three is under review for publication in a peer-reviewed journal. Figure 3.1 identifies the location of this chapter within the overall structure of this thesis.

Figure 3.1

Flow Diagram of Thesis Structure: Chapter Three



Citation for Chapter 3

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). *The trauma-related voices model: An integration of auditory verbal hallucinations and posttraumatic stress* [Manuscript submitted for publication]. School of Population Health, Curtin University.

Introduction

Voice hearing (auditory verbal hallucinations) is an unusual perceptual experience whereby a person hears a voice(s) when the source of that voice is not directly present, and does not perceive the voice to be self-generated (Upthegrove et al., 2016). Whilst voice hearing experiences are diverse, many voice hearers suffer significant psychological distress and psychosocial impairment (Alonso et al., 2018; Woods et al., 2015). Voice hearing is typically associated with psychotic spectrum disorders but is also associated with a range of other mental illnesses and neurological conditions (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019). Voice hearing is also experienced by psychologically healthy individuals (Baumeister et al., 2017); approximately 10 – 28% of the general population report hearing a voice at some point in their lives (de Leede-Smith & Barkus, 2013; Sommer et al., 2010) and 20% of voice hearers do not meet criteria for psychological disorder (Johns et al., 2002). As such, psychotic-like symptoms, such as voice hearing, need to be studied as distinct symptoms that are separate from other psychotic-like symptoms and psychotic diagnoses (i.e., the psychotic spectrum; Carpenter, 2016; Murray, 2017).

Trauma and Voice Hearing

Preliminary evidence suggests that, at least for some people, trauma has a causal role in voice hearing (Hardy et al., 2019; Varese et al., 2012). People with psychotic disorders are four to six times more likely to have experienced victimisation trauma (abuse and/or neglect) compared to the general population (de Vries et al., 2019; Matheson et al., 2013) and approximately 70 - 75% of voice hearers report a history of trauma (de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016), with childhood sexual abuse and bullying being most strongly linked to hallucinations (including voices; Bailey et al., 2018; Hardy et al., 2005). Compared to 3.9 – 5.6% prevalence rates within the general population, 16.0 – 21.5% of voice hearers meet diagnostic criteria for PTSD (de Bont et al., 2015; Hardy et al., 2016) and many more experience clinically significant PTSD symptoms that do not meet full diagnostic criteria (Hardy et al., 2019).

Trauma may shape the phenomenological characteristics of voices, whereby the content of voices is linked to past trauma (i.e., *trauma-related voice hearing*). An estimated 57.5% of voice hearers who report past trauma experience *indirect* trauma-related voices, whereby the content of voices is thematically similar to past trauma, and 12.5% report a combination of indirect and *direct* trauma-related voices, whereby the latter involves voices that repeat phrases spoken by the perpetrators of trauma (Hardy et al., 2005). Although 42.5% perceive no apparent link between their trauma and voices (Hardy et al., 2005),

people may become aware of associations between their voices and trauma as they gain a more complete understanding of their symptoms during therapy.

Current Models of Trauma-Related Voice Hearing

Most models of voice-hearing are derived from cognitive behavioural theories of broader positive symptoms of psychosis (i.e., the presence of cognitive and/or perceptual disturbances, including hallucinations, delusions, and disorganised thought, speech, and/or behaviour; Tarrier & Taylor, 2014). These models typically suggest that voices begin as normal intrusive stimuli, but that information processing dysfunction increases the likelihood of mistakenly appraising intrusions as being externally generated and/or threatening (Birchwood & Chadwick, 1997; Garety et al., 2001; Morrison, 2001; Paulik, 2012; Tarrier, 2006; Tarrier & Taylor, 2014). The distress generated by these appraisals increases both the frequency of intrusions and continued maladaptive appraisals, which can lead to distressing voices of a pathological nature (Birchwood & Chadwick, 1997; Garety et al., 2001; Morrison, 2001; Paulik, 2012; Tarrier, 2006; Tarrier & Taylor, 2014).

Trauma-related voice hearing has been likened to the re-experiencing symptoms of PTSD (Wells & Matthews, 1994) and has been conceptualised using cognitive behavioural models of PTSD. These models suggest that traumatic information is encoded with poor contextual detail due to disruptions to memory encoding during traumatic events (Steel et al., 2005). When poorly contextualised memories are retrieved, they are perceived as disturbing external stimuli occurring in the present (Morrison, 2001; Steel et al., 2005). Although this may explain direct voices, it does not explain indirect voices (Strachan et al., 2022b), which are more commonly experienced (Hardy et al., 2005).

Trauma-informed models of voices extend these “stand-alone” models of positive symptoms and PTSD by integrating maintenance and change factors from models of each set of symptoms (Berry & Bucci, 2016; Berry et al., 2017; Hardy, 2017). These models suggest that early traumatic experiences produce neurodevelopmental changes and/or insecure attachment styles that increase the likelihood that people will experience information processing dysfunction, engage in maladaptive appraisals, and use maladaptive coping strategies that increase the likelihood of voices (Berry & Bucci, 2016; Berry et al., 2017; Hardy, 2017). However, only one of these models provides an explanation of direct and indirect voices (Hardy, 2017). Hardy’s (2017) model of posttraumatic stress in psychosis emphasises the memory-based assumptions of PTSD models and suggests that direct voices are a more severe form of PTSD re-experiencing, whilst indirect voices are the result of dissociative coping responses disrupting normal

perception, causing trauma-informed inner dialogue (self-talk) to be experienced as an egodystonic voice (i.e., thematically linked to trauma; Hardy, 2017).

The Need for an Integrative Model of Trauma-Related Voices

A model is required that can explain trauma-related voices within and outside of the psychotic spectrum, distinguish between trauma- and non-trauma-related voices, and that comprehensively integrates maintaining factors from existing models of post-traumatic stress and voice-hearing. For example, most people who experience psychotic-like symptoms do not meet criteria for a psychotic spectrum disorder (Johns et al., 2014; van Os et al., 2009) and there is evidence of specificity in the relationships between different adverse experiences and distinct psychotic-like symptoms (i.e., childhood neglect may be specific to negative symptoms and childhood sexual abuse specific to voices; Bailey et al., 2018; Hardy et al., 2005). These findings suggest that there may be different trauma-related psychological processes that are specific to distinct psychotic-like symptoms, and that these processes exist outside of the psychotic spectrum (Bailey et al., 2018; Hardy et al., 2019), which emphasises the need to study voices separately from other psychotic-like symptoms and psychotic diagnoses (Carpenter, 2016; Murray, 2017). However, models of broader positive symptoms suggest hallucinations, delusions, and disorganised thought share similar maintaining factors (e.g., Garety et al., 2001; Tarrier, 2006; Tarrier & Taylor, 2014) and, therefore, lack the mechanistic specificity to explain distinct psychotic-like experiences (including voices) or different types of voices (i.e., direct, indirect, or no trauma-voice association), and, as noted above, models of PTSD do not explain indirect voices, which are more commonly experienced (Strachan et al., 2022b). Futhermore, most studies in this field used samples with psychotic spectrum disorders, investigated broader positive symptoms (i.e., did not measure voices separately from other psychotic-like symptoms), and/or did not assess whether or not voices were trauma-related (see Bailey et al., 2018; Varese et al., 2012; Williams et al. 2018).

Cognitive behavioural therapy (CBT) for psychosis based on theoretical models of broader positive symptoms (i.e., that target a range of factors broadly associated with hallucinations, delusions, and disorganised thought) shows inconsisent effectiveness in treating voices (Paulik, Hayward, et al., 2019; Thomas et al., 2014). Similarly, CBT based on models of PTSD effectively reduces PTSD symptoms amongst trauma-affected voice hearers, but does not reduce psychotic-like symptoms, such as voices (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017; van den Berg et al., 2015). In contrast, there is preliminary evidence that imagery rescripting, which uses mental imagery techniques to modify the meaning of distressing memories, effectively reduces both post-traumatic

stress and voice hearing symptoms amongst trauma-affected voice hearers (Ison et al., 2014; Paulik, Steel, et al., 2019). These results suggest that PTSD intrusions may be distinct to trauma-related voices, with each symptom set requiring a unique intervention, at least for those with indirect voices.

Together, these findings suggest that there may be similarities and differences in the psychological factors that underlie PTSD, non-trauma-related voices, and trauma-related voices (both of which occur within and outside the psychotic spectrum), which cannot be explained by stand-alone models of PTSD and positive symptoms (Strachan et al., 2022a). Although Hardy's (2017) model of post-traumatic stress in psychosis incorporates factors from stand-alone models of PTSD and positive symptoms, a recent review (Strachan et al., 2022a) categorised factors as being common or unique to models of PTSD and positive symptoms and found that no existing model includes all identified factors. An integrative model that addresses these limitations would aid the generation of novel hypotheses that may support the development of more effective psychological interventions.

The first aim of this review is to develop an integrative model of trauma-related voices that extends on current trauma-informed models of voices, by outlining directional relationships and interactions between factors that are common and unique to both sets of symptoms, for different types of voices. The second aim is to propose a future research agenda based on novel hypotheses that are informed by the integrative model.

The Trauma-Related Voices Model

Model Development

A recent review (Strachan et al., 2022a) compared and contrasted 10 models of PTSD and six models of positive symptoms, two of which provided a trauma-informed perspective on voices, to identify psychological factors common and unique to each set of symptoms. As only three models of positive symptoms were specific to voices, factors associated with broader positive symptoms were included in the review as they may provide a foundation for understanding distinct psychotic-like symptoms, such as voices. Twenty-one factors were extracted from these models; six factors were unique to models of PTSD (conditioning, excessive associative learning, and schematic assimilation, and extinction, habituation and fear inhibition failure), nine were unique to models of positive symptoms (faulty information processing, negative affect, meta-cognitive beliefs, theory of mind deficits, thought control deficits, maladaptive coping, emotion dysregulation, insecure attachment, and attention biases), and six were common across both sets of symptoms

(dissociation, stress sensitisation, maladaptive appraisals, negative schemas, poor self-efficacy, and memory contextualisation deficits).

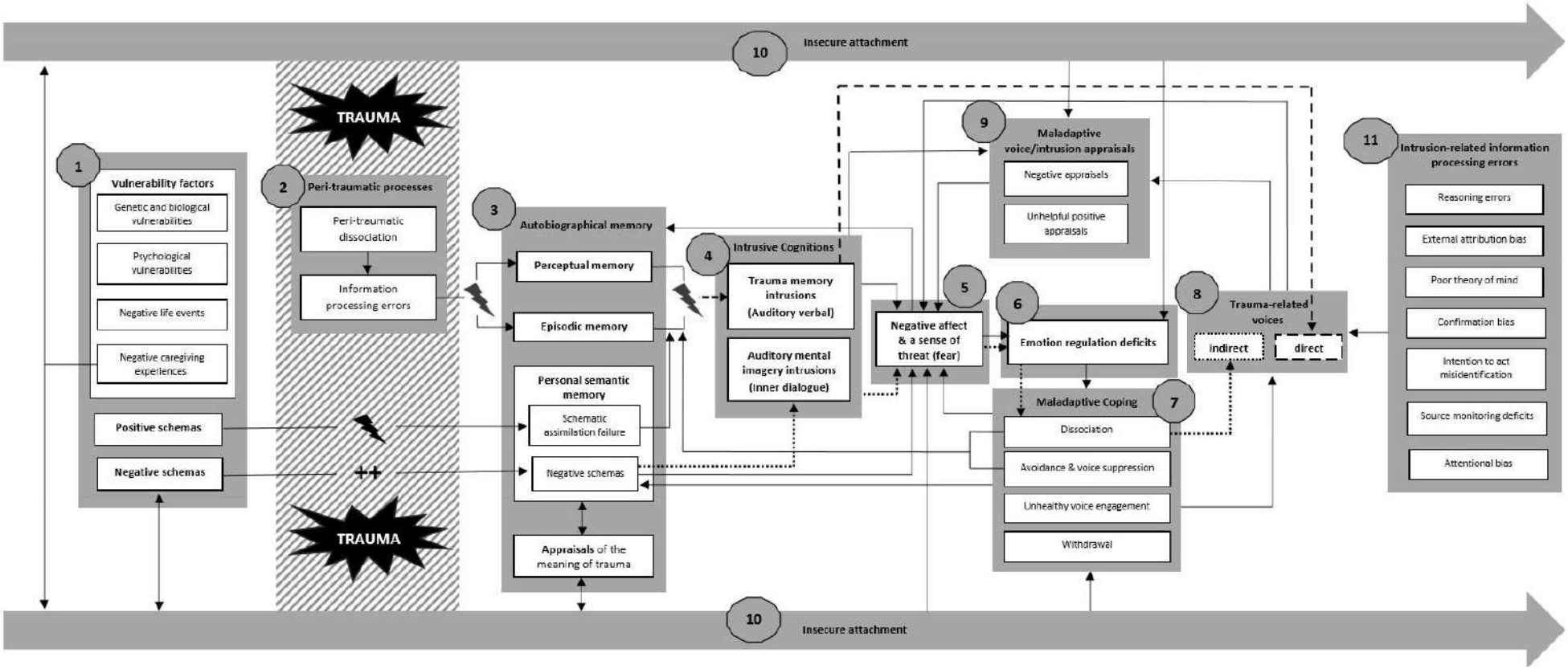
An analogical abduction approach to model development was adopted, whereby the models examined by Strachan et al. (2022a) were further reviewed by LS to identify vulnerability factors that are common and unique across each set of symptoms. Together, these vulnerability factors and the shared and unique maintaining factors identified by Strachan et al. (2022a) provided the foundation of the integrative model in the current paper. To extend further on existing models, LS compared and contrasted the theoretical accounts of such models to establish an in-depth account of the theorised relationships between each factor. LS combined these relationships into a broader integrative model; all theorised relationships were included. The pathways to direct and indirect voices were informed by Hardy's (2017) model of posttraumatic stress in psychosis, and additional relationships between factors were integrated into these pathways to identify factors that may be specific to each type of voice hearing, and those that may not be linked to a particular type of voice hearing. Throughout model development, the theoretical relationships were reviewed, clarified, and refined by all authors. The resulting Trauma-Related Voices (TRV) model (a) provides a comprehensive amalgamation of factors common and unique to positive symptoms and PTSD, (b) elaborates on theorised processes and relationships between factors, (c) demarcates factors that may be specific to different types of voices or may be involved in voices more generally, and in doing so, (d) identifies multiple pathways to different types of trauma-related voice hearing (Figure 3.2).

Overview of the Trauma-Related Voices Model

The TRV model outlines theorised pathways to direct (indicated by dashes) and indirect (indicated by dots) trauma-related voices, and other factors (indicated by solid lines) that are not linked to a particular type of voice hearing. Detailed explanations of the mechanistic processes and relationships within each component of the integrated model (grouped into numbered boxes), generally moving from the left to the right, are provided below, followed by a summary of the pathways to direct and indirect voices. Vulnerability factors and peri-traumatic processes (i.e., occurring during the traumatic event; to the left and inside the shaded trauma box, respectively) appear on the far left of the model and will be discussed briefly. Mechanisms of maintenance and change are the key foci of this model and appear in the centre and right of the model, after the experience of trauma (to the right of the shaded trauma box). Additional learning and information processing

Figure 3.2

The Trauma-Related Voices Model



Note. Pathways to direct voices are indicated by dashed arrows. Pathways to indirect voices are indicated by dotted arrows.

mechanisms that are believed to underlie trauma symptoms more generally (e.g., conditioning and extinction processes) are discussed below, but were excluded from Figure 3.2 to improve readability.

Pre-traumatic Factors

Pre-traumatic factors that may be related to voices appear on the far left of the model (box one) before the experience of trauma (indicated by the shaded box). Pre-existing positive and negative schemas may lead to different post-traumatic processes (box three) that produce different types of voices. These processes are discussed in more detail in the autobiographical memory section below.

The biopsychosocial factors theorised to increase vulnerability to PTSD and voices are largely common across both sets of symptoms (Strachan et al., 2022a). The relationships between these vulnerability factors and the factors of maintenance and change within the TRV model are discussed below, but most were omitted from Figure 3.2 to improve readability. Similar genetic and biological factors increase psychological vulnerability to both PTSD and voices (Strachan et al., 2022a). For example, temperamental factors may increase the likelihood of hypervigilance, stress sensitivity, arousal, and negative affect (box five; Ehlers & Clark, 2000; Hardy et al., 2016; Tarrier, 2006), source- difficulties, and attribution, attentional, and reasoning biases (box 11; Brewin & Holmes, 2003; Ehlers & Clark, 2000; Garety et al., 2001; Kuipers et al., 2006; Morrison, 2001; Tarrier, 2006). Vulnerability to PTSD symptoms may be increased due to excessively low or high inhibitory control over emotions and cognitions (box six), which may increase the risk of difficulty integrating traumatic information into one's schematic network and, therefore, the risk of schematic assimilation failure (box three; Horowitz, 2011).

Negative caregiving experiences and life events may lead to psychological vulnerabilities that increase the risk of PTSD and voices (Strachan et al., 2022a). For example, caregiver mental illness or caregiving inconsistencies may contribute to the development of insecure attachment styles (arrows numbered 10, along the top and bottom of the model; Berry et al., 2017). As voice hearers often experience disadvantageous childhood experiences (Bailey, 2018) and the content of voices is often linked to such experiences (Hardy et al., 2005; Paulik, Steel, et al., 2019), this relationship was included in the Figure 3.2 as arrows from caregiving experiences to insecure attachment (box 10). Negative caregiving experiences, social disadvantage, and poor social support may increase the risk of maltreatment (shaded trauma box) and the development of negative schemas (boxes one and three; Berry et al., 2017; Brewin &

Holmes, 2003; Ehlers & Clark, 2000; Horowitz, 2011; Janoff-Bulman, 1989; Kuipers et al., 2006; Paulik, 2012), heightened stress sensitivity and negative affect (box five; Benight & Bandura, 2004; Hardy, 2017; Kuipers et al., 2006), emotion regulation deficits (box six; Berry et al., 2017; Hardy et al., 2016), poor coping skills (box seven; Benight & Bandura, 2004; Hardy, 2017; Horowitz, 2011), and a tendency to negatively appraise information (boxes three and nine; Dalgleish, 2004; Ehlers & Clark, 2000; Horowitz, 2011; Kuipers et al., 2006).

Peri-traumatic Processes

Peri-traumatic psychological processes appear in box two. Peri-traumatic dissociation during traumatic experiences may disrupt normal information processing, including memory encoding (Thompson-Hollands et al., 2017). Memory encoding involves three key aspects of autobiographical memory; *perceptual* memory comprises egocentric sensory and perceptual information (e.g., visual and auditory detail), *personal semantic* memory includes abstract knowledge about oneself (i.e., the perceived meaning of events), and *episodic* memory includes temporal and contextual specifics of the event (Brewin et al., 1996; Brewin & Holmes, 2003; Dalgleish, 2004; Ehlers & Clark, 2000; Garety et al., 2001). Information processing errors during trauma may lead to *perceptual* and *personal semantic* information being encoded with high detail and *episodic* information with poor detail, which results in a lack of cohesion (i.e., fragmentation) between the collective elements of traumatic event (depicted by the disrupted connection between box two and three; Brewin et al., 1996; Brewin & Holmes, 2003; Dalgleish, 2004; Ehlers & Clark, 2000; Garety et al., 2001).

Mechanisms of Maintenance and Change

Autobiographical Memory and Intrusive Cognitions. Autobiographical memory processes may be associated with different types of intrusive cognitions that are related to different types of voices (box three; Hardy, 2017). Autobiographical memory fragmentation may cause the highly detailed *perceptual* components of trauma memories to be easily and involuntarily activated without appropriate *episodic* detail (i.e., positioning of the information as a past event), which may lead to dissociated intrusive trauma-based mental imagery (mental perception of sensory information without an external stimulus) from past experiences, whereby the person perceives these events to be re-occurring in the present time (Morrison, 2001; Steel et al., 2005). Activation of fragmented memories with strong auditory verbal perceptual elements and inadequate episodic information (indicated by the disrupted connections on the right-hand side of box three) may cause auditory verbal trauma memory intrusions (box four), which may be experienced as *direct* voices

(indicated by the dashed line to box eight; Hardy, 2017). Unhelpful appraisals of the meaning of these intrusions (box nine) may maintain voices more generally and will be discussed in subsequent sections.

Activation of the *perceptual* elements of trauma memories may be heightened by classical conditioning processes (Grillon, 2002; Lissek & van Meurs, 2015). Threatening unconditioned stimuli (e.g., being assaulted) may be paired with previously neutral stimuli that, due to their association with the unconditioned stimulus, become cues for danger (conditioned stimuli; Lissek & van Meurs, 2015). For example, if the assault took place in a dark alleyway, alleyways and darkness may become threatening. Furthermore, excessive associative learning (classical conditioning) may cause a person to make unrealistic and over-generalised associations between unconditioned and neutral stimuli, whereby unrelated or loosely related stimuli become conditioned (e.g., the side of buildings or dim lighting; Grillon, 2002). Due to their associations with the unconditioned stimuli present during past trauma, conditioned stimuli may frequently activate perceptual elements of the fragmented trauma memory (Lissek & van Meurs, 2015) and, consequently, increase the frequency of *direct* voices.

Personal semantic memory, core beliefs, and schemas (box three) are conceptually similar psychological constructs that are often used interchangeably in psychological literature; the term schema will be used throughout this paper. Schemas are shaped by a person's unique experiences and contain the abstract knowledge and conceptual understanding that a person develops about themselves, others, and the world (Prebble et al., 2013). The relationship between schemas and new information is interactive; new information is integrated into the existing schemas, and existing schemas influence the way in which people attend to, appraise, and respond to new information (Beck & Alford, 2009). Consequently, there is a reciprocal relationship between schemas and appraisals; schemas shape the way in which a person appraises traumatic information, and the way that traumatic information is appraised shapes schemas (indicated by the bi-directional arrow at the bottom of box three; Beck & Alford, 2009).

Pre-existing schemas (box one) may be involved in both direct and indirect trauma-related voices. Pre-existing positive schemas (e.g., I am safe) may lead to difficulties assimilating traumatic information into the pre-existing schemas (depicted by the disrupted connection between box one and three; Janoff-Bulman, 1989; Janoff-Bulman & Frantz, 1997; Janoff-Bulman & Frieze, 1983). This failure may lead to ongoing processing of traumatic sensory perceptual and episodic information that intrudes into conscious awareness (Janoff-Bulman, 1989; Janoff-Bulman & Frantz, 1997; Janoff-Bulman & Frieze,

1983), thereby increasing the frequency of trauma-memory intrusions associated with *direct* voices (Hardy, 2017).

Pre-existing negative schemas may be strengthened (depicted by the amplified connection between pre-exiting and negative schemas in box one and three), or new negative schemas may be formed, due to negative appraisals about the meaning of the trauma (Rauch & Foa, 2006). For example, a person with pre-existing negative self-schemas characterised by poor self-efficacy (e.g., I am unable to cope) may interpret their trauma as being evidence that they are powerless, which may strengthen their existing schema (Berry et al., 2017; Birchwood & Chadwick, 1997; Brewin & Holmes, 2003; Chadwick & Birchwood, 1994; Dalgleish, 2004; Ehlers & Clark, 2000; Hardy, 2017; Tarrier, 2006). Negative schemas generate negative affect (box five; Benight & Bandura, 2004; Hardy, 2017), which may be involved in voices more generally and will be discussed in more detail below.

Schemas shape the sensory, semantic, and affective content of mental imagery across all sensory modalities (Çili & Stopa, 2015; Hackmann et al., 1998). Inner dialogue is a form of auditory mental imagery and may include self-talk whilst problem-solving, planning, or evaluating information relating to past experiences, present activities, or future goals (Oleś et al., 2020). Inner dialogue may be spontaneous or ruminative, compassionate or unsupportive, and may reflect multiple perspectives (Oleś et al., 2020). In the context of trauma, inner dialogue may be ruminative and contain distressing content that is thematically linked to trauma-informed schemas (Hardy, 2017; McCarthy-Jones et al., 2012; 2014). For example, a person with domestic violence trauma may have developed strong negative schemas about themselves (e.g., I am vulnerable) and others (e.g., others are unpredictable), and may experience hypervigilance and ruminative inner dialogue regarding potential threats to safety. Another example would be a person with a history of childhood sexual abuse who may have developed negative self-schema (e.g., I am bad) experiencing inner dialogue that is blaming or demeaning in nature. Negative inner dialogue may generate negative affect (indicated by the dotted arrow from box four to five), which interacts with other factors to produce indirect voices.

Negative Affect and a Sense of Threat. Interactive relationships between negative affect and a sense of threat (fear; box five) and other mechanisms within the TRV model maintain direct and indirect voices. There are several processes related to voices that may generate negative affect and/or a sense of threat. Trauma memory intrusions across all sensory modalities (box four) and voices themselves (box eight) may be appraised in maladaptive ways (box nine) that generate distress (box five; Hardy, 2017). Similarly,

ineffective coping strategies (box seven) and insecure attachment (arrows numbered 10, along the top and bottom of the model), which are discussed in succeeding sections, may generate distress. Classical conditioning processes may also maintain a sense of current threat, whereby conditioned stimuli generate a similar (conditioned) fear response to that of the unconditioned stimulus (e.g., racing heart).

Negative affect may have a reciprocal relationship with trauma memory intrusions (box four), with the latter being associated with *direct* voices. For example, if the physiological symptoms of negative affect and/or conditioned responses match elements of the fragmented trauma memory (box three), they may increase the likelihood of the trauma memory being re-activated and triggering trauma-memory intrusions (box four; Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994; Garety et al., 2001; Hardy, 2017; Lissek & van Meurs, 2015; Morrison, 2001; Tarrier, 2006; Tarrier & Taylor, 2014) that may be experienced as *direct* voices (box eight; Hardy, 2017).

Negative affect may activate negative schemas, which may in turn, generate negative affect (indicated by the bi-directional arrow between box three and five; Bowlby, 1982; Mikulincer & Shaver, 2005). Negative schemas (box three) may produce trauma-informed mental imagery that may be involved in *indirect* voices and has a powerful impact on emotion (this relationship is indicated by the dotted arrow between box four and five and will be elaborated in subsequent sections; Holmes & Mathews, 2010). Using the examples provided in the previous sections, a person who experiences mental imagery about potential risks to their safety may experience fear, whilst a person who experiences critical or demeaning mental imagery may experience powerful feelings of shame.

Emotion Regulation Deficits. Emotion regulation describes the ways in which people control their experience and expression of emotion (Gross & Thompson, 2006; Gross, 1998). Emotion regulation deficits may cause a person to use unhealthy strategies to cope with emotion, which may perpetuate *indirect* voices and voices more generally (indicated by the dotted and solid arrows from box five, through six, to seven; Berry et al., 2017; Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994; Hardy, 2017; Morrison, 2001; Tarrier, 2006; Tarrier & Taylor, 2014). People with insecure attachment styles (arrows numbered 10, along the top and bottom of the model) are more likely to experience emotion regulation deficits (Berry & Bucci, 2016; Berry et al., 2017; Mikulincer & Shaver, 2012).

Maladaptive Coping. Dissociation is a maladaptive coping strategy that may be specific to *indirect* voices (Hardy, 2017). Dissociation interacts with other factors to form a pathway to *indirect* voices (indicated by the dotted arrows); negative schemas (box three)

may generate trauma-informed auditory mental imagery (i.e., inner dialogue; box four) that produces distress (box five). Emotion regulation deficits (box six) may mean that a person is unable to regulate this distress in healthy ways, which may lead to a dissociative response (box seven; Hardy, 2017). As dissociation disrupts normal perception, dissociative responses may cause a person to perceive distressing trauma-informed inner dialogue as an *indirect* voice that is different to their own cognitions (indicated by the dotted arrow to box eight; Berry et al., 2017; Brewin & Holmes, 2003; Dalgleish, 2004; Hardy, 2017). Continuing with the examples from previous sections, a person with negative schemas about themselves (e.g., I am vulnerable) and others (e.g., others are unpredictable) may dissociate in response to distressing ruminative inner dialogue regarding threats to safety and experience a voice that monitors and draws their attention to threat cues, issues warnings, or reinforces messages of vulnerability. Another person who developed negative self-schemas (e.g., I am bad) may dissociate in response to self-blaming and demeaning inner dialogue and experience a voice that bullies or belittles them.

Dissociation, as well as other coping strategies that are not linked to a particular type of voice hearing, may maintain other processes in the model. Avoiding other trauma-related stimuli via dissociation, withdrawal, physical avoidance, of suppression of thoughts and/or voices may prevent an individual from successfully integrating the fragmented aspects of autobiographical memory associated with their trauma (indicated by the solid arrow to the disrupted connection between episodic and perceptual memory in box three), thereby maintaining trauma memory intrusions (box four; Berry et al., 2017; Brewin et al., 1996; Foa et al., 1989; Hardy, 2017). Similarly, avoidance may prevent successful habituation and extinction learning, whereby a person experiences a decline in physiological arousal (box five) after repeated and/or prolonged exposure to conditioned stimuli (e.g., dark lighting) without an aversive outcome (e.g., assault; Lissek & van Meurs, 2015; Groves & Thompson, 1970).

Unhealthy voice engagement (e.g., distrusting others at the instruction of voices), withdrawal, and failed attempts to avoid distressing cognitions and emotions (e.g., via dissociation or suppression) may reinforce maladaptive negative schemas (box three) by reinforcing negative schemas (e.g., I cannot cope) and by preventing experiences that disconfirm negative schemas and promote healthier schemas, which would support adaptive reappraisals of the meaning of trauma (indicated by the solid arrow to negative schemas in box three; Benight & Bandura, 2004; Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994; Morrison, 2001). Similarly, these coping strategies may increase

external stressors (e.g., stigma, limited social resources) that maintain negative affect (indicated by the solid arrow to box five; Benight & Bandura, 2004; Tarrier, 2006; Tarrier & Taylor, 2014). As such, the interactive relationship between maladaptive coping and other factors may maintain voices more generally (indicated by the solid arrow to box eight).

Maladaptive Appraisals of Intrusions and Voices. Maladaptive appraisals of intrusions and/or voices are not linked to a particular type of voice hearing (Benight & Bandura, 2004; Berry et al., 2017; Brewin et al., 1996; Chadwick & Birchwood, 1994; Dalgleish, 2004; Ehlers & Clark, 2000; Garety et al., 2001; Horowitz, 1983, 1986, 2011; Morrison, 2001; Tarrier, 2006). Appraisals may be influenced by broader schemas about the self, others, and the world (Beck & Alford, 2009) and meta-cognitive beliefs (e.g., thoughts and, therefore, voices are powerful; Morrison, 2001), however, this pathway was excluded from Figure 3.2 to improve readability. Appraisals may be shaped by a person's attachment style (arrows numbered 10, along the top and bottom of the model; Bowlby, 1982) and this relationship will be discussed in subsequent sections. Negative appraisals about the content and meaning of intrusions (e.g., I am losing control of my mind) and voices (e.g., the voice is dangerous), as well as unhelpful positive appraisals of voices (e.g., the voice is protecting me from hidden threats), may generate negative affect and influence the way in which a person responds to perceived threat (boxes five and seven; Berry & Bucci, 2016; Berry et al., 2017; Birchwood & Chadwick, 1997; Brewin & Holmes, 2003; Chadwick & Birchwood, 1994; Dalgleish, 2004; Hardy, 2017; Tarrier, 2006; Tarrier & Taylor, 2014). For example, a person who appraises their voices as protecting them from unseen threats may withdraw from others, whilst a person who believes their voice is malevolent may attempt to forcefully suppress their voice.

Intrusion-related Information Processing Errors. In addition to information processing errors at the time of the trauma (box two), information processing errors post-trauma may increase the likelihood that people will attribute their own mental activity to an external source (i.e., a voice; Berry et al., 2017; Garety et al., 2001; Morrison, 2001; Tarrier, 2006). For example, reasoning errors (e.g., jumping to conclusions and an unwillingness to consider alternative explanations for distressing mental activity) and confirmation bias (e.g., interpreting ambiguous social behaviour consistently with persecutory voices) may cause a person to overlook important evidence for making accurate judgements about the meaning of distressing mental activity (box nine; Garety et al., 2001; Morrison, 2001; Tarrier, 2006; Tarrier & Taylor, 2014). Additionally, attentional bias toward potential threats (i.e., hypervigilance toward distressing mental activity and/or perceptual stimuli), source monitoring (i.e., the ability to identify the source of perceptions

as being internal or external), theory of mind deficits (i.e., difficulty attributing mental states to oneself), an external attribution style (i.e., a tendency to identify external causes to events), and difficulties recognising one's own mental state and intention to act (e.g., the perception that one's mental states are alien) may increase the likelihood of evaluating voices as originating from an external source (Garety et al., 2001; Morrison, 2001; Tarrier, 2006; Tarrier & Taylor, 2014).

Insecure Attachment. Attachment is strongly influenced by early relationships with caregivers (box one) and describes an individual's emotional bond with others and their internalised knowledge of how people behave socially and relate with each other (Bailey et al., 2018; Bowlby, 1982). Insecure attachment is not associated with a particular type of voice hearing but may indirectly maintain voices by influencing various other mechanistic processes. As such, insecure attachment appears as arrows across the top and bottom of Figure 3.2 (arrows numbered 10, along the top and bottom of the model). Insecure attachment is associated with unhealthy early relationships (e.g., abuse, neglect, other caregiving inconsistencies) and is closely associated with negative schemas about the self and/or others, including the way in which social information is appraised (see bi-directional relationships with boxes one and three; Mikulincer & Shaver, 2012). Insecure attachment is associated with greater negative affect (box five) and emotion regulation deficits (box six; Berry & Bucci, 2016; Berry et al., 2017). Given the social and relational nature of voices (Paulik, 2012), insecure attachment may also drive maladaptive appraisals (box nine) and maladaptive coping (box seven; Berry & Bucci, 2016; Berry et al., 2017). For example, those with a desire for interpersonal closeness (anxious-preoccupied) may seek out and comply with the demands of their voices, whilst individuals who avoid closeness (dismissive-avoidant) may be more inclined to suppress or avoid distressing cognitions and/or voices (e.g., dissociate), and those who vacillate between seeking and avoiding closeness (fearful-avoidant) may oscillate between different coping strategies (Berry & Bucci, 2016; Berry et al., 2017).

Summary of the Pathways to Direct and Indirect Voices

The overview above provides a detailed account of the various mechanistic processes, interactions, and feedback loops that are involved in trauma-related voices. Whilst there are various processes and interactions that may contribute to trauma-related voices more generally (solid lines), some are theorised to be specifically involved in the pathway to direct (dashed lines) versus indirect voices (dotted lines). The pathway to *direct* voices starts with perceptual and episodic memory fragmentation (box three) that, when activated, triggers distressing sensory perceptual memory intrusions (box four; Brewin et

al., 1996; Brewin & Holmes, 2003; Dalgleish, 2004; Ehlers & Clark, 2000; Garety et al., 2001), which may be experienced as *direct* voices (Hardy, 2017). The pathway to *indirect* voices starts with trauma-informed schemas (box three) that generate auditory mental imagery intrusions in the form of negative inner dialogue (box four; Hardy, 2017). Emotion regulation deficits (box six) may lead a person to use dissociative strategies to cope (box seven) with the negative affect (box five) generated by distressing inner dialogue (Benight & Bandura, 2004; Berry et al., 2017; Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994; Hardy, 2017; Morrison, 2001; Tarrier, 2006; Tarrier & Taylor, 2014). As dissociation distorts perception, a person in a dissociative state may experience distressing inner dialogue as a voice that is *indirectly* linked to past trauma (Hardy, 2017).

Strengths and Limitations of the Trauma-Related Voices Model

A key strength of the TRV model, which sets it apart from existing models, is that it outlines multiple causal pathways to different types of voices. Consequently, several novel hypotheses can be tested using the TRV model, which are outlined in the future research agenda below. The TRV model was developed from established theories of PTSD and positive symptoms, and systematic reviews provide evidence that variables within the model mediate the relationship between traumatic life experiences and voice hearing more generally (see Bloomfield et al., 2020; Gibson et al., 2019; Williams et al., 2018). Whilst these findings indicate that the TRV model has empirically supported foundations, these relationships have not been tested specifically in relation to trauma-related voices. The TRV model was developed by integrating mechanisms from stand-alone models of posttraumatic stress and positive symptoms, and the similarities and differences between trauma-related voices, other post-traumatic stress symptoms, and voices that are not obviously linked to past trauma may be important for accurate formulation and treatment planning of complex case presentations. However, these similarities and differences have not been tested.

Due to its comprehensive inclusion of vulnerability factors and maintaining factors from established theories of PTSD and positive symptoms (Strachan et al., 2022a), the TRV model reflects the complexity and dimensionality of hallucinatory and PTSD symptoms. Additionally, the model comprises cognitive, emotional, and behavioural PTSD symptom clusters associated with the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (DSM-5; APA, 2013): intrusion symptoms (Criterion B) appear in the model as intrusive memories and mental imagery (box four); avoidance coping (Criterion C) appears as avoidance, withdrawal, and voice suppression (box seven); alterations to cognition and mood (Criterion D) appear as negative affect, negative

schemas, and dissociation (which may also be considered a form of avoidance under Criterion C; Kumpula et al., 2011; boxes five, three, and seven); and alterations to arousal and reactivity (Criterion E) appear as emotion dysregulation, a sense of current threat, and confirmation bias (i.e., due to hypervigilance; boxes five, six, and 11). As elements of the model can be mapped onto the DSM-5 criteria for PTSD, the model may have future clinical utility as a case conceptualisation tool for clinicians who work within the DSM-5 framework.

Future Research Directions

There is need for multiple types of evidence for the hypothesised causal pathways to different types of voices. Future research is needed to explore similarities and differences between trauma-related voices, other post-traumatic stress symptoms, and voices that are not obviously linked to past trauma to clarify the specificity of the TRV model. A future research agenda is presented below with respect to the types of evidence needed to test hypotheses and theoretical questions raised by the TRV model.

Testing Associations between Different Symptoms

Studies are needed to test the relative strengths of association between the variables in the TRV model across different types of trauma-related voices. For example, according to the TRV model, negative schemas, intrusive inner dialogue, and dissociation are specific to, and therefore should be most strongly associated with, indirect voices, whilst intrusive trauma memories are specific to and most strongly related to direct voices. However, as negative affect, insecure attachment, information processing errors, maladaptive appraisals, and maladaptive coping (avoidance, voice suppression, unhealthy voice engagement, and withdrawal) are not associated with specific type of voices, these variables may be similarly associated with direct and indirect voices. Additionally, modelling studies may test the structure of the model by testing the directional relationships within the different pathways within the model. For example, if negative affect and emotion regulation deficits predicted indirect voices, and this relationship was mediated or moderated by dissociation, this would provide some support for the pathway to indirect voices.

As the TRV model was developed using factors that are common and unique to models of PTSD and positive symptoms of psychosis (Strachan et al., 2022a), studies may test the relative strengths of association between common versus unique variables, and different types of trauma-related voices. For example, if the relationship between factors that are unique to PTSD (i.e., conditioning and extinction processes, schematic assimilation failure) and direct voices are stronger than the relationship between these

factors and indirect voices, this may provide preliminary evidence that direct voices share similar mechanistic processes to PTSD flashbacks. Future studies may also test the relative strength of relationships between common versus unique factors, PTSD symptoms, trauma-related voices, and non-trauma-related voices. For example, if factors that are common to both PTSD and positive symptoms (i.e., dissociation, maladaptive appraisals, negative schemas, memory storage and retrieval deficits) are more strongly associated with trauma-related voices than factors that are unique to models of PTSD or positive symptoms, this may suggest that individualised treatments that target common factors would be more broadly effective than treatments based on stand-alone models of PTSD and/or positive symptoms.

Future studies may test whether the mechanistic processes within the TRV model differ between groups who (a) hear trauma-related voices, (b) hear voices that are not obviously linked to a past trauma, and (c) experience post-traumatic stress symptoms without voices. Uncovering differences between direct voices and PTSD symptoms, non-trauma-related voices, and different types of trauma-related voices may generate potential explanations for the differential effects of CBT interventions for PTSD and positive symptoms (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017; van den Berg et al., 2015; Thomas et al., 2014) and novel interventions, such as imagery rescripting (Ison et al., 2014; Paulik, Steel, et al., 2019), on different symptoms. For example, trauma memory fragmentation is theorised to maintain both direct voices and PTSD flashbacks, and direct voices may be associated with more severe memory fragmentation. Future studies may test differences in the degree of memory fragmentation (see Bedard-Gilligan & Zoellner, 2012) between groups with PTSD flashbacks versus direct voices. Should groups with direct voices show a higher degree of trauma-memory fragmentation than those with PTSD flashbacks only, it may be that CBT interventions that aim to re-contextualise fragmented trauma memories effectively reduce PTSD symptoms associated with moderately fragmented memories, but do not reduce direct voices that are associated with severely fragmented memories (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017; van den Berg et al., 2015). Similarly, it could be that imagery rescripting effectively targets moderately and severely fragmented trauma memories, which may explain preliminary findings that imagery rescripting effectively reduces both post-traumatic stress symptoms and voices (Ison et al., 2014; Paulik, Steel, et al., 2019).

High comorbidity between trauma-related voices and PTSD symptoms (de Bont et al., 2015; Hardy et al., 2016; 2019) suggests it is possible for people to hear both trauma and non-trauma-related voices, so within-participant comparisons across different

symptoms may be more practicable than between-group comparisons. For example, unhelpful appraisals of intrusions (including voices) are common to PTSD flashbacks and non-trauma-related voices, and, according to the TRV model, direct and indirect trauma-related voices. However, dissociation is common to PTSD flashbacks and non-trauma-related voices, and unique to indirect voices. Future studies may compare the relative strength of associations between different types of unhelpful voice appraisals (see Chadwick et al., 2000) or different types of dissociation (see Černis et al., 2018), and different intrusion symptoms. Furthermore, should these studies reveal differences in the strength of associations across intrusion symptoms, prospective or experimental studies may test temporal change in dissociation and voice appraisals, and different types of voices to gather stronger evidence of temporality and causality.

Testing Temporality Dynamics and Causality

Longitudinal and treatment studies are needed to test the temporal precedence of factors within the different pathways outlined in the TRV model, and experimental studies are needed to provide stronger evidence of causation (Kazdin, 2007). Ecological momentary analysis (EMA) studies have been successfully conducted amongst people with psychotic-like symptoms (Myin-Germeys et al., 2003) and would be useful in testing real-time temporal dynamics between contextual factors (e.g., activity, environmental and social factors), and the activation of mechanistic factors in relation to symptoms. Given the emphasis on gathering precise detail about the chronology of different experiences, EMA studies may identify between- and within-person differences in cognitions, emotion, and/or behaviour (Shiffman et al., 2008) that may explain differences between direct voices and PTSD intrusions, direct and indirect voices, and/or trauma-related and non-trauma-related voices. For example, an EMA that measured the content of different intrusions and found that direct voices contain pre-traumatic content, PTSD flashbacks contain peri-traumatic content, and both occur immediately after exposure to trauma-related stimuli, would provide some support for the TRV model by indicating both trauma intrusions (direct voices and PTSD flashbacks) are associated with activation of fragmented trauma-memories. Additionally, finding that direct voices and PTSD flashbacks are linked to different time points in those memories may clarify theoretical understandings of differences between direct voices versus PTSD flashbacks and, therefore, inform intervention studies. The TRV model would also be supported if an increase in negative inner dialogue preceded an increase in dissociation, and dissociative responses preceded indirect but not direct voices. EMA studies could also test differences in inner dialogue, affect, emotion regulation, and dissociation across positive and negative indirect voices.

Given that trauma-affected voice hearers may be a difficult population to access, prospective cohort studies and uncontrolled treatment studies may be a practical method of gathering preliminary evidence for the temporal dynamics between maintaining factors and voices (Kazdin, 2007). As voice hearing is associated with a range of psychological disorders (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019) and there are currently no clinical practice guidelines for trauma-related voices, psychological treatments that are currently offered to people who hear voices are diverse and target different theorised maintaining factors (Hayward, 2018; Turkington et al., 2016). Prospective cohort studies could track temporal change in voices, other trauma-related symptoms, and the factors targeted by different psychological treatments (e.g., CBT for voices, compassion-focussed therapy, schema therapy) and intervention strategies (e.g., relational responding, imagery rescripting, coping strategy engagement) that are offered to clients with trauma-related voices. To further support recruitment efforts, clinicians working with PTSD and voice hearing populations could be encouraged to routinely assess for trauma-related voices. Should the results of prospective studies provide evidence for the temporal pathways outlined in the TRV model, this may support the need for larger, controlled experimental studies, which are necessary to provide stronger evidence of causation (Kazdin, 2007).

Experimental Studies

Past experimental studies have used distressing films to reliably produce negative affect and intrusions, and to assess peri- and post-traumatic mechanisms within healthy, non-traumatised samples (Ehring et al., 2013; Holmes & Bourne, 2008). As trauma films typically depict trauma to others (Holmes & Bourne, 2008), they may not be effective in producing trauma-related voices, which are strongly associated with person-directed victimisation trauma (physical, emotional, and sexual abuse, and physical and/or emotional neglect; Bailey et al., 2018; de Vries et al., 2019; Matheson et al., 2013). Whilst trauma films could be adapted to depict victimisation trauma, this may induce distressing emotional reactions that are ethically unjustified.

Other studies have successfully manipulated cognitive triggers of auditory hallucinations amongst individuals with auditory hallucinations (Stinson et al., 2010) and similar experimental methods could be used to test the pathway to indirect voices. For example, according to the TRV model, negative inner dialogue associated with trauma-informed schemas generates negative affect that triggers indirect voices. Experimental studies could manipulate the content of inner dialogue by instructing groups to engage in thoughts consistent with the content of indirect voices, engage in thoughts that

compassionately counteract the content of indirect voices, or engage in neutral cognitions. Between-group differences in dissociation and trauma-related voices could then be measured. Should the experimental groups experience more dissociation and voices than the control group, these findings may suggest that inner dialogue and dissociation are related to positively and negatively valenced indirect voices.

Treatment Studies

Past treatment studies can be replicated with minor methodological changes that allow different elements of the TRV model to be tested. For example, past treatment studies with PTSD and/or voices outcome measures could be extended to include a measure of trauma-related voices to measure temporal change in maintaining factors (e.g., schemas, dissociation, emotion regulation), different types of trauma-related voices, and other symptoms. Randomised clinical trials that compare the efficacy of different trauma-focussed interventions in reducing different types of voices and other post-traumatic stress symptoms would be informative. For example, clinical trials may track change in trauma-related voices and other post-traumatic stress symptoms across groups that are treated using either mental imagery techniques that modify the meaning of traumatic memories (e.g., imagery rescripting; Ison et al., 2014; Paulik, Steel, et al., 2019; Taylor et al., 2019) or exposure-based mental imagery (e.g., reliving therapy; Holmes et al., 2005), versus a wait-list control group. If exposure strategies are more effective than imagery rescripting techniques at reducing direct voices, and imagery rescripting techniques are more effective than exposure strategies at reducing indirect voices, this would support the TRV model by suggesting that perceptual and episodic memory fragmentation is specific to direct voices and, trauma appraisals (and associated personal semantic memories) are specific to indirect voices.

Another example may be a clinical trial that tracks temporal change in trauma appraisals, schemas, PTSD symptoms, and indirect voices between groups that are treated using either imagery rescripting protocols, cognitive restructuring, or are placed in a wait-list control group. Imagery rescripting and cognitive restructuring both aim to challenge unhelpful appraisals of trauma and modify negative schemas, which are associated with both PTSD symptoms and indirect voices. However, imagery rescripting uses mental imagery techniques (Arntz & Weertman, 1999), whilst cognitive restructuring uses written and verbal techniques (Resick & Schnicke, 1993). Given that mental images feel more “real” and are more emotionally impactful than verbal cognitions (Mathews et al., 2013), if both interventions effectively reduce PTSD symptoms, but imagery rescripting is more effective than cognitive restructuring in reducing trauma-related voices, this may

suggest that the maladaptive schemas associated with voices are more inflexible than those associated with PTSD symptoms, and that verbal strategies are insufficient in manipulating rigid appraisals and schemas.

Qualitative Studies

The theories of voices that informed the TRV model are primarily focussed on explaining positive symptoms, however, voices have been associated with other psychological disorders (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019) and with psychologically healthy individuals (Baumeister et al., 2017). Qualitative studies with transdiagnostic samples may be useful in identifying potential commonalities and differences in (a) the phenomenological experiences of different symptoms, (b) the perceived cause of voices (i.e., appraisals of voices), and/or (c) perceived reasons for change (or lack thereof) associated with different treatments. For example, qualitative studies may uncover important distinctions between direct voices and other PTSD intrusions by collecting phenomenological accounts of the temporality of intrusive content (e.g., flashbacks, dissociation, and voices), the perceived “realness” of intrusions, or triggers to different intrusions. Personal insights about the cognitive and emotional changes post-trauma may clarify the role of schematic assimilation failure, maladaptive appraisals, attachment style, and negative schemas across different types of voices and PTSD symptoms. Similarly, perceived reasons for change (or lack thereof) in voices, PTSD symptoms, and/or other psychological and behavioural outcomes associated with different interventions may identify important mechanistic differences across treatments.

Methodological Recommendations

Although psychotic-like symptoms should be studied separately from psychotic diagnoses (Carpenter, 2016; Murray, 2017), transdiagnostic samples with various trauma experiences that are large enough to make comparisons across diagnostic groups are needed to test the transdiagnostic applicability of the TRV model. As trauma-affected voice hearing populations may be difficult to access, large-scale international scientific collaborations may be needed to generate adequate data for larger treatment studies, with data made available through public repositories. Initial research within healthy samples experiencing a continuum of unusual auditory experiences and post-traumatic symptoms may provide useful preliminary evidence about the relationships within the model. Findings from these studies may be used to further refine hypotheses based on the TRV model prior to engaging in more challenging recruitment efforts.

Although there are established psychometric measures of voices more generally (e.g., Leishout & Goldberg, 2007), there are no established protocols or tools for assessing and measuring trauma-related voices. To ensure consistency across studies, there is a need to develop clear criteria for differentiating indirect voices and other non-trauma-related voices, and direct voices and other PTSD intrusions. For example, measures of trauma-related voices should not only assess the number of voices, the frequency, loudness, duration, location, and clarity of voices, as well as the interference, distress, and emotional impact of voices, they should also assess the frequency and strength of both positively and negatively valenced voices to improve content validity. Similarly, although existing measures assess the frequency in which people comply with the demands of voices (e.g., Leishout & Goldberg, 2007), some trauma-affected individuals perceive voices to take command of their body (Fung et al., 2020), and future measures should be adapted to capture the full range of compliance-like behaviour.

Participants should be given clear instructions and a rationale for measuring different types of voices to prevent inaccurate reporting that may confound research findings. However, given that voice hearers often experience cognitive functioning deficits (Daalman et al., 2011), researchers should consider whether researcher-administered methods of data collection would be more reliable than self-report methods. Similarly, future studies should reduce participant burden through designs that are minimally time-consuming or cognitively demanding.

Conclusions

The TRV model identifies novel theoretical questions and hypotheses that can be used to guide future research and interventions. There is a need for multiple types of evidence to test the relationships between maintaining factors within the TRV model, and to clarify similarities and differences between trauma-related voices, other post-traumatic stress symptoms, and non-trauma-related voices. Future research should recruit transdiagnostic samples with a diverse range of traumatic experiences, post-traumatic and voice hearing symptoms, and carefully measure post-traumatic stress and different types of voices. If the pathways to indirect and direct voices are supported and refined, the TRV model may be a practical clinical tool for conceptualising complex cases and identifying key treatment targets.

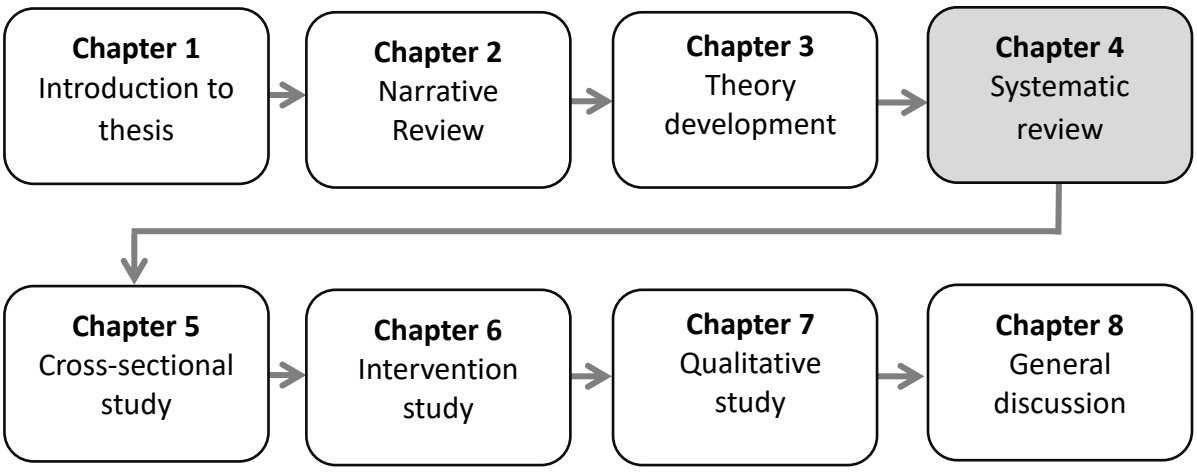
Chapter 4 (Study 3): A Systematic Review of Relationships Between Voices, Posttraumatic Stress Symptoms, and Potential Mechanisms of Maintenance and Change

Introduction to Chapter 4

The future research agenda outlined in chapter three highlighted a need to examine evidence for the associations outlined in within the TRV model. Reviewing evidence for associations between the mechanisms within the TRV model, voices, and PTSD symptoms may identify key gaps in the literature to be examined in future studies. Differences in the relative strength of associations between mechanisms, voices, and PTSD symptoms, or between groups with PTSD and voices, PTSD without voices, and voices without PTSD may identify potential explanations for the differential impacts of CBT and ImRs on such symptoms, which can be examined in future research. As such, the current chapter presents a systematic review of the associations between individual mechanisms within the TRV model, PTSD symptoms, and voices. This study is currently prepared for submission to a peer-reviewed journal. Figure 4.1 outlines the location of this chapter within the overall structure of this thesis.

Figure 4.1

Flow Diagram of Thesis Structure: Chapter Four



Introduction

Voice hearing is associated with a range of psychological disorders (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019) and there is strong evidence of a relationship between trauma and voices (Bailey et al., 2018; Hardy et al., 2005). Voice are common in people with PTSD (Shinn et al., 2020) and PTSD symptoms are common in people with psychotic spectrum disorders (Buswell et al., 2021). Most voice hearers report a history of trauma and childhood sexual abuse and bullying are strongly associated with voices (de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016). Additionally, there is growing evidence that most trauma-affected voice hearers experience trauma-related voices, whereby the content of voices is directly (voices repeat perpetrators comments) or indirectly (voices are thematically related to past trauma) linked to past traumatic experiences (Hardy et al., 2005; Paulik et al. 2019; Peach et al., 2020).

Although voices are experienced across a range of disorders (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019), few studies have examined voices separately from other psychotic-like symptoms and psychotic spectrum disorders. However, compared to people with psychotic-spectrum disorders who do not have comorbid PTSD symptoms, those with comorbid PTSD symptoms experience more severe psychopathology and poorer response to psychological and pharmacological treatments (Hassan & De Luca, 2015; Schneeberger et al., 2014; Seow et al., 2016; Trotta et al., 2015). A mechanism is a process that is causally related to maintenance and change in a particular outcome (Kazdin, 2007) and recommended treatments for trauma-affected voice hearers include CBT for PTSD and CBT for positive symptoms, whereby each treatment aims to modify different mechanisms (National Institute for Health and Care Excellence, 2014, 2018). CBT for PTSD aims to modify the maladaptive trauma appraisals, avoidance, and memory-based mechanisms that are theorised to underlie PTSD (Zalta, 2015), and is associated with medium to large reductions in PTSD symptoms amongst people who do not hear voices (Ehring et al., 2014). However, CBT for PTSD it is associated with small reductions in PTSD symptoms and does not reduce distressing voices in people with psychotic spectrum disorders (Brand et al., 2018). CBT for positive symptoms targets a range of mechanisms theorised to maintain broader positive symptoms (i.e., hallucinations, delusions, disorganised thought), such as maladaptive beliefs about voices, maladaptive coping responses, broader schemas about the self and others, social beliefs, and distress (Thomas et al., 2014). Whilst CBT for positive symptoms is effective in treating broader positive symptoms, it has inconsistent

effectiveness in treating distressing voices and does not reduce PTSD symptoms (Paulik, Hayward, et al., 2019; Thomas et al., 2014). These findings suggest that the mechanisms that maintain voices in trauma-affected populations may differ to those that maintain PTSD and other positive symptoms. Therefore, current stand-alone theories of PTSD and positive symptoms do not adequately explain the mechanisms of voices in trauma-affected individuals.

Identifying and understanding the psychological mechanisms that maintain trauma-related voices is critical for the development of effective psychological treatments. Recently, the TRV model was developed to address the limitations of existing theories and guide future research that may lead to the development of more effective treatments for trauma-affected voice hearers (Strachan et al., 2022b). The TRV model was developed by integrating the mechanisms of stand-alone models of PTSD and positive symptoms, which were summarised by Strachan et al. (2022a) as being unique to PTSD versus positive symptoms, or common to both PTSD and positive symptoms. By outlining the theorised interactions and feedback loops between the common and shared mechanisms, the TRV model generates novel hypotheses about the mechanisms that underlie direct trauma-related voices, indirect trauma-related voices, and those that may maintain voices more generally. As a first step in testing the TRV model, there is a need to examine existing evidence for the associations between the individual mechanisms within the TRV model and PTSD symptoms and voices.

The Current Study

A key aim of this study was to systematically review evidence for the relationships between potential mechanisms of trauma-related voices, PTSD symptoms, and voices as a distinct symptom (separate from psychotic spectrum disorder diagnoses). Differences in the relative strength of associations between mechanisms and PTSD symptoms versus voices may identify potential explanations for the differential impacts of CBT and ImRs on such symptoms. Thus, this review aimed to gather evidence for each component of the TRV model and identify key avenues for future research. As PTSD symptoms and positive symptoms are considered dimensional constructs (Broman-Fulks et al., 2006; Yung et al., 2009), studies with samples with clinical levels of PTSD or voices, as well as other clinical and non-clinical samples with symptoms of posttraumatic stress or voices, were included in this review.

Method

Protocol and Registration

A study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 31st March 2020 (registration CRD42020176771). Reporting of the review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (see supplementary materials for checklist; Moher et al., 2009).

Eligibility Criteria

The following criteria guided inclusion of studies in the review:

(a) Journal articles were quantitative, published in peer reviewed journals between 1980 and 2020, and written in English,

(b) Samples comprised participants over the age of 18,

(c) Studies assessed the severity (frequency, intensity, and/or associated distress) of PTSD symptoms[1],

(d) Studies assessed hallucinations[2] (including voices) categorically (present vs. not present) or the severity of hallucinations,

(e) Studies reported statistical relationships between continuous outcome variables (hallucinations and PTSD symptoms) and at least one mechanism variable[3], or

(f) assessed one of the two outcome variables and at least one mechanism variable, but examined groups that differed on the remaining outcome variable (e.g., measured hallucinations in groups that were categorically different on PTSD symptoms).

Information Sources

Six electronic databases were searched on 7th September 2022: PsycInfo (1967-2020), Embase (1974-2020), Medline (1946-2020), Scopus (1993-2020), the Cochrane Database of Systematic Reviews (all years), and the Cochrane Central Register of Controlled Trials (all years).

Search

[1] As PTSD symptoms may also be conceptualised as potential mechanisms (e.g., intrusions, avoidance) in the TRV model, measures of overall PTSD symptoms were considered outcome measures, whereas measures of specific PTSD symptoms (e.g., post-traumatic avoidance) were considered potential mechanisms.

[2] Initial eligibility criteria stipulated that studies must assess voice hearing. Due to the dearth of research that met this criterion, inclusion criteria were adjusted to include studies that examined broader hallucinations (including voices). As voices are the most common hallucinatory symptom (Chaudhury, 2010; Oertel-Knoechel, 2011), measures of hallucinations are likely to predominantly comprise of voice hearing symptoms. This change was updated on the PROSPERO register on 23rd February 2023.

[3] Initial eligibility criteria stipulated that studies must meet criterion E and measure all variables continuously (i.e., collected interval or ratio data). Due to the dearth of research that met these criteria, inclusion criteria were later extended (criteria D and F).

Searches were limited to peer-reviewed publications written in English and published after 1980. The search included the following terms: *unusual perceptual experiences, voices, voice hearing, auditory hallucination, psychotic-like experience, psychosis, post-traumatic stress, PTSD, trauma, mechanisms, explanatory, mediators, temporal association*, as well as proposed mechanisms identified by Strachan et al. (2022a; see Table 2.1). A comprehensive outline of search terms and the search strings is included in Appendix I. The reference lists of all publications were inspected to identify further relevant publications.

Study Selection

Assessment of eligibility was conducted by seven research assistants and one of the review authors (LS). There was a 93% agreement rate between reviewers and uncertainties over the eligibility of studies were resolved via discussion. Titles and abstracts were screened for reference to PTSD symptoms, hallucination symptoms, and potential mechanisms. Authors of studies who did not report sufficient data to meet inclusion criteria were invited to provide that data (i.e., correlations between mechanism and symptom measures) to enable their study to be included in the review; authors of eight studies provided this data. A PRISMA flow diagram of the selection strategy is outlined in Figure 4.2 and a summary of the literature included in this review is provided in Table 4.1.

Data Collection and Summary Measures

A data extraction spreadsheet was developed by the authors. Information extracted from articles included (a) study design, (b) sample characteristics (including diagnostic status), (c) sample size, (d) type of intervention, (e) hallucination measure, (f) PTSD measure, and (g) mechanism measure(s). The primary measure was bivariate correlations between each outcome measure and proposed mechanisms. If bivariate correlations were not available, Phi (φ) was used to report distribution differences, Cohen's *d* was used to report mean differences, and Cohen's *f* was used to report variance. Cohen's effect size conventions are as follows: Bivariate correlations, r = .10 (small), r = .30 (medium), and r = .50 (large); distribution differences, φ = .2 (small), φ = .5 (medium), and φ = .8 (large); mean differences, d = .02 (small), d = .50 (medium), and d = .80 (large); and variance, f^2 = .02 (small), f^2 = .15 (medium), *and* f^2 = .35 (large; Cohen, 1988).

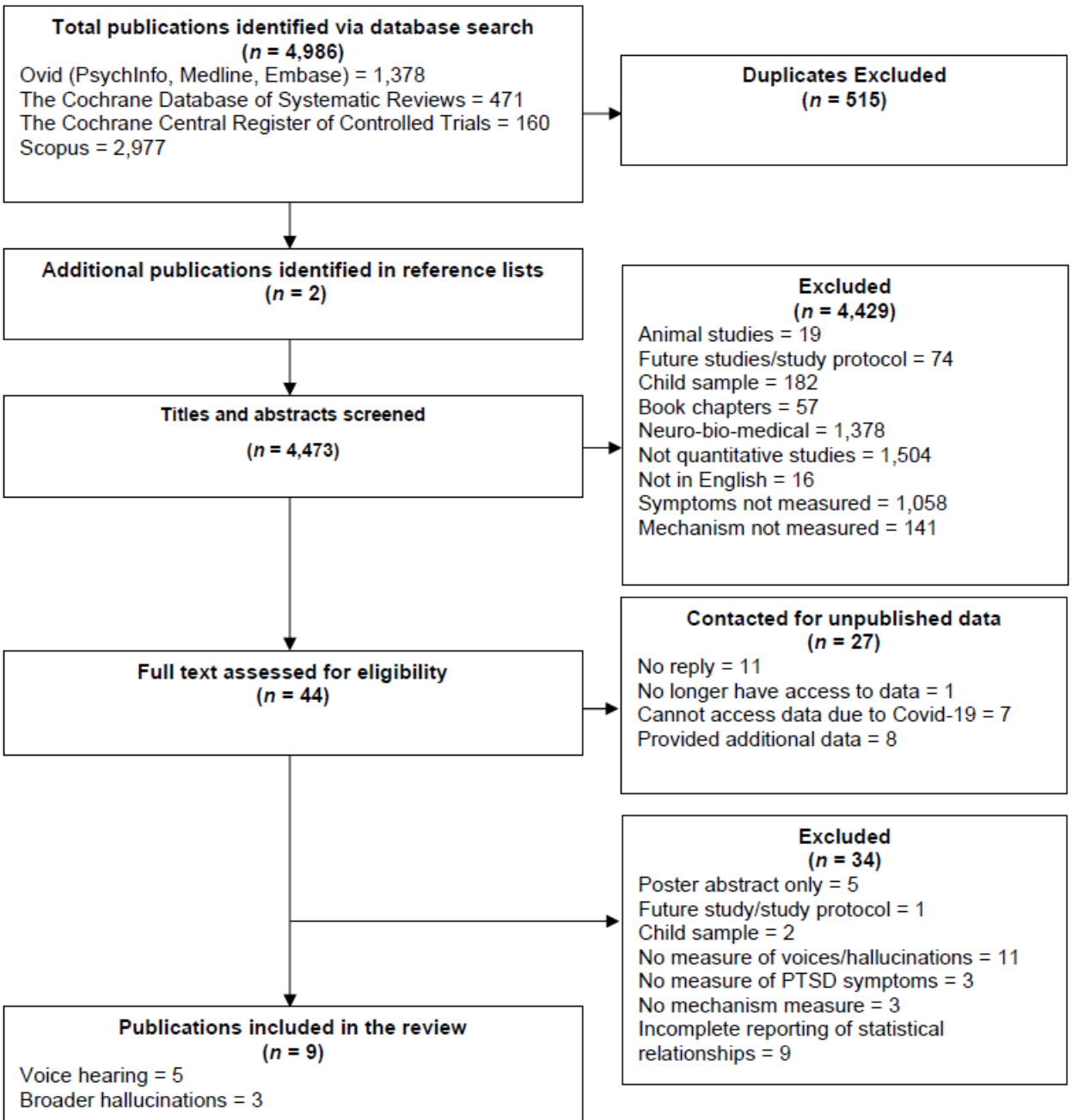
Results

Due to the small number of studies identified in the systematic literature search (see Table 1.1), a narrative review was conducted in place of a meta-analysis. Five publications, comprising six studies, measured voices as a distinct symptom set and, in combination, examined seven mechanisms; beliefs about voices, trauma-memory

appraisals, state dissociation, peri-traumatic dissociation, trait dissociation, thought suppression, and behavioural responses to voices. Three studies measured hallucinations across all sensory modalities (including voices). Together, these three studies measured six mechanisms: beliefs about voices, trauma appraisals, post-traumatic avoidance, self-concept clarity (stability of self-schemas), a sense of current threat, and intolerance of uncertainty. There was one treatment study and nine cross-sectional studies, and the authors of all studies provided results of additional analyses for this review. Together, these studies comprised 1,827 participants. A critical appraisal tool was used to evaluate the risk of bias associated with individual studies included in this review (Moola et al., 2020). All studies were evaluated to be of medium quality with a low risk of bias. The results from studies that examined voices as a distinct symptom set have been presented first, followed by those that examined broader hallucinations.

Figure 4.2

Flow Chart of Literature Selection



Note. The nine publications included in this review comprised ten studies that met inclusion criteria.

Table 4.1

Summary of Study Characteristics

Study	Sample characteristics	Sample size	Treatment	Voices measure	PTSD measure	Mechanism measure
Anketell et al., 2010	PTSD Group 1 - hearing voices Group 2 - no voices	*N* = 40 *n* = 20 *n* = 20	Yes, details not reported	N/A, compared groups	PDS	DES WBSI
Brewin & Patel, 2010	War veterans Group 1 – current PTSD Group 2 – past PTSD Group 3 – no PTSD	*N* = 158 *n* = 93 *n* = 21 *n* = 44	Not reported	Single item from DES-T	N/A	DES-T PDEQ
Brewin & Patel, 2010	Civilians Group 1 – current PTSD Group 2 = no PTSD	*N* = 44 *n* = 30 *n* = 14	Group 1 – yes, type of treatment not reported Group 2 – no treatment	Single item from DES-T	PSS	DES DES-T
Clarke et al., 2022	Schizophrenia with intrusive trauma memory	*N* = 12	Imagery rescripting	PSYRATS-AH	PDS-5	Single-item
Holt et al., 2018	Non-clinical, women who recently gave birth	*N* = 1393	Not reported	LSHS	IES	SCCS
Peach et al, 2019	First episode psychosis, diagnosis of psychotic disorder	*N* = 66	Yes, type of treatment not reported	PANSS - item 3	CAPS	PTCI CAPS subscale
Rajanthiran et al., 2022	Voice hearers Group 1 – Schizophrenia Group 2 – Schizophrenia with PTSD Group 3 – PTSD	*N* = 56 *n* = 19 *n* = 20 *n* = 17	Not reported	PSYRATS-AH	N/A	BAVQ-R CADSS
Wearne et al., 2018	PTSD with dissociation Group 1 – hearing voices Group 2 – no voices	*N* = 69 *n* = 41 *n* = 28	Yes, type of treatment not reported	N/A, compared groups	PSSI	DSPS
Wearne et al., 2020	Experiencing auditory hallucinations Group 1 – schizophrenia Group 2 – PTSD Group 3 – schizophrenia & PTSD	*N* = 71 *n* = 18 *n* = 27 *n* = 26	Yes, type of treatment not reported	PSYRATS-AH	PSSI	CADSS
White & Gumley, 2009	Diagnosis of schizophrenia Group 1 – post-psychotic PTSD Group 2 – no PTSD	*N* = 27 *n* = 10 *n* = 17	Yes, type of treatment not reported	PANNS – item 3	IES	FoRSe IVI IUS

Note. BAVQ-R = Beliefs About Voices Questionnaire-Revised; CADSS – Clinician-Administered Dissociative States Scale; CAPS – Clinician Administered PTSD Scale; DES - Dissociative Experiences Scale; DES-T - Dissociative Experiences Scale – Taxon; DSPS - Dissociative Subtype of PTSD Score; FoRSe - Fear of Recurrence Scale; IES – Impact of Events Scale, IUS – Intolerance of Uncertainty Scale; IVI – Interpretation of Voices Inventory; LSHS – Launay Slade Hallucinations Scale; PANNS – The Positive and Negative Syndrome Scale; PDS – Posttraumatic Stress Diagnostic Scale; PDS-5 = Posttraumatic Stress Diagnostic Scale for DSM-5; PSS – Posttraumatic Stress Scale; PDEQ – Peritraumatic Dissociative Experiences Scale; PSSI – PTSD Symptom Scale Interview; PSYRATS-AH – Psychotic Symptom Rating Scales – Auditory Hallucinations; PTCI – Posttraumatic Cognitions Inventory; SCCS – Self Concept Clarity Scale; WBSI – White Bear Suppression Inventory

The Relationship Between Voices, PTSD Symptoms, and Potential Mechanisms

Maladaptive Appraisals

Beliefs About Voices. One cross-sectional study examined the relationship between beliefs about voices and the severity of voices in three groups of voice hearers, each with different diagnoses: schizophrenia (*n* = 19), PTSD with dissociation (*n* = 17), and comorbid schizophrenia and PTSD with dissociation (*n* = 20; Rajanthiran et al., 2022). There were no significant differences in beliefs about voices between groups. However, unpublished bivariate correlations provided by the authors showed that within the schizophrenia group, the severity of voices showed a large negative association with benevolence beliefs (beliefs that voices have positive intent; *r* = -.80, *p* <.001), a medium positive association with omnipotence beliefs (beliefs that voice are powerful; *r* = .51, *p* = .03), and the non-significant small-medium positive association with malevolence beliefs (*r* = .34, *p* = .15) may be due to the small sample size. Within the PTSD group with schizophrenia, the severity of voices showed a non-significant small negative association with malevolence beliefs (*r* = -.10, *p* = .68), and non-significant medium negative associations with omnipotence (*r* = -.28, *p* = .23) and benevolence beliefs (*r* = -.34, *p* = .14) that were likely due to the small sample size. Within the PTSD group without schizophrenia, the severity of voices had a non-significant small association with omnipotence beliefs (*r* = -.13, *p* = .63), and the small sample size may account for the non-significant medium associations between the severity of voices, malevolence (*r* = -.24, *p* = .36), and benevolence beliefs (*r* = .23, *p* = .37).

Appraisals of Trauma Memories. One treatment study examined the relationship between the strength of distressing self-referential trauma-memory appraisals, PTSD symptoms, and the severity of voices in trauma-affected voice hearers with psychotic spectrum disorders (Clarke et al., 2022). Unpublished bivariate correlations calculated from baseline data that was provided by the authors showed non-significant small associations between trauma appraisals and the severity of PTSD symptoms (*r* = .09, *p* = .77), and the severity of voices (*r* = .20, *p* = .54). However, given the small sample size (*n* = 12), it is possible this study was insufficiently powered to detect these small effects. Additionally, as trauma appraisals were measured using a single-item measure that was developed by the authors, the validity and reliability of this measure is unknown.

Maladaptive Coping Strategies

Dissociation. Six studies have examined the relationship between voices, PTSD symptoms, and four different types of dissociation. Anketell et al. (2010) cross-sectionally examined the frequency of dissociative experiences (across a spectrum of mild to severe

dissociative experiences) and pathological dissociation (severe dissociative experiences that are typically associated with dissociative and trauma-spectrum disorders) within two groups of war veterans with PTSD: one group currently heard voices (*n* = 20) and the other reported no history of voices (*n* = 20). Unpublished bivariate correlations provided by the authors showed that in the total sample, there was a significant positive relationship between PTSD symptoms and dissociative experiences (*r* = .54, *p* < .001), and pathological dissociation (*r* = .50, *p* = .001). In the voice hearing group, there was a medium significant positive association between PTSD symptoms and dissociative experiences (r_{RHO} = .52, *p* = .02), and a medium but non-significant positive relationship between PTSD symptoms and pathological dissociation (r_{RHO} = .44, *p* = .05). In the non-voice hearing group, there was a significant positive association between PTSD symptoms and dissociative experiences (*r* = .64, *p* = .002), and pathological dissociation (*r* = .60, *p* = .006). Compared to non-voice hearers, voice hearers had significantly more frequent dissociative experiences and pathological dissociation (*d* = .88 and *d* = .79, respectively, *ps* < .02). Effect size calculations[4] based on reported data showed that voice hearers reported significantly higher rates of torture than non-voice hearers (φ = .35, *p* = .03). There was no significant difference in PTSD symptoms between groups (*d* = .26, *p* = .41).

Brewin and Patel (2010) conducted two cross-sectional studies to test the relationships between the frequency of voices and pathological dissociation, and the severity of peri-traumatic dissociation (dissociation during a traumatic event). The first study involved a sample of war veterans and compared voices and dissociation symptoms between three groups: one group had a current diagnosis of PTSD (*n* = 93, 58% reported voices), a second group had a past diagnosis of PTSD (*n* = 21, 65% reported voices), and a third group had no history of PTSD (*n* = 44, 21% reported voices). Unpublished bivariate correlations provided by the authors showed that in the current PTSD group, there was a significant positive association between the frequency of voices and pathological dissociation (*r* = .58, *p* < .001), and peri-traumatic dissociation (*r* = .26, *p* = .02). In the group with no history of PTSD, there was a significant positive relationship between the frequency of voices and pathological dissociation (*r* = .45, *p* = .002) and a non-significant negative association between the frequency of voices and peri-traumatic dissociation (*r* < -.01, *p* = .99). In contrast, in the past PTSD group, there was a non-significant positive association between the frequency of voices and pathological dissociation (*r* = .14, *p* =

[4] Cohen's *d* effect sizes calculated as M_{pre}-M_{post}/SD_{pooled}, Phi effect sizes calculated as $\sqrt{\chi^2/n}$

.55), and a non-significant negative association with peri-traumatic dissociation (r = -.22, p = .38).

Effect size calculations based on reported data found that the current PTSD group had significantly more frequent voices than the no PTSD group (d = .83, p < .05). The current PTSD group had significantly more frequent pathological dissociation than the past PTSD group (d = .95, p < .05) and no PTSD group (d = 1.68, p < .05), as did the past PTSD group when compared to the no PTSD group (d = 1.15, p < .05). The current PTSD group reported significantly more peri-traumatic dissociative experiences[5] than the no PTSD group (d = .82, p < .05). The no PTSD group had a significantly lower number cumulative PTSD symptoms than the current and past PTSD groups (d = 5.36 and d = 4.81, respectively, p <.05). There were no other significant differences between groups (d = .28 to .82, ps ≥ .05). However, as the past and no PTSD groups were small, this study may have been insufficiently powered to detect these effects.

Brewin and Patel's (2010) second study compared the frequency of voices, dissociative experiences, and pathological dissociation between a group of civilians with a diagnosis of PTSD (n = 30, trauma was primarily experienced in adulthood) and a civilian control group who had experienced a Criterion A trauma (APA, 2013) but did not meet diagnostic criteria for PTSD (n = 13). Unpublished data provided by the authors showed that in the total sample, there were significant positive relationships between the frequency of voices and dissociative experiences, pathological dissociation, and the severity of PTSD symptoms (rs = .70, .78, and .63, respectively, ps < .001), and between the severity of PTSD symptoms and the frequency of dissociative experiences, and pathological dissociation (rs = .72 and .66, respectively, ps < .001). In the PTSD group, voices were significantly positively associated with the frequency of dissociative experiences, pathological dissociation, and the severity of PTSD symptoms (rs = .63, .75, and .46, respectively, ps ≤ .03). There was also a significant positive relationship between the severity of PTSD symptoms and the frequency of dissociative experiences, and pathological dissociation (rs = .74 and .66, respectively, ps < .001). In the no PTSD control group, there was a non-significant positive association between voices and the frequency of dissociative experiences (r = .71, p = .08), pathological dissociation, and the severity of PTSD symptoms (both rs = .55 and ps = .20). It is likely that this study was not sufficiently powered to detect medium effects given the small sample size for the no-PTSD control group. However, there was a significant positive association between the severity of PTSD

[5] Only participants who reported combat-related trauma completed the measure of peri-traumatic dissociation (current PTSD, n = .89; past PTSD, n = .20, no PTSD, n = .27)

symptoms and the frequency of dissociative experiences, and pathological dissociation in the no PTSD control group (*r*s = .84 and .79, respectively, *p*s ≤ .03).

Published data revealed that compared to the no PTSD control group, the PTSD group had significantly more frequent voices, dissociative experiences, pathological dissociation, and more severe PTSD symptoms (*d* = 1.56; *d* = 1.45; *d* = 1.38, and *d* = 3.97, respectively, *p*s < .05). In summary, in the PTSD group, there were positive relationships between voices and the frequency of dissociative experiences and pathological dissociation. These relationships were not significant in the no PTSD group. Across both groups, there were positive relationships between the severity of PTSD symptom and the frequency of dissociative experiences and pathological dissociation. The PTSD group had significantly more frequent voices, dissociative experiences, pathological dissociation, and more severe PTSD symptoms than the no PTSD control group.

Wearne et al.'s (2018) cross-sectional study examined the differences in the severity of pathological dissociation between two groups with a diagnosis of PTSD with dissociation: one group reported voices (*n* = 41) whereas the other group did not (*n* = 28). Point biserial correlations using unpublished data provided by the authors showed that, in the total sample, there was a significant positive correlation between voices (dichotomous variable) and pathological dissociation, and PTSD symptoms (*r*s = .46 and .33, respectively, *p*s ≤ .007), and between PTSD symptoms and pathological dissociation (*r* = .69, *p* < .001). In both the voice hearing and non-voice hearing groups, there was a significant positive relationship between the severity of PTSD symptoms and pathological dissociation (*r* = .66 and *r* = .68, respectively, *ps* <.001). The following effect sizes were calculated from the reported group data. The voice hearing group were more likely to have experienced sexual violence trauma (68% versus 39%, respectively). The voice hearing group had significantly more severe pathological dissociative than the non-voice hearing group (*d* = 1.04, *p* < .001), which included dissociative symptoms of derealisation/depersonalisation (*d* = .88, *p* = .001) and loss of awareness (*d* = .74, *p* = .005). There were no significant between-group differences in dissociative psychogenic amnesia (*d* = .10, *p* = .70). In summary, there were positive associations between dissociation and PTSD symptoms in both groups. Voice hearers with PTSD had significantly more severe pathological dissociative symptoms compared to those with PTSD with no voices.

Rajanthiran et al. (2022) cross-sectionally examined the associations between state dissociation (transient dissociative symptoms), voices, and PTSD symptoms within three voice hearing groups: PTSD with dissociative symptoms (PTSD), schizophrenia (SCZ),

and comorbid schizophrenia and PTSD with dissociative symptoms (PTSD+SCZ). Between-group differences in state dissociation were not assessed. Whilst there were medium-large associations between voice severity and state dissociation in the two PTSD groups (PTSD group r = .57, p = .02, and PTSD+SCZ group r = .65, p = .002), the medium association in the SCZ group was not significant (r = .47, p = 0.05). As this study had a small sample (n = 17), it may have lacked the power to detect these effects.

Wearne et al. (2020) cross-sectionally examined differences in the relationship between voices and state dissociation within two voices hearing groups: one group had PTSD (PTSD; n = 27) and the other had a comorbid PTSD and schizophrenia (PTSD+SCZ; n = 26). Unpublished data provided by the authors showed that in the total sample, there were significant positive associations between voices and PTSD symptoms (r = .48, p < .001), between voices and state dissociation, and between PTSD symptoms and state dissociation (both rs = .64, ps < .001). Reported data and unpublished date provided by the authors showed that in the PTSD group, there were significant positive associations between voices and PTSD symptoms (r = .55, p < .001), and state dissociation (r = .54, p < .05), and between PTSD symptoms and state dissociation (r = .66, p < .001). Similarly, in the PTSD+SCZ group, there were also significant positive associations between voices and PTSD symptoms (r = .82, p < .001), and state dissociation (r = .37, p < .05), and between PTSD symptoms and state dissociation (r = .54, p < .05).

The following effect sizes were calculated from the reported group data. Compared to the PTSD+SCZ group, the PTSD group had significantly more severe PTSD symptoms (d = 1.00, p < .05) and state dissociation (d = .68, p < .05). On dissociative subscales, the PTSD group had significantly higher dissociative depersonalisation than the PTSD+SCZ group (d = .96, p < .05). There were no other statistically significant group differences (ds = .07 to .45, ps ≥ .05). In summary, there were positive relationships between voices and state dissociation, and between PTSD symptoms and state dissociation in both groups. The PTSD group had significantly higher PTSD symptoms and state dissociation than the PTSD+SCZ group.

Overall, these studies found positive relationships between dissociation and PTSD symptoms, regardless of the presence of voices or PTSD diagnostic status (Anketell, 2010; Brewin & Patel, 2010; Wearne et al. 2018; 2020), and between dissociation and voices, but only amongst people with PTSD (Brewin & Patel, 2010; Rajanthiran et al., 2022; Wearne et al., 2020). There was a positive relationship between pathological dissociation and PTSD symptoms, but only amongst those who have PTSD without voices

(Anketell, 2010), and a positive relationship between dissociation and voices amongst people with current PTSD and no history of PTSD (Brewin & Patel, 2010). There was a positive relationship between voices and peri-traumatic dissociation amongst people with a current diagnosis of PTSD (Brewin & Patel, 2010), and a positive relationship between voices and state dissociation amongst people with PTSD and PTSD with comorbid schizophrenia (Rajanthiran et al., 2022). Additionally, people with a diagnosis of PTSD, and people who hear voices, report more dissociative experiences, pathological dissociation, and peri-traumatic dissociation compared to those without PTSD, and without voices (Anketell, 2010; Brewin & Patel, 2010; Rajanthiran et al., 2022; Wearne et al., 2018). However, voice hearers with PTSD report more dissociative symptoms than those with comorbid schizophrenia (Wearne et al., 2020).

Thought suppression. One cross-sectional study examined the relationship between PTSD symptoms and the tendency to suppress thoughts between two groups (n = 20 per group) with PTSD; one with and one without voices (see above; Anketell et al., 2010). Given that voices have been conceptualised as dissociated inner speech (Berry & Bucci, 2016; Hardy, 2017; Strachan et al., 2022b), it is possible that thought suppression may comprise voice suppression. Unpublished bivariate correlations provided by the authors showed that there was a significant positive relationship between PTSD symptoms and thought suppression in the total sample (r_{RHO} = .56, p < .001), in the voice hearing group (rs$_{RHO}$ = .57, p = .009), and in the non-voice hearing group (rs$_{RHO}$ = .63; p = .003). There was no significant difference in thought suppression between groups (d = .08, p = .80). In summary, there was a positive association between PTSD symptoms and thought suppression in both groups.

Engagement Versus Resistance to Voices. One cross-sectional study (Rajanthiran et al., 2022) examined associations between the severity of voices and the behavioural responses to voices within two domains: resistance (attempts to avoid, stop, or ignore voices) and engagement (willingly listens to, complies with, seeks out voices; Chadwick et al., 2000). These associations were examined within three voice hearing groups with different diagnoses: schizophrenia (SCZ), PTSD with dissociation (PTSD), and comorbid schizophrenia and PTSD with dissociation (PTSD+SCZ; Rajanthiran et al., 2022). There were no significant differences in behavioural responses to voices across groups. Unpublished bivariate correlations provided by the authors showed that there were small and non-significant associations between behavioural responses to voices in the PTSD+SCZ or PTSD groups (rs < .24, ps > .05). However, within the SCZ group, there

was a significant large association between the severity of voices and engagement (r = .71, p = .001).

The Relationship Between Broader Hallucinations, PTSD Symptoms, and Potential Mechanisms

A Sense of Current Threat

One cross-sectional study tested differences in the severity of hallucinations, PTSD symptoms, and fear of reoccurrence (a sense of current threat) between two groups with schizophrenia: one group met criteria for a diagnosis of post-psychotic PTSD (PTSD symptoms are associated with the experience of psychosis, n = 10), whereas the other did not meet criteria for PTSD (no PTSD; n = 17; White & Gumley, 2009). Neither group had PTSD symptoms related to non-psychosis related events. Unpublished bivariate correlations provided by the authors (White & Gumley, 2009) showed that in the total sample there were non-significant positive associations between the severity of hallucinations and PTSD symptoms (r = .17, p = .40), and a sense of current threat (r = .22, p = .26), and a significant positive association between a sense of current threat and the severity of PTSD symptoms, including avoidance, intrusiveness, and hyperarousal subscales (rs = .74, .63, .63, and .75, respectively, and ps < .001). In the PTSD group, there were non-significant but small to medium or medium positive associations between hallucination severity and PTSD symptoms (r = .50, p = .14), and a sense of current threat (r = .35, p = .32), and between PTSD symptoms and a sense of current threat (r = .57, p = .09). In the no-PTSD group, there were non-significant positive associations between the severity of hallucinations and PTSD symptoms (r = .23, p = 36), and between a sense of current threat and the severity of hallucinations, and the severity of PTSD symptoms (r = .38, p = .12, and r = .31, p = .21, respectively). The statistical significance of these effects was likely affected by low power due to the small samples.

The following effect sizes were calculated from reported and unpublished group data provided by the authors (White & Gumley, 2009). The PTSD group had significantly more severe PTSD symptoms (d = 2.34, p < .01) and higher sense of current threat (d = 1.66, p < .01) compared to the no PTSD group, which included fear of relapse and fear of intrusiveness subscales (ds = 1.55 and 1.39, respectively, ps < .01). There was no significant difference in the severity of hallucinations between groups (d = .12, p = .93). In summary, there were no significant relationships between a sense of current threat and hallucinations or PTSD symptoms within either diagnostic group, but the PTSD group had significantly higher average sense of current threat than the no PTSD group.

Maladaptive Appraisals

Trauma appraisals. Peach et al. (2019) explored associations between PTSD symptoms, hallucination severity, and trauma beliefs (i.e., appraisals) amongst people experiencing first episode psychosis who met criteria for a psychotic disorder (n = 66). Trauma appraisals comprised negative beliefs about the meaning of the trauma in relation to oneself, the world, and self-blame; higher scores indicated more negative appraisals. Hallucination severity was significantly positively associated with overall PTSD symptoms, including post-traumatic intrusions and avoidance, (r = .47, r = .44, and r = .43, respectively ps < .01) and trauma appraisals (r = .36, p < .01), and there was a significant positive relationship between overall PTSD symptoms, including post-traumatic intrusions and avoidance, and trauma appraisals (rs = .46, .48, and .49, respectively, ps ≤.05).

Additionally, a two-stepped hierarchical regression found that in step one, comorbid delusions and post-traumatic avoidance together accounted for 15% of variation in hallucination severity (R^2 = .15, $F(2, 60) = 5.43$, p < .01); comorbid delusions was not a significant predictor (sr^2 = .01, β = .12, p > .05) but post-traumatic avoidance was a significant predictor of hallucination severity (β = .33, p = .01). When childhood trauma, post-traumatic intrusions, and trauma appraisals were added they explained an additional 11% of variance in hallucination severity, R^2_{change} = .11, $F_{change}(3, 57) = 2.85$, p = .04). In combination, the five predictors accounted for 26% of variance in hallucination severity (f^2 = .35). However, in the full model, post-traumatic intrusions was the only significant predictor of hallucination severity (sr^2 = .09, β = .53, p = .01).

Beliefs About Voices. One cross-sectional study tested differences in the severity of hallucinations, PTSD symptoms, and the interpretation of voices (voice appraisals) between two groups (post-psychotic PTSD and no PTSD) with schizophrenia (White & Gumley, 2009; see above for study details). Unpublished bivariate correlations provided by the authors showed that in the total sample there was a non-significant positive association between voice appraisals and the severity of hallucinations (r = .35, p = .07), and a significant positive association between voice appraisals and the severity of PTSD symptoms (r = .45, p = .02), including avoidance (r = .40 p = .04), intrusiveness (r = .42, p = .03), and hyperarousal subscales (r = .44, p = .02). In the PTSD group, there was a non-significant positive association between voice appraisals and the severity of hallucinations (r = .58, p = .08), and a significant positive association with the severity of PTSD symptoms (r = .86, p = .002), which included avoidance (r = .75, p = .01), intrusiveness (r = .65, p = .04), and hyperarousal subscales (r = .88, p = .001). The severity of PTSD symptoms was significantly and positively associated with the metaphysical appraisals (i.e., voices have transcendental meanings; r = .76, p = .01) and loss of control appraisals

subscales (i.e., voices mean I am losing control; r = .75, p = .01). There was also a non-significant positive association between the severity of PTSD symptoms and the positive appraisals about voices subscale (i.e., voices are helpful/mean that I am special; r = .56, p = .09). In the no-PTSD group, there was a non-significant positive association between voice appraisals and the severity of hallucinations, and the severity of PTSD symptoms (r = .16, p = .52, and r = .27, p = .28, respectively). In summary, there was no significant relationship between voice appraisals and hallucinations in either diagnostic group. There was a positive relationship between voice appraisals and PTSD symptoms in the PTSD group, but not in the no-PTSD group.

Maladaptive Coping Strategies

Avoidance. Peach and colleagues (2019) also examined post-traumatic avoidance (avoidance of trauma-related stimuli) as a predictor of hallucination severity and found that it was significantly positively associated with hallucination severity and overall PTSD symptoms (r = .43 and r = .47, respectively, ps < .01). However, a two-stepped hierarchical regression found that although post-traumatic avoidance was a significant predictor of hallucination severity (sr^2 = .09, β = .33, p = .01), when post-traumatic intrusions and trauma appraisals were added to the model, it was no longer a significant predictor.

Schemas

One study examined the relationship between hallucinations, PTSD symptoms, and self-concept clarity (Holt et al., 2018). Self-concept clarity involves the degree to which a person's schematic structure has stable, strongly held, clearly defined, and cognitively accessible self-schemas (Campbell et al., 1996). The study was conducted with mothers who had no history of psychosis and gave birth two to six months prior to recruitment into the study (N = 1303). Hallucinations and PTSD symptoms were positively significantly associated (r = .39, p < .01), and self-concept clarity had a significant negative association with both hallucinations and PTSD symptoms (r = -.40 and r = -.41, respectively, ps < .01).

Intolerance of Uncertainty

Intolerance of uncertainty is a dispositional fear of the unknown and an inability to endure the aversive responses associated with perceptions of uncertainty (Carleton, 2016), and can be considered a psychological vulnerability within the TRV model (Figure 3.2). Previous research has demonstrated an association between IU and multiple emotional disorders (McEvoy et al., 2019) including PTSD symptoms (Raines et al., 2019). White and Gumley's (2009, see above for study details) cross-sectional study examined associations between severity of hallucinations, PTSD symptoms, and intolerance of uncertainty in individuals with schizophrenia who had post-psychotic PTSD or no PTSD

(White & Gumley, 2009; see above for study details). Unpublished bivariate correlations provided by the authors showed that in the total sample there was a non-significant positive association between intolerance of uncertainty and the severity of hallucinations (r = .29, p = .14), and significant positive associations between intolerance of uncertainty and the severity of PTSD symptoms (r = .63, p < .001), including avoidance (r = .48 p = .01), intrusiveness (r = .58, p = .001), and hyperarousal subscales (r = .61, p < .001). In the PTSD group (n = 10), there was a non-significant medium positive association between intolerance of uncertainty and the severity of hallucinations (r = .52, p = .12), and a significant positive association between intolerance of uncertainty and PTSD symptoms (r = .81, p = .004), which included avoidance, intrusiveness (both r = .68, p = .03), and hyperarousal subscales (r = .79, p = .006). In the no PTSD group (n = 17), there was a non-significant positive association between intolerance of uncertainty and the severity of hallucinations (r = .10, p = .69), and a non-significant positive association with the severity of PTSD symptoms (r = .42, p = .08).

Effect sizes calculated from the reported group data revealed that the PTSD group had significantly higher intolerance of uncertainty than the no PTSD group (d = .97, p < .05). In summary, there was no significant relationship between intolerance of uncertainty and hallucinations in either diagnostic group, although the small sample size likely militated against the effects reaching statistical significance in several instances. The magnitude of the effect was smallest with respect to hallucinations and intolerance of uncertainty in the no PTSD group, but all other effects were medium to large. There was a relationship between intolerance of uncertainty and PTSD symptoms in PTSD group, but not in the no PTSD group.

Discussion

The aim of this study was to systematically review evidence for mechanisms within the model. The systematic review identified seven studies that examined voices and three studies that measured broader hallucinations, which together, examined twelve mechanisms: beliefs about voices, trauma appraisals, state dissociation, dissociative experiences, pathological dissociation, peri-traumatic dissociation, thought suppression, behavioural responses to voices, post-traumatic avoidance, self-concept clarity (schema stability), a sense of current threat, and intolerance of uncertainty. The results of these studies have been discussed below in relation to the TRV model, starting from the left of the model (see Figure 3.2) and moving toward the right.

Vulnerability Factors

Vulnerability factors were not a focus of this systematic review. However, there is recent meta-analytical evidence that several proposed mechanisms within the TRV model increase vulnerability to hallucinations (Bloomfield et al., 2020). Dissociation, emotion dysregulation and PTSD symptoms such as avoidance, numbing (e.g., withdrawal), and hyperarousal (i.e., a sense of current threat) mediate the relationship between trauma and hallucinations (Bloomfield et al., 2020). Although these findings do not provide evidence that these variables maintain voices, they do suggest that these variables may be important in explaining related trauma-related voices, and thereby provide additional support for the TRV model. One study in the current review also revealed that intolerance of uncertainty was associated with PTSD symptoms but not hallucinations, suggesting that this factor might be specific to PTSD rather than voices (White & Gumley, 2009).

Insecure Attachment

No studies explicitly examined the relationship between insecure attachment, PTSD, and voices. However, Holt et al. (2018) found that greater stability of self-schemas (self-concept clarity) is negatively associated with PTSD symptoms and hallucinations. Although self-concept clarity is not explicitly identified in the TRV model, it may be related to insecure attachment. For example, schemas influence a person's cognitions and behaviour, are closely related to attachment styles, and insecure attachment styles are often characterised by an unstable sense of self (Teyber & Teyber, 2017). Although these findings may provide some indirect evidence that insecure attachment is related to voices, this is a key area for future research, particularly considering that insecure attachment is theorised to influence multiple other mechanisms within the TRV model.

Peri-Traumatic Information Processing Errors and Poor Autobiographical Memory Integration

Higher levels of peri-traumatic dissociation were associated with a current diagnosis of PTSD and there was a weak relationship between peri-traumatic dissociation and voices across diagnostic groups (current, past, and no history of a PTSD diagnosis; Brewin & Patel, 2010). However, this relationship was only significant amongst those with a current PTSD diagnosis. Although peri-traumatic dissociation is a time-limited process and, therefore, cannot operate as a maintaining mechanism, it may exacerbate information processing errors during trauma that disrupt normal memory processes, which, in turn, produce and maintain trauma memory intrusions. This evidence may provide some support for the role of poor autobiographical memory integration in trauma-related voices. However, as the TRV model (Figure 3.2) indicates that variations in autobiographical

memory disintegration explains direct versus indirect voices, there is a need for future research to explore the nature of autobiographical memory integration (i.e., between episodic, perceptual, and personal semantic memory domains) amongst trauma-affected voice hearers through autobiographical memory assessments (see Lapidow & Brown, 2016 for summary). Additionally, there is a need to test whether differences in autobiographical memory processes exist between PTSD re-experiencing symptoms and direct trauma-related voices, and between direct and indirect trauma-related voices.

Maladaptive Schemas and Schematic Assimilation Processes

No studies examined the relationship between schemas, PTSD symptoms, and voices. Clarke et al. (2022) found no association between trauma appraisals, which are theorised to shape negative schemas (Brewin & Holmes, 2003; Dalgleish, 2004; Strachan et al., 2002a), and voices, or PTSD symptoms. However, Peach et al. (2019) found a medium relationship between trauma appraisals and both hallucination severity and PTSD symptoms. These mixed findings may be due to differences in the measurement of these variables. Although trauma appraisals predicted hallucination severity, once added as a predictor, post-traumatic intrusions were the only significant predictor of hallucination severity (Peach et al., 2019). Thus, it is possible that intrusions may mediate the relationship between trauma appraisals and hallucinations, and future research is needed to examine this relationship.

No studies explicitly examined the relationship between schematic assimilation failure and trauma memory intrusions. Whilst Holt et al.'s (2018) study of self-schema stability may provide evidence that insecure attachment is related to trauma and hallucination symptoms, alternatively, these findings may provide evidence for schematic assimilation failure. For example, it is possible that, rather than being trait-like (i.e., related to attachment patterns), self-concept instability may be time-limited and/or event-specific. Thus, one's self-concept may become temporarily unstable due to difficulties integrating the meaning of traumatic events (e.g., traumatic birth) into one's schematic network (Dalgleish, 2004; Horowitz, 2011). Future research is needed to examine the associations between different types of trauma-related voices, PTSD symptoms, and appraisals, schemas, and schematic assimilation.

Trauma Memory Intrusions

No studies specifically examined the relationship between trauma memory intrusions, PTSD symptoms, and voices. Although Peach et al. (2019) suggested that post-traumatic intrusions may mediate the relationship between other mechanisms (post-traumatic avoidance and trauma appraisals) and hallucination severity, this relationship

was not examined and may be an important future research direction. As intrusions are theorised to be associated with highly detailed perceptual information and poorly detailed episodic information (and related to direct voices; Hardy, 2017; Strachan et al., 2002a), future research should test the relationship between autobiographical memory processes and intrusions across different types of trauma-related voices.

Inner Dialogue

No studies examined the relationship between inner dialogue, PTSD symptoms, and voices. Inner dialogue is theorised to be associated with highly detailed personal semantic information alongside poorly detailed episodic information related to past traumatic events (and related to indirect voices; Hardy, 2017; Strachan et al., 2002a). Future research should explore the relationship between autobiographical memory processes and mental imagery across different types of trauma-related voices.

Negative Affect and a Sense of Current Threat

No studies examined the relationship between negative affect and voices. There was no significant relationship between a sense of current threat and hallucinations, or PTSD symptoms, irrespective of PTSD diagnosis (White & Gumley, 2009), which suggests that a sense of current threat may not be related to hallucinations or PTSD symptoms. Future research is needed to test the relationship between negative affect and trauma-related voices specifically.

Emotion Regulation Deficits

No studies examined the relationship between emotion regulation, PTSD symptoms, and voices. As emotion regulation deficits are theorised to trigger maladaptive coping strategies (Berry et al., 2017; Hardy, 2017; Tarrier, 2006; Strachan et al., 2002a), future research should explore these relationships amongst trauma affected voice hearers.

Maladaptive Coping Strategies

Dissociation

There were mixed findings for the association between dissociation, voices, and PTSD symptoms, which may be due to differences in the definitions of dissociation across studies. There was evidence that dissociative experiences were associated with voices and PTSD symptoms. With regards to a spectrum of dissociative experiences, people with voices and people with PTSD experienced significantly more dissociative experiences than people without voices and people without PTSD (Anketell et al., 2010; Brewin & Patel, 2010). There were medium to large associations between voices and dissociative experiences amongst people with PTSD but not amongst those without PTSD (Brewin & Patel, 2010). There were large relationships between PTSD symptoms and dissociative

experiences amongst those with and without PTSD, and both with and without voices (Anketell et al., 2010; Brewin & Patel, 2010). Together, these findings suggest that dissociative experiences are associated with PTSD symptoms, regardless of voice hearing or diagnostic status, but that dissociative experiences are only associated with voices in trauma-affected people with PTSD.

Regarding pathological dissociation, people with PTSD (with and without voices) have significantly higher pathological dissociation than people without PTSD (Brewin & Patel, 2010). There were medium to large associations between pathological dissociation and PTSD symptoms in people with and without PTSD (Brewin & Patel, 2010), and in people with PTSD who do not hear voices (Anketell et al., 2010; Wearne et al., 2018). Whilst one study found the medium association between pathological dissociation and PTSD symptoms was also significant amongst people with PTSD who hear voices (Wearne et al., 2018), another found this association was not significant within this group (Anketell et al., 2010). There were medium to large relationships between voices and pathological dissociation amongst people with and without PTSD (Brewin & Patel, 2010). Together, these findings suggest that pathological dissociation may be associated with voices, regardless of PTSD status, and whilst pathological dissociation is associated with PTSD symptoms in people with and without PTSD, future studies are needed to examine whether the significance of this relationship varies depending on whether people with PTSD hear voices.

State dissociation was significantly higher in voice hearers with PTSD without comorbid schizophrenia, compared to those with schizophrenia with and without comorbid PTSD (Rajanthiran et al., 2022; Wearne et al., 2020). There were medium to large associations between state dissociation and PTSD symptoms, and state dissociation and voices amongst voice hearers with PTSD and voice hearers with comorbid PTSD and schizophrenia (Rajanthiran et al., 2022; Wearne et al., 2020). However, amongst voice hearers with schizophrenia (without PTSD), these associations were not significant (Rajanthiran et al., 2022; Wearne et al., 2020). Together, these findings suggest that state dissociation is associated with both voices and PTSD symptoms, but only amongst voice hearers with PTSD.

In summary, there is evidence that PTSD symptoms are associated with dissociative experiences (across a spectrum of relatively normal to severe symptoms) and pathological dissociation, regardless of PTSD diagnostic status. However, the association between PTSD symptoms and pathological dissociation amongst people with PTSD who hear voices is less clear. Voices are associated with pathological dissociation, regardless

of PTSD diagnostic status, and are only associated with broader dissociative experiences in people with PTSD, which may suggest that people with PTSD tend to experience more severe dissociative experiences (i.e., pathological), and that less severe (relatively normal) dissociative experiences are not related to voices. Finally, both PTSD symptoms and voices are associated with state dissociation, but only amongst people who meet criteria for PTSD, regardless of whether they have comorbid schizophrenia.

Whilst the TRV model does not specify that a particular type of dissociation underlies trauma-related voices, it suggests that dissociative responses to distressing inner dialogue may disrupt normal cognition, thereby causing inner dialogue to be misperceived as a voice. One explanation for these findings is that voices are linked to more severe state-based dissociative reactions to specific triggers, such as unwanted and distressing inner dialogue, whereas PTSD is related to trait, state, and pathological dissociative symptoms, which may provide some support for the TRV model. Another finding was that, compared to non-voice hearers, voice hearers reported higher rates of sexual trauma (Wearne et al., 2018) and torture (Anketell et al., 2010). It is possible that prolonged, intentionally violent forms of trauma increase the likelihood that people develop a tendency to dissociate to cope with distressing stimuli (Berry et al., 2017). Alternatively, it may be that in some trauma-affected individuals, dissociation interacts with other mechanisms to increase the likelihood of trauma-related voices, or that different types of dissociation underlie trauma-related versus non-trauma-related voices. Future studies are needed to explore the relationship between non-trauma-related voices, indirect voices, direct voices, and different types of dissociation (e.g., identity alteration, depersonalisation, derealisation, discontinuation of awareness, and dissociative amnesia), different forms of dissociation (trait-based versus state-based), across the dissociative spectrum (general dissociative experiences versus pathological dissociation) in larger samples.

Thought Suppression

There were no differences in thought suppression between voice hearers with PTSD and non-voice hearers with PTSD, and there was a medium-large relationship between PTSD symptoms and thought suppression in both voice hearers and non-voice hearers (Anketell et al., 2010). Given that voices have been conceptualised as dissociated inner speech (Berry & Bucci, 2016; Hardy, 2017; Strachan et al., 2022a), it is possible that thought suppression may comprise voice suppression. If so, these findings suggest that voice suppression may be related to PTSD symptoms but may not be related to trauma-related voices. However, as voice suppression was not specifically examined, firm

conclusions cannot be drawn from these findings and future research should explicitly test the relationship between voice suppression and different types of trauma-related voices.

Avoidance

Post-traumatic avoidance was moderately associated with both hallucination severity and PTSD symptoms (Peach et al., 2019), which suggests that avoidance-based coping it is related to both sets of symptoms. Additionally, avoidance has been theorised to perpetuate other mechanistic processes, such as a lack of autobiographical memory integration, whereby avoidance of trauma memories prevents successful reintegration of such information into relevant memory systems (Brewin et al., 1996). However, post-traumatic avoidance was not a significant predictor of hallucination severity once post-traumatic intrusions and trauma appraisals were included in the regression model, which suggests that the effect of post-traumatic avoidance on hallucination severity may be mediated by intrusions and trauma appraisals. However, future studies are needed to examine the temporal relationships between avoidance-based coping and different types of voices, and if future studies find evidence that these variables operate as mediators, the TRV model should be updated to reflect these relationships.

Maladaptive Appraisals of Voices and Intrusions

No studies examined the relationship between maladaptive appraisals of intrusions, PTSD symptoms, and voices. There were no significant associations between voice appraisals and hallucinations, or voices amongst voice hearers with schizophrenia, PTSD, or comorbid schizophrenia and PTSD (Rajanthiran et al., 2022; White & Gumley, 2009). There was a large relationship between voice appraisals and PTSD symptoms amongst voice hearers with comorbid schizophrenia and PTSD, but not amongst those without comorbid PTSD (White & Gumley, 2009). These findings suggest that voice appraisals may interact with PTSD symptoms amongst individuals with clinical levels of PTSD symptoms, but may not be associated with the severity of voices. Additional research is needed within larger transdiagnostic samples to explore the relationship between different types of trauma-related voices, appraisals of voices, and appraisals of intrusions.

Intrusion-Related Information Processing Errors

No studies examined the relationship between (post-trauma) intrusion-related information processing errors, PTSD symptoms, and voices. Research is needed to test the relationship between specific information processing errors and each type of trauma-related voices.

Intolerance of Uncertainty

There was no significant relationship between intolerance of uncertainty and hallucinations amongst individuals with schizophrenia, regardless of whether participants had comorbid post-psychosis PTSD (White & Gumley, 2009). However, there were medium to large relationships between intolerance of uncertainty and PTSD symptoms amongst those with schizophrenia, both with and without post-psychotic PTSD (White & Gumley, 2009). These findings suggest that intolerance of uncertainty may not play a role in trauma-related voices and may rather be a vulnerability factor for PTSD symptoms specifically.

Strengths, Limitations, and Additional Future Research Directions

There were several common limitations across the studies included in the systematic review that restrict the ability to draw firm conclusions. Most studies did not report whether the content of participants' voices was related to past trauma and did not measure the type of voices experienced by their participants (i.e., direct vs. indirect). This limits the ability to apply these findings to the TRV model and, therefore, whether relationships are associated with distinct or both types of voices. Future research should assess and report whether participants experience direct, indirect, or both types of voices to determine whether mechanistic processes differ across different types of voices, to determine whether trauma-voice associations change during treatments, and whether certain trauma-voice associations are more resistant to change. Finally, coronavirus lockdowns prevented some authors from accessing unpublished data that otherwise may have been included in this review (n = 7).

There is a strong need for future research to provide multiple types of evidence. Most studies were cross-sectional (Anketell et al., 2010; Brewin & Patel, 2010; Holt et al., 2018; Peach et al., 2019; Rajanthiran et al., 2022; Wearne et al., 2018; Wearne et al., 2020; White & Gumley, 2009), which are helpful for providing preliminary evidence of covariance between potential mechanisms and trauma-related voices. Future research is needed to test for covariance between previously un-examined mechanisms within the TRV model (i.e., insecure attachment, schemas and schematic processes, intrusions, mental imagery, emotion regulation, voice engagement, and post-traumatic information processing) and to replicate findings from past studies that examined relationships between dissociation, self-concept stability, peri-traumatic dissociation, a sense of current threat, appraisals, and avoidance (Anketell et al., 2010; Brewin & Patel, 2010; Holt et al., 2018; Peach et al., 2019; Wearne et al., 2018; Wearne et al., 2020; White & Gumley, 2009). As the TRV model (Strachan et al., 2022a) suggests that specific PTSD symptoms (e.g., intrusions, avoidance) may underlie trauma-related voices, future studies are also

needed to examine the associations between these specific symptoms, voices, and broader PTSD symptoms in voice hearers. Furthermore, according to the TRV model (Strachan et al., 2022a), it is likely that mechanisms interact in the pathway to trauma-related voices, which suggests future studies are needed to examine evidence for the associations between mechanisms in the pathways from trauma to PTSD symptoms and voices. Another limitation of past studies is the use of small sample sizes (Anketell et al., 2010; Brewin & Patel, 2010; Wearne et al., 2018; Wearne et al., 2020; White & Gumley, 2009), which may mean that these studies lacked the power to detect smaller to medium effects. Future research should aim to recruit larger samples.

Some studies used participants with clinical diagnoses (Anketell et al., 2010; Clarke et al., 2022; Peach et al., 2019; Rajanthiran et al., 2022; Wearne et al., 2018; 2020; White & Gumley, 2009) or examined broader hallucinatory symptoms rather than voices as a distinct symptom (Holt et al., 2018; Peach et al., 2019; White & Gumley, 2009). Although these samples provide insights into potential mechanistic relationships within specific diagnostic groups or amongst people with broader positive symptoms, these findings may not generalise to people who hear voices outside the psychotic spectrum, to those with sub-clinical PTSD symptoms, or populations who only hear voices (and no other hallucinations). Given that voices are experienced across a range of non-clinical and clinical populations, and both within and outside the psychotic spectrum (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019), future studies should test the relationships between potential mechanisms and voices amongst diverse trauma samples and various diagnostic groups.

Many studies also used single item measures of voices that may have poor content or construct validity (Anketell et al., 2010; Brewin & Patel, 2010; Wearne et al., 2018), and for which reliability cannot be determined, which potentially limits the internal reliability of findings. To increase internal reliability and allow for comparison of findings across studies, future studies should use reliable and valid voices measures that assess a fuller range of voice hearing experiences (e.g., location of voices, frequency and intensity of voices, distress associated with voices, the valence of voice content, and trauma-voice associations). Although multi-item measures of voices exist, such as the Hamilton Program for Schizophrenia Voice Questionnaire (Van Lieshout & Goldberg, 2007), many still do not capture the full range of voice hearing characteristics, do not assess trauma-voice associations, and were designed for (and validated within) samples with psychosis-spectrum disorders. The reliability and validity of voices measures within healthy voice hearing samples, and within samples reporting trauma-related voices, needs to be

assessed in future research. Alternatively, future studies may develop and validate measures specifically designed to assess the full spectrum of trauma-related voices.

Conclusions

This review identified preliminary evidence for relationships between PTSD symptoms, voices, and dissociation, self-concept clarity, peri-traumatic dissociation, appraisals, thought suppression, and post-traumatic avoidance in relation to PTSD symptoms and voices, but no studies were identified that examined associations with insecure attachment, schemas, schematic processes, intrusions, mental imagery, emotion regulation, voice engagement, voice suppression, or post-traumatic information processing. There is a strong need for multiple types of evidence to test and verify various components within the TRV model. Future research should aim to administer robust measures of voices, as well as larger, diverse voice hearing and trauma samples.

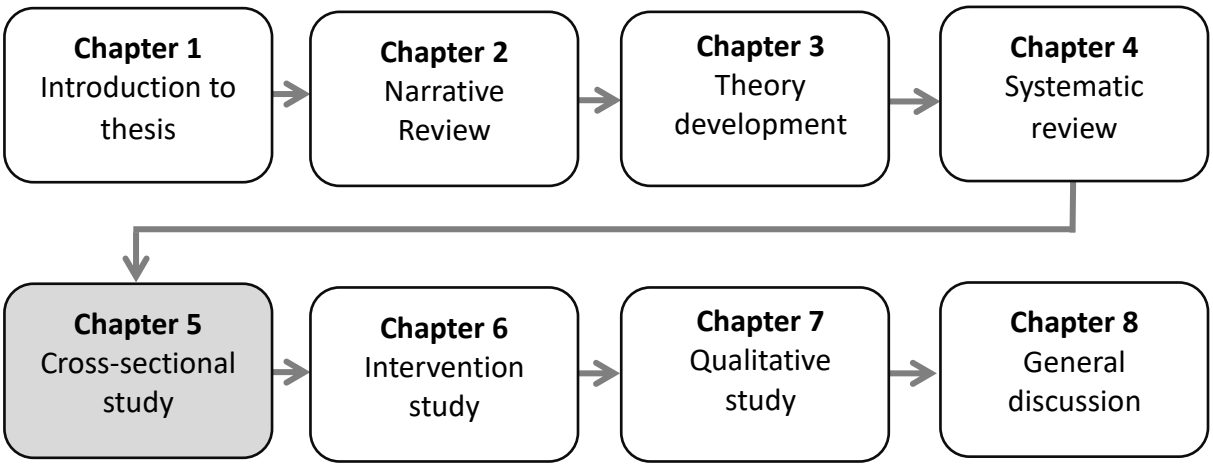
Chapter 5 (Study 4): Pathways From Trauma to Unusual Perceptual Experiences: Modelling the Roles of Insecure Attachment, Negative Affect, Emotion Regulation, and Dissociation.

Introduction to Chapter 5

Whilst the systematic review in chapter four provided preliminary evidence that a subset of mechanisms within the TRV model (chapter 3) were associated with PTSD symptoms and voices, most of the studies within this review excluded participants who did not meet diagnostic criteria for PTSD or had comorbid diagnoses. As trauma-related voices are a transdiagnostic symptom that occurs within various clinical and non-clinical populations, chapter four recommended that future studies examine mechanisms across the spectra of trauma and voice hearing symptoms. Additionally, the findings from chapter two suggested that it is important to examine the interactions between mechanisms within the TRV model. Chapter five involves a quantitative survey study, which models the theorised associations between a subset of mechanisms in the TRV model (chapter 3) within the pathway from diverse trauma experiences to a spectrum of unusual perceptual experiences (including voices). This chapter is under review with a peer-reviewed journal. Figure 5.1 indicates the location of this chapter within the overall structure of this thesis.

Figure 5.1

Flow Diagram of Thesis Structure: Chapter Five



Citation for Chapter 5

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Introduction

Unusual perceptual experiences (UPEs) involve sensory perceptions in the absence of external stimuli (Upthegrove et al., 2016) that range from mild misperceptions to severe hallucinations (Mitchell et al., 2017). UPEs can occur in any sensory modality (e.g., visual, auditory), in one or multiple modalities (multi-modal UPEs; Mitchell et al., 2017). Although there is an established relationship between trauma and UPEs in both clinical and non-clinical populations (Hardy et al., 2019; Baumeister et al., 2017), less is understood about mechanistic pathways from trauma to UPEs. This paper discusses the relationships between trauma and UPEs, and theorised pathways from trauma to UPEs.

Continuum models of positive symptoms (i.e., hallucinations, delusions, disorganised thought, speech, or behaviour) exist within general and clinical populations (van Os et al., 2000), which is consistent with evidence that UPEs are experienced in a range of psychiatric disorders and by mentally well individuals (de Leede-Smith & Barkus, 2013). Within the general population, UPEs are typically mild, fleeting, and infrequent (Linscott & van Os, 2013). However, UPEs within clinical populations are typically vivid, persistent, multi-modal, distressing, and disruptive (Goghari & Harrow, 2016; Linscott & van Os, 2013). Clinical and general UPE populations experience significantly higher rates of trauma compared to healthy controls without UPEs (Daalman et al., 2012; Sommer et al., 2010).

The Relationship Between Trauma and Unusual Perceptual Experiences

There is strongest evidence for the relationship between trauma and voices (McCarthy-Jones, 2011), and preliminary evidence suggests that in some instances this relationship may be causal (Hardy et al., 2019). Approximately 16-21.5% have post-traumatic stress disorder (PTSD; de Bont et al., 2015; Hardy et al., 2016), childhood sexual abuse and bullying are most strongly associated with voices (Hardy et al., 2016), and trauma increases the likelihood of multi-modal UPEs (Badcock et al., 2021), Furthermore, the content of UPEs is often linked to past trauma (Hardy et al., 2005).

Trauma-Related Voices (TRV) Model: Pathways from Trauma to Unusual Perceptual Experiences

There are no clinical practice guidelines for the treatment of trauma-related voices and other UPEs. Psychological treatments are typically based on cognitive behavioural models of PTSD or positive symptoms of psychosis, which have no (Brand et al., 2018) and inconsistent effectiveness (Paulik, Hayward, et al., 2019; Thomas et al., 2014) in treating voices, respectively. The TRV model (Strachan et al., 2022b) was recently developed by integrating mechanisms of maintenance and change from models of PTSD

and positive symptoms (Strachan et al., 2022a) to identify pathways from trauma to voices, and therefore offers hope for more effective interventions for trauma-affected voices. The TRV model adopts a transdiagnostic and dimensional approach to explain voices both within and outside of the psychotic spectrum (Strachan et al., 2022b). As there are no trauma-informed models that can guide research into UPEs in other sensory modalities, the TRV model may be useful in studying pathways between trauma and multi-modal UPEs.

Key Relationships in the TRV Model

The TRV model (Strachan et al., 2022b) outlines multiple pathways to UPEs that include interactions between over 20 potential factors. Individual factors within the TRV model that are associated with key theories of PTSD and broader positive symptoms (including UPEs), such as negative schemas, maladaptive appraisals, and trauma memory de-contextualisation, are associated with trauma and voices (Bloomfield et al., 2020; Gibson et al., 2019; Williams et al., 2018). However, cognitive behaviour therapies (CBT) that target trauma-related negative schemas, appraisals, and memory-based factors have shown no effectiveness in treating voices (Brand et al., 2018), and CBTs that target maladaptive beliefs about voices, maladaptive coping with voices, and negative schemas about the self and others have shown inconsistent effectiveness in treating voices in psychotic and non-psychotic spectrum samples (Paulik, Hayward, et al., 2019; Thomas et al., 2014). These findings suggest that whilst these factors may be associated with voices and other UPEs, it may be important to examine other factors in pathways from trauma to trauma-related UPEs.

Negative affect, emotion regulation deficits, and dissociation may be critical factors within the TRV model, given that interact in the pathways to UPEs more frequently than other factors. Insecure attachment may be another key factor, given that it connects trauma to most other factors. Furthermore, the theorised relationships between insecure attachment, negative affect, dissociation, were informed by Berry et al.'s (2017) Cognitive Attachment Model of Voices. Systematic reviews provide evidence that individually, these factors mediate the relationship between trauma and UPEs amongst people with psychotic spectrum disorders (Bloomfield et al., 2021; Gibson et al., 2016; Williams et al., 2018). However, individual factors alone cannot explain the complex pathways from trauma to UPEs (Gibson et al., 2016) and there is a need to examine how the relationships between these factors may explain trauma-related UPEs. The following sections outline the theorised associations between trauma, insecure attachment, negative affect, emotion regulation deficits, dissociation, and UPEs, based on the TRV model (Strachan et al.,

2022b) and the Cognitive Attachment Model of Voices (Berry et al., 2017), and summarise existing evidence for these relationships.

Trauma and Insecure Attachment

Trauma-affected voice hearers often meet DSM-5 criteria for PTSD (APA, 2013). However, many experience complex relational experiences (e.g., non-life threatening experiences of bullying or unattuned caregiving) that are associated with clinically relevant trauma symptoms that do not meet PTSD diagnostic criteria (Bailey et al., 2018; Berry & Bucci, 2016; Hardy et al., 2016; McCarthy-Jones, 2011; Paulik, Steel et al., 2019). As such, it is important to assess diverse interpersonal traumas in relation to UPEs.

Within the TRV model, negative caregiving experiences and other negative life events (including DSM-5 trauma) increase the degree of insecure attachment (Strachan et al., 2022b). Attachment style describes an internalised knowledge of relationships based on interdependent knowledge about the self and others (Shaver & Mukulincer, 2012), which is predominantly shaped by the quality of early emotional connections with caregivers and other significant others (Teyber & Teyber, 2017). Attachment is broadly categorised as secure or insecure, and insecure attachment involves a sense of vulnerability in relationships, which stems from inadequate emotional availability and responsiveness from early attachment figures (Bowlby, 1982; Prebble et al., 2013; Shaver & Mukulincer, 2012). As such, people who experience early interpersonal trauma from caregivers or peers are more likely to develop insecure attachment styles (Benoit, 2004; Koiv, 2012). People with a history of childhood abuse or neglect have high levels of insecure attachment (Baer & Martinez, 2006; Erozkan, 2016; Fuchshuber et al., 2019), as do those with psychotic spectrum disorders (Berry et al., 2007). Additionally, preliminary evidence shows that insecure attachment mediates the relationship between childhood adversity and voice severity (Pilton et al., 2016).

Insecure Attachment and its Relationship with Negative Affect, Emotion Regulation, and Dissociation

Emotion regulation deficits, negative affect, and dissociation are related factors, whereby emotion regulation deficits involve diminished ability to manage emotions (e.g., negative affect; Gross, 2015) due to the use of emotion regulation strategies that ultimately maintain or exacerbate distress (e.g., dissociation; Gross, 2015; Lanius et al., 2010). Whilst the relationships between these factors are important and are discussed in detail in subsequent sections, the TRV model suggests that insecure attachment indirectly influences voices by increasing emotion regulation deficits, negative affect, and dissociation (Strachan et al., 2022b). Emotion regulation includes the strategies people

use to control their emotional experiences (Gross, 2015) and, as attachment is shaped by the emotional availability and responsiveness of early attachment figures, attachment provides the basis for emotional regulation development (Bowlby, 1982; Shaver & Cassidy, 2016; Shaver & Mukulincer, 2012).

Attachment is measured across two continuums: anxiety and avoidance. The attachment anxiety continuum is characterised by a view of the self as emotionally deprived and a fear of rejection or abandonment by others, and strategies to regulate the anxiety-based distress include preoccupation with perceived “threats” of rejection or abandonment, amplification of emotions or emotional needs to attract support from others, and persistent proximity seeking (Shaver & Mukulincer, 2012; Teyber & Teyber, 2017). The attachment avoidance continuum is characterised by a view of the self as self-sufficient and a fear of hostility or oppression by others, and strategies to regulate avoidant-related distress include avoidance of emotional intimacy and interdependency, including minimisation of emotional needs and suppression of emotions (Shaver & Mukulincer, 2012; Teyber & Teyber, 2017). Insecure attachment is sub-categorised as preoccupied (high anxiety and low avoidance), dismissive (low anxiety, high avoidance), or fearful (high anxiety and avoidance), and people with insecure attachment styles experience more negative affect and tend to regulate emotions in maladaptive ways (Shaver & Mukulincer, 2012). Amongst people with psychotic spectrum disorders, insecure attachment is positively associated with emotional distress, emotion regulation difficulties, and hallucination severity (Owens et al., 2013; Ponizovsky et al., 2013). There is also evidence that emotion regulation and negative affect mediate the relationship between attachment and hallucinations in clinical and non-clinical samples (Partridge et al., 2022).

Dissociation is a dimensional construct that is experienced within the general population (Černis et al., 2018) and dissociation during trauma has been described as an evolutionary response that counteracts physiological arousal associated with unsuccessful attempts to “fight or flight” (Felmingham et al., 2008). Specifically, dissociation suppresses the intensity of subjective and physiological emotional experiences and thus may be negatively reinforcing in the short-term (Felmingham et al., 2008; Sheppes, 2020). However, for some trauma-affected people dissociation may become a pathological, non-voluntary, conditioned response to elevations in negative affect, physiological arousal, or other trauma-related cues (e.g., cognitions; Brewin et al., 1996; Briere, 2006). Consequently, pathological dissociation is considered a maladaptive emotion regulation strategy (Cavicchioli et al., 2021; Lanius et al., 2010) that precludes deliberate and flexible

selection of emotion regulation strategies that are situationally suitable (Sheppes et al., 2015).

Insecurely attached individuals may be at greater risk of experiencing pathological dissociation due to their caregivers being less facilitative of adaptive emotion regulation strategies (Briere, 2006; Felmingham et al., 2008; Shaver & Cassidy, 2016). The association between insecure attachment and dissociation is stronger than that between trauma and dissociation (Nilsson et al., 2011), and insecure attachment mediates the relationship between childhood adversity and adult dissociation (Kong et al., 2018). Furthermore, amongst people with psychotic spectrum disorders, insecure attachment is positively associated dissociation (Pearce et al., 2017), and dissociation is positively associated with voice severity (Pilton et al., 2015). Although attachment and dissociation mediate the relationship between trauma and voices (Pearce et al., 2017; Perona-Garcelán et al., 2012), no known studies have tested whether dissociation mediates the relationship between attachment and UPEs.

The Relationships Between Negative Affect, Emotion Regulation, and Dissociation

Global emotion regulation deficits involve broader difficulties understanding and relating to one's emotions (Naragon-Gainey et al., 2017). People with emotion regulation deficits tend to experience difficulties managing negative affect and over-use maladaptive emotion regulation strategies, such as dissociation (Gross, 2015; Lanius et al., 2010). Whilst there is no comprehensive theory that explains the relationship between emotion regulation and dissociation, prominent theories of emotion regulation state that experiential avoidance is a type of emotion regulation strategy that involves attempts to supress the intensity of one's emotional experience (Gross, 2015; O'Driscoll et al., 2014). Dissociation has been conceptualised as an "over-modulated" form of experiential avoidance, whereby dissociative processes alter normal consciousness and result in a mental "escape" or detachment from overwhelming cognitions and emotions (Cavicchioli et al., 2021; Krause-Utz et al., 2017). The TRV model suggests that dissociation causes trauma-related mental activity to be perceived as egodystonic UPEs (Strachan et al., 2022b). Meta-analytic findings show large positive associations between dissociation and voices (Pilton et al., 2015), and that emotion regulation difficulties and dissociation mediate the relationship between childhood trauma and hallucinations (Bloomfield et al., 2021).

The TRV model suggests that negative affect may independently increase the frequency of dissociative experiences, whereby the elevations in psychological and physiological arousal associated with negative affect increase the frequency of automatic, conditioned dissociative responses (Brewin et al., 1996; Strachan et al., 2022b). However,

the TRV model also suggests that as high levels of negative affect are difficult to regulate, emotion regulation deficits will increase the frequency in which a person uses dissociation to cope with negative affect. This hypothesised relationship is consistent with prominent theories of emotion regulation, which state that negative affect may activate emotion regulation processes (Gross, 2008; Gross, 2015), and with evidence that dysregulated affect predicts the use of maladaptive regulation strategies amongst trauma-affected people with global emotion regulation deficits (Short et al., 2018). There is evidence that higher levels of distress predict emotion regulation difficulties amongst people with positive symptoms (Lincoln et al., 2017) and dissociation (Varese et al., 2011) amongst people with psychotic spectrum disorders who hear voices. Furthermore, amongst people with psychotic spectrum disorders, those who experienced childhood maltreatment have higher levels of negative affect (Schäfer & Fisher, 2011) and more severe dissociation than to those without past trauma (Dorahy et al., 2009).

The Current Study

There is evidence that individually, insecure attachment, negative affect, emotion regulation deficits, and dissociation mediate the relationship between trauma and voices (Bloomfield et al., 2021; Gibson et al., 2016; Williams et al., 2018), and preliminary evidence of mediation between these factors across the different components of this pathway within samples with UPEs (Berry et al., 2008; Partridge et al., 2022; Pilton et al., 2016; Short et al., 2018). However, there is a need to test the overall structure of associations within this pathway by analysing theorised relationships between all factors in combination. Additionally, much of the existing evidence for these relationships comes from studies that used clinical samples with psychotic spectrum disorders, and as UPEs are dimensional constructs that exist within the general population (Baumeister et al., 2017; de Leede-Smith & Barkus, 2013), there is a need to test these associations across a continuum of multi-modal UPEs (Carpenter, 2016; Murray, 2017).

The aim of this study was to investigate pathways from trauma (including diverse interpersonal traumas) to the frequency of UPEs based on the hypothesised relationships between insecure attachment, negative affect, emotion regulation deficits, and dissociation within the TRV model (Figure 5.2; Strachan et al., 2022b). Consistent with continuum models of trauma and UPEs (Cloitre, 2020; van Os et al., 2000), we tested a continuum of multi-modal UPEs and diverse interpersonal traumas within a non-clinical sample. Based on the TRV model and existing literature, we hypothesised that trauma would be indirectly associated with the frequency of UPEs via insecure attachment, negative affect, emotion regulation deficits, and dissociation.

Method

Participants

Participants (*N* = 528) were undergraduate psychology students at Curtin University and were recruited through the university's research participation pool as part of their course requirement. Participants had a mean age of 22.14 (*SD* = 5.82; range 17-56) and 24.1% (*n* = 127) were male, 74.4% (*n* = 393) were female, and 1.5% (*n* = 8) were non-binary. The sample comprised 298 (56.4%) White, three (.7%) Aboriginal, 90 (17%) Asian, 30 (5.7%) Middle Eastern, and 54 (10.2%) Mixed Race/Ethnicity participants. Fifty-three (10%) reported they were from "another" race/ethnicity or did not wish to disclose their race/ethnicity.

Mplus version 8.7 (Muthén, 1998-2017) was used to conduct an a priori Monte Carlo simulation with 1000 replications to estimate coverage (proportion of replications for which 95% confidence intervals contain the true parameter value; values should be > .90) and power (proportion of replications for which the null hypothesis is correctly rejected at α = .05) for each parameter (Wolf et al., 2013). The simulated sample size was increased in the model if power fell below .80 on any parameter. The model revealed that a total sample of 400 would achieve .80 power to detect medium direct (*β* = .30) and small indirect (*β* = .09) effects between variables. However, over 500 participants were recruited in case any parameters were smaller than estimated.

Measures

Traumatic Experiences

The trauma screening tool from the PTSD Diagnostic Scale for DSM-5 (PDS-5; Foa et al., 2016) was used to categorically assess exposure to DSM-5 Criterion A traumas (APA, 2013), and was adapted to include two additional items to assess diverse interpersonal trauma; (a) other domestic/family violence (verbal/emotional/financial intimidation, abuse, and/or violence within a family/intimate relationship) and (b) any other event that was upsetting/distressing (argument, upsetting interpersonal exchange, embarrassing event, humiliating event etc.). Participants were asked to select all events that they had experienced, witnessed, or been repeatedly confronted with, and those who endorsed either of the two additional items were asked to briefly describe these events.

Insecure Attachment

The State Anxiety Attachment Scale (SAAM; Gillath et al., 2009) is 21-item measure of adult attachment style. The SAAM provides a seven-point Likert scale ranging from 1 (disagree strongly) to 7 (agree strongly) and has three subscales: security, anxiety, and avoidance. As the current study aimed to measure insecure attachment, the secure

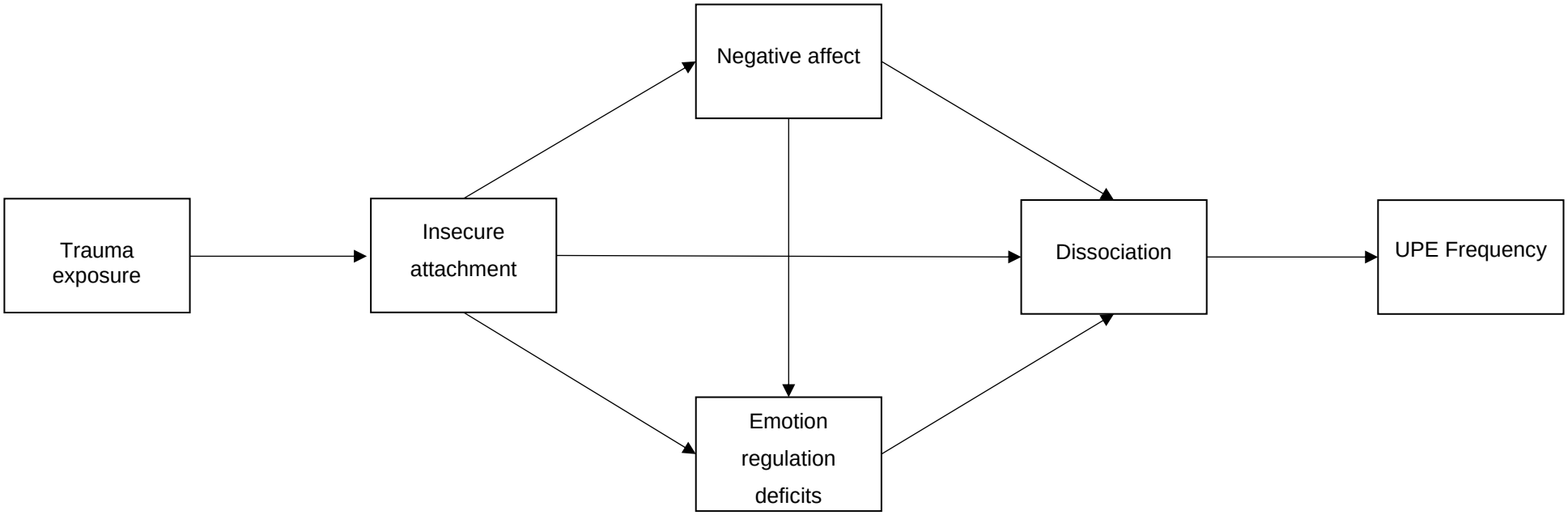
attachment subscale was excluded from the analysis, and the anxiety and avoidance subscales were summed as an overall measure of insecure attachment (SAAM-I); higher scores are indicative of higher degree of insecure attachment. The SAAM subscales have shown excellent internal consistency within undergraduate samples (α = .85 to α = .91, respectively; Gillath et al., 2009).

Negative Affect

The Depression, Anxiety and Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995) is a 21-item measure of negative affect across three domains (anxiety, depression, and stress). Participants are asked to rate their symptoms over the past week using a four-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Higher scores are indicative of elevated negative affect. The DASS-21 has strong internal consistency within undergraduate samples (α = .81-.92; Lovibond & Lovibond, 1995).

Figure 5.2

The Hypothesised Model for Predicting the Frequency of Unusual Perceptual Experiences



Emotion Regulation Ability

The Perth Emotion Regulation Competency Inventory (PERCI; Preece et al., 2018) measures one's ability to regulate experiential and behavioural manifestations of positive and negative emotions (Preece et al., 2018). The PERCI comprises 32 items and provides a seven-point Likert response format ranging from 1 (strongly disagree) to 7 (strongly agree). The PERCI's negative-emotion regulation composite (PERCI-N) was used to measure overall difficulty regulating negative emotions. Higher scores are indicative of greater difficulty regulating negative emotions. The PERCI-N has excellent internal consistency within samples comprising university students (α = 93; Preece et al., 2018).

Dissociative Experiences

The Dissociative Experiences Measure Oxford (DEMO) measures dissociative experiences over the past two weeks using a five-point rating scale ranging from 1 (not at all) to 5 (most of the time; Černis et al., 2018). The DEMO comprises 30 items and has five subscales, each with 6 items: unreality, numb and disconnected, memory blanks, zoned out, and vivid internal world. Higher scores are associated with higher severity of dissociative experiences. The overall measure and subscales of the DEMO have excellent internal consistency within unselected samples (α = 95, and α = .82 to α = .91, respectively; Černis et al., 2018).

Unusual Perceptual Experiences

A modified version of the Multi-modality Unusual Sensory Experiences Questionnaire (MUSEQ) was used to assess the frequency of UPEs across six sensory-perceptual modalities: auditory, visual, olfactory, gustatory, body sensations, and sensed presences. The MUSEQ measures a continuum of UPEs, ranging from mild misperceptions to frank hallucinations (Mitchell et al., 2017) and the original MUSEQ uses a four-point response scale that ranges from 0 (never) to 4 (frequently; at least monthly). As UPEs within general and clinical populations occur more frequently than monthly (Daalman et al., 2010), the MUSEQ was modified to a seven-point rating scale that ranged from 0 (never) to 6 (at least weekly). The original MUSEQ's auditory (α = .82), visual (α = .88), olfactory (α = .87) gustatory (α = .88), bodily sensations (α = .88) subscales have good internal validity, and the sensed presence subscale has satisfactory internal validity amongst undergraduate students (α = .77; Mitchell et al., 2017).

Procedure

Following ethics approval from Curtin University's Human Research Ethics Committee (HRE2020-0333), the study was advertised on Curtin University's Research Participation Scheme website. After providing written consent, participants completed an

online battery of the study measures. Participants received course credit for participation in the study. Data collection occurred between August 2020 and June 2021.

Data Analysis

SPSS version 28.0 was used to analyse descriptive statistics and perform preliminary screening of distributions, skewness, and kurtosis. Mplus was used to conduct path analysis with maximum likelihood (ML) estimation. The hypothesised mediation model comprised one predictor (trauma), four mediators (insecure attachment, negative affect, emotion regulation ability, and dissociation), and one criterion variable (UPE frequency). Standardised beta estimates were used to test the relative strength of indirect effects. Five fit indices were used to test goodness-of-fit. A non-significant chi-square statistic (χ^2) indicates acceptable fit; however, as chi-square is highly sensitive to sample size and minor differences within large samples often produce a statistically significant value, it may not be an informative measure of fit (Tabachnick & Fidell, 2013). As such, chi-square was used in conjunction with additional fit indices; root mean square error of approximation (RMSEA) with 90% confidence intervals (CI), standardised root mean square residual (SRMR), comparative fit index (CFI), and Tucker-Lewis index (TLI). RMSEA values ≤.06, SRMR values ≤.08, and CFI and TLI values ≥.95 indicate a good fit between a model and observed data (Hu & Bentler, 1999; Kline, 2010; Marsh et al., 2004). The proportion of variance in each variable explained by the model was estimated using R^2, and modification indices (MI) ≥ .20 were used to consider areas for model improvement (Whittaker, 2012). A Monte Carlo simulation was repeated post hoc using the observed parameter estimates within our model; coverage was ≥ .94 for all parameters and power ranged from .80 to 1.0.

Results

Preliminary Analyses

Histograms and normality plots showed acceptable univariate and multivariate distributions, and skewness and kurtosis statistics were all <1.0 (Streiner, 2005). All study variables were significantly correlated with no evidence of problematic multicollinearity (all bivariate correlations <.80, tolerances >0.2, variation influation factors <10; Kutner, 2005; Tabachnick & Fidell, 2013). Mahalanobis and Cook's distance indicated there were no influential multivariate outliers (Tabachnick & Fidell, 2013). Missing data analysis revealed 0.2%, 0.4%, 1.1%, 0.4%, and 0.4% of data was missing from the DASS-21, PERCI-N, DEMO, SAAM-I, and MUSEQ, respectively. Little's MCAR test indicated that this data was missing completely at random (χ^2 =32.63, df = 28, p = .25). Missing data was addressed during analysis using full information maximum likelihood (Muthén, 1998-2017).

Of the 528 participants, 181 (34.3%) had no trauma history and 347 (65.7%) had experienced at least one traumatic experience. Of those with a trauma history, 265 (76.4%) had experienced at least one PDS-5 trauma (APA, 2013), leaving 82 (23.6%) who experienced other interpersonal traumatic experiences (commonly reported experiences included witnessing domestic violence, witnessing parent's drug misuse, and experiencing emotional abuse). Descriptive statistics, internal consistency (McDonald's omega), and bivariate correlations for all other study variables are displayed in Table 5.1.

Table 5.1

Descriptive statistics, McDonald's omega, bivariate correlations

	M	*SD*	Min	Max	ω	DASS-21	PERCI-N	DEMO	SAAM-I	MUSEQ
DASS-21	21.6	13.27	0	63	.95					
PERCI-N	59.47	20.44	16	112	.93	.63**				
DEMO	62.75	22.13	30	139	.96	.71**	.62**			
SAAM-I	54.54	14890	14	93	.79	.55**	.56**	.54**		
MUSEQ	108.99	41.22	45	289	.96	.54**	.42**	.61**	.36**	
Trauma	-	-	-	-	-	.19**	.14**	.21**	.24**	.14*

Note. *SD* = standard deviation; Min = minimum; Max = maximum; ω = McDonald's omega; DASS-21 = Depression; Anxiety and Stress Scales-21; PERCI-N = Perth Emotion Regulation Competency Inventory - Negative-emotion Regulation Composite; DEMO = Dissociative Experiences Measure Oxford; SAAM-I = State Anxiety Attachment Scale – Insecure Attachment Composite; MUSEQ = Multi-modality Unusual Sensory Experiences Questionnaire – Frequency. Trauma is a dichotomous variable so associations are point-biserial correlations. All other associations are Pearson's bivariate correlations.

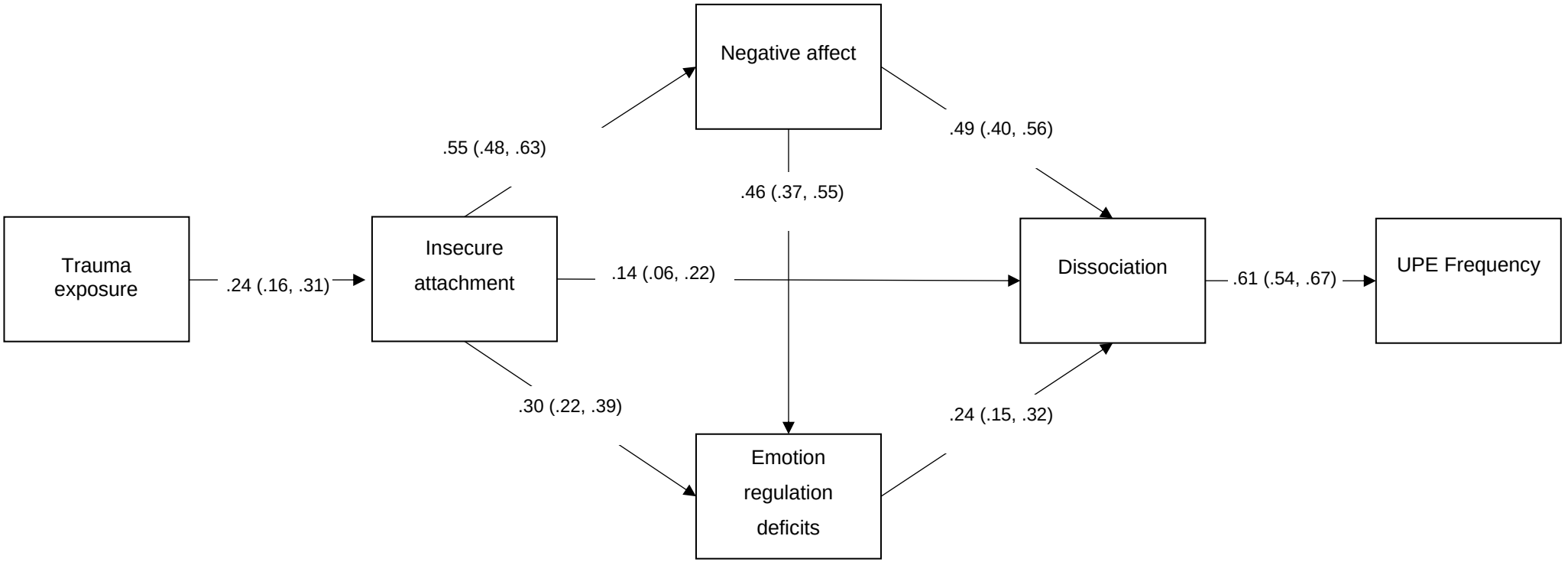
* p <.01, ** p <.001

The Path Model

Except for a significant chi-square value, $\chi^2(7) = 25.36$, p <.001, fit indices showed that the model was a very good fit to the data, CFI =.985, TLI =.968, SRMR = .033, RMSEA = .070 (90% CI [.042, .101]). The model explained 30.6%, 45.7%, 56.9%, 5.7%, and 37.1% of variance in the DASS, PERCI-N, DEMO, SAAM-I, and MUSEQ, respectively, and MIs did not identify areas for significant model improvement. The total (combined) indirect effects from trauma to MUSEQ were significant (β = .08, 95% CI [.05, .11], p <.001), as were the specific indirect effects from trauma through (a) SAAM-I and DEMO (β = .02, 95% CI [.01, .03], p <.01), (b) SAAM-I, DASS, and DEMO (β = .04, 95% CI [.02, .06], p <.001), (c) SAAM-I, PERCI-N, and DEMO (β = .01, 95% CI [.01, .02], p <.001), and (d) SAAM-I, DASS, PERCI-N, and DEMO to MUSEQ (β = .01, 95% CI [.004, .01], p <.001). Standardised path coefficients (95% confidence intervals) are presented in Figure 5.3.

Figure 5.3

Standardised Estimates (95% confidence intervals) of the Hypothesised Model for Predicting the Frequency of Unusual Perceptual Experiences (all ps < .001)



Discussion

The TRV model was recently developed to guide novel research into potential mechanisms of trauma-related voices (Strachan et al., 2022b). This was the first study to test novel hypotheses based on the TRV model by modelling pathways from diverse interpersonal trauma to multi-modal UPEs within an unselected sample. We hypothesised that trauma would be indirectly associated with the frequency of UPEs via insecure attachment, negative affect, emotion regulation deficits, and dissociation. Our results supported our hypothesis and provided preliminary evidence for a subset of key relationships within the TRV model (Strachan et al., 2022b) and the Cognitive Attachment Model of Voices (Berry et al., 2017). The modelled associations between insecure attachment, negative affect, emotion regulation deficits, and dissociation were an excellent fit to the data and accounted for 37.1% of variance in UPE frequency.

A range of interpersonal traumas have been linked to trauma-related voices (Bailey et al., 2018; Berry & Bucci, 2016; Hardy et al., 2016; McCarthy-Jones, 2011; Paulik, Steel et al., 2019), which is consistent with our finding that traumatic experiences, including diverse interpersonal traumas and Criterion A traumas (APA, 2013), have an indirect influence on a continuum of UPEs. Our findings provide further support for continuum accounts of trauma and UPEs (Cloitre, 2020; van Os et al., 2000). Our modelled associations between insecure attachment, negative affect, emotion regulation, and dissociation in combination extend on the findings from past studies, which found that these factors individually mediate the pathway from trauma to UPEs (Partridge et al., 2022; Pearce et al., 2017; Perona-Garcelán et al., 2012; Pilton et al., 2015).

We found that insecure attachment provides an indirect pathway from trauma to other mediating factors within the model, which are linked to UPEs via dissociation. These associations are consistent with those outlined by key theories of attachment and emotion regulation (Gross, 2015; Shaver & Mukulincer, 2012), which provides further support for these hypothesised pathways within the TRV model (Strachan et al., 2022b) and the Cognitive Attachment Model of Voices (Berry et al., 2017). However, attachment, emotion regulation, and dissociation are multifaceted and iterative processes (Gross, 2015; Kennedy et al., 2004; Shaver & Mukulincer, 2012), and future studies should examine how distinct aspects of these processes may interact within the pathways to trauma-related UPEs. For example, as dissociation suppresses the intensity of emotions, it appears to have a similar function to the strategies that are typically used by dismissively attached people with high attachment avoidance (Kennedy et al., 2004; Shaver & Mukulincer, 2012). However, amongst people with psychosis, dissociation is more strongly associated

with fearful and preoccupied attachment styles compared to dismissive attachment (Berry et al., 2008; Pearce et al., 2017; Ponizovsky et al., 2013). A limitation of these previous studies is that they used trait-based measures of attachment and there is evidence that contextual factors may trigger state-based fluctuations in attachment (Verhees et al., 2021). Additionally, different types of dissociation (e.g., depersonalisation vs derealisation) may have different underlying mechanisms (Brown, 2006) and strengths of association across attachment styles (Simeon & Knutelska, 2022) and voices (Dorahy & Palmer, 2016; Longden et al., 2012). Future studies may extend on our findings by examining the associations between state attachment and dissociative subtypes within the pathway from trauma to UPEs.

Although our findings provide preliminary support for a subset of relationships within the TRV model (Strachan et al., 2022b) and the Cognitive Attachment Model of Voices (Berry et al., 2017), future studies are needed to test the relationships within the larger model (Strachan et al., 2022b). Other key relationships in the TRV model involve negative schemas, which are theorised to drive negative inner dialogue that leads to trauma-related voices, due to the interactions between emotion regulation deficits and dissociation (Strachan et al., 2022b). The TRV model outlines a reciprocal relationship between negative schemas, attachment style, and negative appraisals of trauma and voices. Schemas and insecure attachment both involve internalised knowledge and influence how people appraise, experience, and respond to information (Bowlby, 1982; Prebble et al., 2013; Shaver & Mukulincer, 2012). However, schemas comprise *independent* knowledge about the self and others, whilst attachment involves *interdependent* knowledge about the self and others (Shaver & Mukulincer, 2012). Negative automatic thoughts, which may be experienced as negative inner dialogue, are conscious cognitions that stem from “deeper” negative schemas (Oleś et al., 2020), and are often targeted in CBT treatments for PTSD (Bourdon et al., 2019) and voices (Hazell et al., 2018; Paulik, Hayward et al., 2019). As attachment may be more strongly linked to negative affect and emotion regulation processes than schemas (Mikulincer & Shaver, 2005; Shaver & Mukulincer, 2012), it may be important to explore similarities and differences in the negative automatic thoughts (including inner dialogue), appraisals, affect, and coping strategies associated with negative schemas (i.e., *independent* social knowledge) versus attachment style (i.e., *interdependent* social knowledge).

Information processing errors are another factor within the larger TRV model that may increase the risk innocuous mental activity will be experienced as distressing UPEs (Strachan et al., 2022b). There are several psychological constructs, such as

mentalisation, meta-cognition, and self-disturbance, that involve information processing errors that limit the ability to understand and organise one's own cognitions (Nelson et al., 2014a, 2014b; Ridenour et al., 2019; Weijers et al., 2020), which are associated with insecure attachment (Debbané et al., 2016) and dissociation (Liotti & Gumley, 2008) amongst people with psychotic-spectrum disorders. Additionally, there is evidence that insecure attachment, self-disturbance, and the cognitive biases associated with these constructs (e.g., external attribution bias, belief inflexibility) mediate the relationship between trauma and psychosis risk (Gawęda et al., 2018). However, to understand how these factors may interact with other factors in the pathway from trauma to UPEs both within and outside the psychotic spectrum, future studies should examine these associations in relation to UPEs as a distinct symptom (separate from other psychotic-like symptoms) within transdiagnostic samples.

Although our model was tested in an unselected sample in line with continuum models of trauma and psychotic-like symptoms (Cloitre, 2020; van Os et al., 2000), our findings may not be generalisable to clinical populations experiencing pathological trauma symptoms and UPEs. Future studies are needed to examine whether this model generalises across clinical samples with distressing UPEs and whether the model differs across UPE modalities. Additionally, our cross-sectional design cannot provide evidence of temporality or causation between our modelled factors (Kazdin, 2007). Studies that replicate our model within transdiagnostic treatment-seeking samples with UPEs may inform the design of prospective and experimental studies that can provide stronger evidence of temporality and causation between the factors within our model and UPEs. If our findings are replicated in prospective studies and with clinical samples, it would suggest that it may be important for clinicians to assess diverse interpersonal traumas, attachment style, emotion regulation ability, and dissociation amongst clients with distressing UPEs, and that the TRV model may be a practical tool for conceptualising complex cases with voices or broader UPEs.

Conclusion

In conclusion, our results provide preliminary support for a subset of associations in the TRV model (Strachan et al., 2022b) and found that the modelled associations between insecure attachment, negative affect, emotion regulation deficits, and dissociation mediate the relationship between diverse relational traumas and a continuum of multi-modal UPEs. The theorised associations between our modelled mediators are congruent with established theories of attachment and emotion regulation (Gross, 2015; Shaver & Mukulincer, 2012), and future research is needed to examine whether interactions

between specific facets of dissociation, attachment, and emotion regulation are important in understanding trauma-related UPEs. Whilst the TRV model may support clinicians in conceptualising trauma-related UPEs, future studies are needed to replicate our model within diverse transdiagnostic treatment-seeking samples, test the broader pathways within the TRV model, and collect stronger evidence of causality between factors within the TRV model.

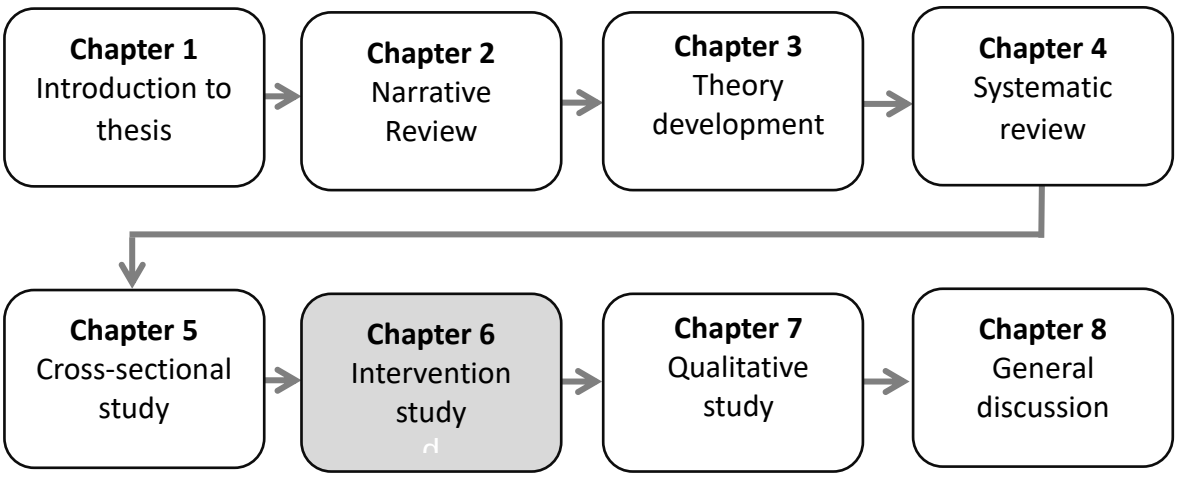
Chapter 6 (Study 5): Effectiveness and Change Mechanisms of Imagery Rescripting for Trauma-Affected Voice Hearers: An Open Trial

Introduction to Chapter 6

The findings from chapter five provide preliminary support for a subset of associations within the TRV model (chapter 3), and evidence that diverse interpersonal traumas are related to a range of unusual perceptual experiences. However, these cross-sectional findings may not generalise to clinically distressed voice hearers and cannot provide evidence that change in these factors coincides with change in voices. The current chapter (study 5) replicates and extends past ImRs studies by testing the impact of ImRs on trauma-related voices, PTSD symptoms, and a subset of mechanisms within the TRV model (chapter 3) within clinically distressed transdiagnostic sample with trauma-related voices. This study is currently prepared for submission to a peer-reviewed journal. Figure 6.1 indicates the location of this chapter within the overall structure of this thesis.

Figure 6.1

Flow Diagram of Thesis Structure: Chapter Six



Introduction

Voices (auditory verbal hallucinations) are characterised by the perception of a voice in the absence of an external stimulus and are the most common type of unusual perceptual experience (Chaudhury, 2010). Although voices are typically conceptualised as a positive symptom associated with psychotic spectrum disorders, they are experienced in non-psychotic disorders and are relatively common in psychologically healthy individuals (de Leede-Smith & Barkus, 2013; Larøi et al., 2012). Voices can therefore be conceptualised as a continuum of symptoms that is distinct from psychotic spectrum diagnoses and other "psychotic-like" symptoms (e.g., delusions; Strachan, Paulik, et al., 2022a).

There is robust evidence for the relationship between trauma and voices, which suggests that childhood sexual abuse, adult sexual abuse, and bullying are strongly associated with voices (Bailey et al., 2018; Hardy et al., 2005). Compared to healthy controls, clinical and general voice hearing populations have a higher prevalence of trauma (Daalman & Diederen, 2013) and are up to six times more likely to have experienced abuse or neglect (de Vries et al., 2019; Matheson et al., 2013). Most voice hearers report a history of trauma (de Bont et al., 2015; Hardy et al., 2016; Tolmeijer et al., 2021), whereby the onset of voices was linked to trauma or other interpersonal events that led to feelings of powerlessness (Escher et al., 2004). Approximately 75% of trauma-affected voice hearers experience trauma-related voices, which are characterised by voice content that is linked to past trauma (Hardy et al., 2005; Peach et al., 2020). Indirect trauma-related voices are most commonly reported, which involve voices that are thematically linked to trauma (e.g., voices making malicious remarks to a person with a history of oppression from significant others), but 12.5% of people with trauma-related voices hear a combination of indirect and direct voices, with the latter being characterised by voices that repeat the exact comments made by perpetrators (Hardy et al., 2005).

Around one-fifth of voice hearers with psychotic spectrum disorders meet diagnostic criteria for post-traumatic stress disorder (PTSD; de Bont et al., 2015; Hardy et al., 2016), which is around four times higher than in the general population (Koenen et al., 2017). Whilst the prevalence of voices in trauma-related disorders, including PTSD (45 - 94%; Anketell et al., 2010; Brewin & Patel, 2010; Shinn et al., 2020), dissociative identity disorder (80 - 90%; Sar & Ozturk, 2008), and borderline personality disorder (27 - 50%; Kingdon et al., 2010; Niemantsveriet et al., 2017) are similar to that in psychotic spectrum disorders (66 – 88; Lim et al., 2016), voices and other "psychotic-like symptoms" do not explicitly appear in diagnostic criteria for trauma-related disorders (American Psychiatric

Association, 2013; World Heath Organisation, 2018). This narrow diagnostic focus, along with the phenomenological similarities between PTSD re-experiencing symptoms and voices (Seedat et al., 2003), suggests that the true comorbidity between voices and trauma-related disorders may be underestimated (Amundsen et al., 2018; Lim et al., 2016; Lommen & Restifo, 2009).

Cognitive behaviour therapies (CBT) that target mechanisms associated with broader positive symptoms (hallucinations, delusions, and disorganised cognitions), such as maladaptive beliefs about voices, maladaptive coping responses, broader schemas about the self and others, social beliefs, and distress, have shown inconsistent effectiveness in treating voices in psychotic and non-psychotic spectrum populations (Paulik, Hayward, et al., 2019; Thomas et al., 2014). Similarly, CBT that targets mechanisms of PTSD, including maladaptive trauma appraisals, avoidance, and trauma memory de-contextualisation (Zalta, 2015), is ineffective for voices and is associated with small reductions in PTSD symptoms in samples with psychotic-like symptoms (Brand et al., 2018). However, there is some evidence to suggest that imagery rescripting (ImRs), which is a mental imagery technique that aims to modify the meaning of trauma memories that are linked to current psychological difficulties (Arntz, 2012), is associated with large reductions in voice frequency (r = .92), voice distress (r = 75), and PTSD symptoms (r = 76) in transdiagnostic samples (Ison et al., 2014; Paulik, Steel, et al., 2019), with 83% experiencing reliable change, 58.3% experiencing clinically significant change, and 25% no longer meeting criteria for PTSD at one-week follow up (Clarke et al., 2022).

Together, these findings suggest that (a) cognitive behavioural models of PTSD and positive symptoms do not adequately explain voice hearing in the context of trauma, (b) there may be differences and similarities in the mechanisms that underlie trauma-related voices, other positive symptoms, and PTSD symptoms, and (c) compared to CBT, ImRs may more effectively manipulate mechanisms associated with trauma-related voices. However, there are only three known ImRs treatment studies of trauma-affected voice hearers, which have several limitations. All studies had small sample sizes ($n \leq 12$) and used semi-structured clinician-related interviews to measure voices (Clarke et al., 2022; Ison et al., 2014; Paulik et al., 2019), which may introduce clinician bias. Two studies did not assess for trauma-related voices specifically (Clarke et al., 2022; Ison et al., 2014). Whilst voices occur across a range of disorders (de Leede-Smith & Barkus, 2013; Larøi et al., 2012), the inclusion criteria of two studies were based on diagnostic status (Clarke et al., 2022; Ison et al., 2014), which limits the generalisability of findings to voice hearers who do not meet criteria for psychotic or trauma-spectrum diagnoses. Two studies used a

single baseline design without a comparison group (Ison et al., 2014; Paulik et al., 2019), which limits the ability to confidently conclude that change was attributable to treatment effects, rather than the effects or spontaneous remission, test reactivity, or regression to the mean. Two studies used short follow-up periods only (Clarke et al., 2022; Ison et al., 2014), which limits the ability to assess delayed effects and the stability of effects. As such, there is a need to extend past studies by testing the impact of ImRs on trauma-related voices within larger transdiagnostic samples, and by assessing the stability of symptoms across multiple baselines and the stability of treatment effects over a longer-term follow up period.

Additionally, understanding the mechanisms maintaining trauma-related voices and how ImRs influences such mechanisms is important for developing and refining interventions (Strachan et al., 2020). Two past studies examined the impact of ImRs on beliefs about voices (Paulik et al., 2019) and trauma appraisals (Clarke et al., 2022), which are mechanisms that are targeted by CBT for positive symptoms and CBT for PTSD, respectively (Thomas et al., 2014; Zalta, 2015). However, to understand why the effects of ImRs on voices and PTSD symptoms differs from the effects of CBT in trauma-affected voice hearers, it may be important to examine the impact of ImRs on mechanisms that are common to both voices and PTSD symptoms (Strachan et al., 2022a). That is, should ImRs modify factors that maintain both sets of symptoms, this may provide evidence for potential mechanisms of trauma-related voices.

Potential Mechanisms of Trauma-Related Voices

Recently, the trauma-related voices (TRV) model was developed by integrating the common and unique mechanisms of PTSD and positive symptoms, to identify novel hypotheses that can guide research into mechanisms of trauma-related voices (Strachan, Paulik, et al., 2022b). Although the TRV model outlines multiple mechanisms and pathways to voices, negative self-beliefs, negative inner speech, emotion regulation deficits, and dissociation are key mechanisms within these pathways (Strachan, Paulik, et al., 2022b). For example, negative self-beliefs that are informed by autobiographical trauma memories may generate trauma-informed negative inner dialogue, which increases negative affect. Subsequently, in the context of emotion regulation deficits, dissociative coping responses may disrupt normal cognition and cause trauma-informed inner dialogue to be misperceived as an egodystonic voice that is linked to past trauma. Furthermore, ineffective attempts to cope with negative inner dialogue or negative affect may strengthen negative self-beliefs about one’s ability to cope with distress, thereby increasing the likelihood of negative inner dialogue and creating a negative feedback loop.

There is robust evidence that these factors individually mediate the relationship between trauma and voices (Bloomfield et al., 2021; Gibson et al., 2016; Williams et al., 2018) and cross-sectional evidence that in combination, emotion regulation and dissociation mediate the relationship between trauma and unusual perceptual experiences (including voices) in unselected samples (Strachan, Paulik, Preece, et al., 2022). Additionally, there is overlap between these factors and those targeted by ImRs. During the three-stage ImRs protocol (Arntz & Weertman, 1999), the first stage involves trauma memories being visualised from the age clients were at the time of the event (younger self), but with the adult self or therapist intervening to help get the child's needs met in the image. The second stage typically involves visualising the event, but this time from the perspective of the client at their current age (compassionate older self), with their adult-self helping get the child's needs met. The third stage involves visualising the event for a final time, again from the perspective of the younger self, watching their adult-self assisting them to get their needs met. Using present tense, the chronology of the event is actively re-constructed using a needs-focussed approach. Victimisation imagery is often replaced with imagery of empowerment, emotional validation, control over the situation, and perpetrators being held accountable for their actions (Arntz & van Genderen, 2009; Arntz & Weertman, 1999; Rusch et al., 2000). Consequently, ImRs aims to change the encapsulated meaning of traumatic memories by influencing what people have learned about themselves and others, thereby modifying maladaptive beliefs and, therefore, associated emotions and behaviours (McCarthy et al., 2022; Morina et al., 2017). There is also evidence that negative inner dialogue, emotion regulation deficits, dissociation, and negative self-beliefs in trauma-affected and voice hearing populations are influenced by ImRs.

Self-Compassion and Inner Dialogue

Negative self-beliefs are common amongst trauma-affected individuals (Alessandra & Francesco, 2018) and are positively associated with PTSD symptoms (Thompson-Hollands et al., 2017). However, self-compassion, which involves self-directed communication that is caring, kind, and validating (Neff, 2003), is negatively associated with PTSD symptoms, voice severity, and voice distress (Maisey et al., 2022; Norman et al., 2020). Additionally, negative self-beliefs are positively associated with negative voice characteristics (Davenport et al., 2020) and negative voice content (Scott et al., 2020). Self-compassion (self-relating) may include self-compassionate inner dialogue, which according to the TRV model, maintains trauma-related voices (Strachan et al., 2022b), and there is evidence that self-compassion, but not self-esteem (self-evaluation), predicts voice

distress (Norman et al., 2020). ImRs often promotes compassionate imagery (Holmes et al., 2007) and preliminary evidence shows that ImRs is associated with increased self-compassion, which shows temporal precedence over reductions in PTSD symptoms (Hoffart et al., 2015), and increased compassion from voices, at least for some people (Strachan, Paulik, Roberts, et al., 2022).

Emotion Regulation Deficits

Gross' (2015) Extended Process Model of Emotion Regulation outlines four sequential stages of emotion regulation: situation (exposure to internal or external stimuli), attention (toward stimuli), appraisal (of stimuli), and response (physical, behavioural, or experiential expressions of emotion). Cognitive reappraisal is an emotion regulation strategy that occurs during the appraisal stage and involves consideration of alternative evaluations of stimuli that modify their emotional impact (Gross, 2001) and is considered a healthier emotion regulation strategy, due to its positive association with psychological wellbeing (Gross & John, 2003; John & Gross, 2004). Expressive suppression involves inhibition of emotional expression during the response stage (Gross, 2001) and is considered to be a less healthy strategy, due to its negative association with psychological wellbeing (Gross & John, 2003; John & Gross, 2004).

Trauma-affected and voice hearing individuals underuse cognitive reappraisal and overuse expressive suppression (Badcock et al., 2011), which is positively associated with voice (Badcock et al., 2011) and PTSD symptom severity (Seligowski et al., 2015). ImRs imagery often incorporates expression of previously inhibited needs and emotions (Arntz & Weertman, 1999) and, whilst no known studies have tested the impact of ImRs on cognitive reappraisal and expressive suppression specifically amongst people with voices or PTSD, ImRs is associated with reductions maladaptive emotion regulation strategies more generally amongst people with trauma-related disorders, including borderline personality disorder (Schaitz et al., 2020) and PTSD associated with child abuse (Raabe et al., 2022).

Emotion Regulation Self-Efficacy

Emotional self-efficacy describes one's perceived competence in understanding and managing emotions (Kirk et al., 2008) and is associated with ability to adapt one's emotional regulation strategy in response to changing circumstances (Milioni et al., 2015). Self-efficacy is informed by past performance experiences (Bandura, 1997) and as people with poor self-efficacy believe they will be unsuccessful in identifying and coping with emotions, they are less likely to use and persevere with effortful strategies to achieve these goals (Bandura, 2006). As such, it is possible that people with past experiences of

overwhelming emotions and ineffective emotion regulation attempts may be less likely to practice healthier, yet cognitively demanding emotion regulation strategies (e.g., cognitive reappraisal; Gross, 2001), due to poor emotional self-efficacy in regulation emotions.

There are no known studies of emotion regulation self-efficacy amongst trauma-affected or voice hearing populations. However, general negative self-efficacy is positively associated with distressing voices (Laloyaux et al., 2020; Løberg et al., 2019) and PTSD symptom severity (Luszczynska et al., 2009), and coping self-efficacy is negatively associated with negative trauma-related cognitions (Benight et al., 2015). ImRs often replaces helplessness imagery with mastery imagery, whereby a person experiences effectively responding and coping with difficult experiences (Rusch et al., 2000; Smucker et al., 1995), and is associated with increased perception of control over intrusive cognitions amongst voice-hearers (Ison et al., 2014) and trauma-affected individuals (Long & Quevillon, 2009).

Dissociative Coping Strategies

Dissociation has been conceptualised as an evolutionary response that modulates overwhelming emotions in traumatic situations when a person is unable to escape or defend themselves (Krause-Utz et al., 2017). Although dissociation suppresses the intensity of distress in the short term, it is considered to be a maladaptive emotion regulation strategy due to its propensity to become non-voluntary, generalise to other relatively non-distressing situations, and distort normal cognition (Cavicchioli et al., 2021; Krause-Utz et al., 2017; Lanius et al., 2010). Consistent with the TRV model (Strachan, Paulik, et al., 2022b), theories of self-efficacy (Bandura, 1997) suggest that past experiences of ineffective dissociative coping maintain negative self-efficacy beliefs, increase the likelihood of future dissociation (i.e., less-effortful emotion regulation strategies), and reduce motivation to engage in healthier strategies (e.g., cognitive reappraisal) that are more demanding.

Dissociation has a moderate to large positive association with maladaptive emotion regulation (Cavicchioli et al., 2021), PTSD re-experiencing symptoms (Stein et al., 2013), and the severity of voices in transdiagnostic samples (Pilton et al., 2015). Additionally, the TRV model (Strachan, Paulik, et al., 2022b) suggests that dissociation may cause inner dialogue to be perceived as an egodystonic voice, and preliminary evidence suggests dissociation mediates the relationship between inner dialogue and proneness to voices (Alderson-Day et al., 2014). Whilst ImRs is effectively reduces trauma-related voices amongst people who experience dissociation (Paulik et al., 2020) and effectively reduces dissociation amongst people with PTSD related to childhood trauma (Boterhoven de Haan

et al., 2020), no known studies have tested the impact of ImRs on dissociative symptoms in voice hearers.

In summary, self-compassion, emotion regulation deficits, emotion regulation self-efficacy, and dissociation are associated with both PTSD symptoms and voices (trauma- and non-trauma-related), and mediate the relationship between trauma and voices (Bloomfield et al., 2021; Gibson et al., 2016; Strachan, Paulik, Preece, et al., 2022; Williams et al., 2018). Whilst no known studies have examined the impact of ImRs on these factors amongst voice hearers, there is evidence ImRs is associated with change in these factors amongst trauma-affected and other clinically distressed populations (Boterhoven de Haan et al., 2020). Thus, these factors may be mechanisms of trauma-related voices that are modified during ImRs.

The Current Study

The primary aim of this study was to investigate whether ImRs is associated with changes in (a) primary outcomes: PTSD symptoms and emotional characteristics of voices (voice distress); (b) secondary outcomes: PTSD re-experiencing symptoms, physical characteristics of voices (voice frequency/intensity), and emotional symptoms; and (c) potential mechanisms: self-compassion, cognitive reappraisal, expressive suppression, emotional self-efficacy, and dissociation. The secondary aim of this study was to explore weekly trajectories of change in symptoms including number of trauma-related intrusions, voice frequency, voice distress, frequency of positively valenced voices, and frequency of negatively valenced voices.

Based on past findings, our first hypothesis was that ImRs would be associated with reductions in PTSD symptoms, PTSD re-experiencing symptoms, the emotional characteristics of voices (voice distress), the physical characteristics of voices, and emotional symptoms. Our second hypothesis was that ImRs would be associated with reductions in expressive suppression and dissociation, and increases in self-compassion, cognitive reappraisal, and emotional self-efficacy.

Method

Design

A one-arm open trial design was used with three pre-treatment baselines and one mid-treatment, post-treatment, and three-month follow up assessments of full psychometric measures. A short battery of single-item measures was administered at each of the three baselines, immediately prior to each treatment session, and at three-month follow up.

Participants

Participants (*N* = 49) were clients at Perth Voice Clinic, an Australian specialist transdiagnostic treatment and research clinic for people who hear voices, who received ImRs as part of routine service provision. Clients were assessed by a clinical psychologist to determine suitability for ImRs. Inclusion criteria for ImRs: (a) currently hearing voices, (b) a trauma history associated with current post-traumatic stress symptoms[6], (c) voices that are indirectly or directly linked to trauma, (d) client and clinician agreement that trauma symptoms are the primary treatment goal, and (e) ≥ 18 years of age. Exclusion criteria: (a) experiencing acute psychosis, enduring delusions, thought disorder (scored ≥ 5 on Unusual Thought Content or Conceptual Disorganization items of the Brief Psychiatric Rating Scale;Ventura et al., 1993), or another psychological condition that the clinician believed may impair participants' ability to consent or engage effectively in treatment (e.g., dementia), (b) in a current mental health or situational crisis (especially experiencing trauma that was related to the trauma being targeted in ImRs) at the time of therapy commencement, or (c) at significant risk of harming themselves or others. ImRs clients who did not consent for their data to be used for service evaluation were excluded from analyses (see Figure 6.2 for CONSORT flow diagram). Demographic and clinical characteristics are reported in Table 6.1.

Measures

Primary and Secondary Outcomes

PTSD Symptoms. The Posttraumatic Diagnostic Scale for DSM-5 (PDS-5) comprises 22-items with a five-point scale ranging from 0 (not at all) to 4 (6 or more times a week/severe; Foa et al., 2016). The PDS-5 total score and re-experiencing subscales were used to assess PTSD symptom severity (primary outcome) and re-experiencing symptom severity (secondary outcome), respectively. The PDS-5 total score and re-experiencing subscales (PDS-5-RE) have strong internal consistency (α = .95 and α = .90) and one-month test-retest reliability (*r* = .90 and *r* = .85) in trauma-affected samples (Foa et al., 2016).

[6] As voice hearers often report clinically significant symptoms of PTSD that do not meet full criteria for PTSD (Hardy et al. 2019), trauma history included (a) exposure to DSM-5 Criterion A traumas (measured using the trauma screen from the Posttraumatic Diagnostic Scale for DSM-5; Foa et al., 2016) or (b) another event that caused significant distress (e.g., bullying). PTSD symptom severity or diagnosis of PTSD were not part of inclusion criteria; post-traumatic stress symptoms included any clinically significant symptoms associated with DSM-5 Criteria B to H (APA, 2013).

Figure 6.2

CONSORT Flow Diagram for ImRs

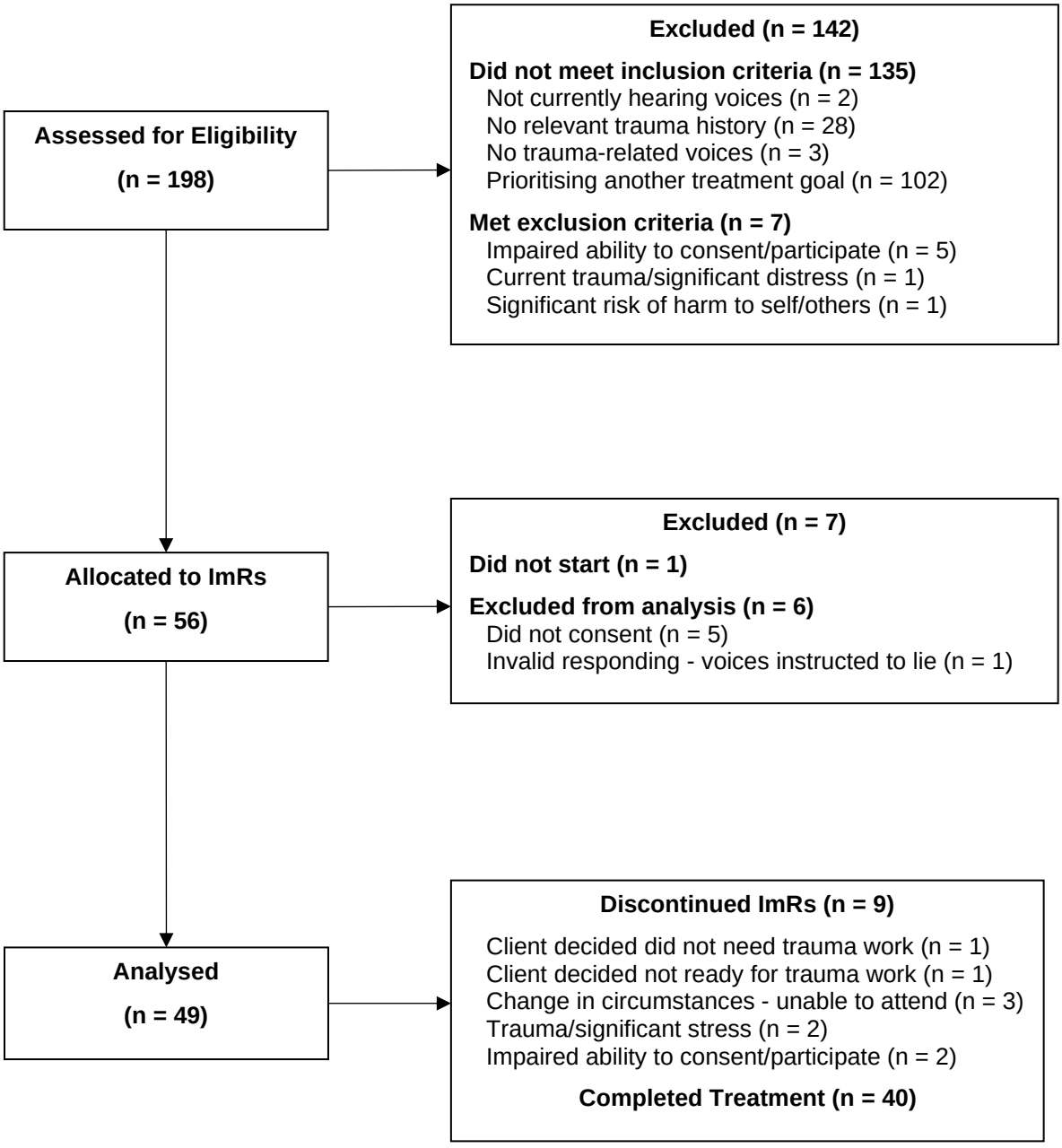


Table 6.1

Participant Demographic and Clinical Characteristics (N = 49)

	No. Participants
Age (years)	*M* =35.86 (SD = 14.33, range = 18-67
Gender	
Female	35 (71.4%)
Male	13 (26.5%)
Non-binary	1 (2.0%)
Employment Status	
Paid full-time	3 (6.1%)
Paid part-time	7 (14.3%)
Voluntary part-time	1 (2.0%)
Unemployed receiving government support	29 (59.2%)
Student	6 (12.2%)
Homemaker	3 (6.1%)
Relationship Status	
Single	21 (42.9%)
Married/civil partnership	7 (14.3%)
Cohabiting	2 (4.1%)
Separated/divorced	10 (20.4%)
In a long-term relationship	9 (18.4%)
Education	
Left school ≤ 16-years-old	15 (3.6%)
Completed/completing year 12	5 (10.2%)
Completed/completing TAFE/college	16 (32.7%)
Completed/completing undergraduate university degree	11 (22.4%)
Completed/completing post-graduate university degree	1 (2.0%)
Did not disclose	1 (2.0%)
Currently taking psychotropic medications	42 (85.7%)
Age at voices onset	20.17 (SD = 12.72, range = 5 – 52)
Previously received psychological treatment	43 (87.8%)
Referrers' diagnostic impressions[a]	
Psychotic spectrum disorder	22 (44.9%)
PTSD/complex PTSD	16 (32.7%)
Mixed depression and anxiety	16 (32.7%)
Borderline/cluster b personality disorders	9 (18.37%)
Bipolar disorders	2 (4.1%)
Autism spectrum disorder	4 (8.2%)
Attention deficit disorder	1 (2.0%)
Depressive disorders	8 (16.3%)
Anxiety disorders	5 (10.2%)
Dissociative disorders	1 (2.0%)
Obsessive compulsive disorders	3 (6.1%)
Eating disorders	1 (2.0%)
Did not specify	1 (2.0%)
Comorbidity	34 (69.4%)
Types of Traumas	

Serious, life threatening illness	4 (8.2%)
Physical assault	22 (44.9%)
Sexual assault	15 (30.6%)
Child non-sexual abuse	37 (75.5%)
Child sexual abuse	24 (49%)
Accident	6 (12.2%)
Other trauma	33 (67.3%)
Bullying	23 (49.9%)
Domestic violence (adulthood)	11 (22.4%)
Domestic violence (childhood)	3 (6.1%)
Childhood neglect	6 (12.2%)
Unexpected death of parent/sibling	5 (10.2%)
Near death of child	1 (2.0%)
Suicide of parent	1 (2.0%)
Suicide of friends	4 (8.2%)
Seeing dead bodies (suicide, terrorist attack)	2 (4.1%)
Learning siblings were sexually abused	1 (2.0%)
Parental abandonment, separation, imprisonment	4 (8.2%)
Intense events during psychotic episodes	1 (2.0%)
Own abuse towards children	1 (2.0%)
Number of Different Types of Traumas	2.88 (SD = 1.24)
1	4 (8.2%)
2	19 (38.8%)
3	13 (26.5%)
4	6 (12.2%)
5	6 (12.2%)
6	1 (2.0%)
Trauma-voice association	
Indirect only	21 (42.9%)
Direct only	2 (4.1%)
Both	25 (51.0%)
Not assessed	1 (2.0%)

Note. M = mean; *SD* = standard deviation.
[a] Diagnostic information is from referral letters and may not have been made as part of a formal diagnostic assessment.

Voice Severity. The emotional (voice distress; primary outcome) and physical characteristics subscales (voice frequency/intensity; secondary outcome) of the Hamilton Program for Schizophrenia Voices Questionnaire (HPSVQ) were used to measure voice severity (Kim et al., 2010; Van Lieshout & Goldberg, 2007). The HPSVQ is a 13-item measure with a five-point rating scale ranging from 0 (least severe/impairing) to 4 (most severe/causes the largest amount of disruption). Items 10 – 13 are not included in severity scores and were not administered. The HPSVQ emotional (HPSVQ-E; primary outcome) and physical characteristics subscales (HPSVQ-P; secondary outcome) were used to measure voice severity (Kim et al., 2010). The HPSVQ has strong internal consistency (α

= .83 - .94), concurrent validity, and one-week test-retest reliability (ICC = .84) in voices hearing samples with schizophrenia (Kim et al., 2010).

Emotional Symptoms. The Depression Anxiety and Stress Scales (DASS-21) is a 21-item measure that provides a four-point rating scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time; Lovibond & Lovibond, 1995) and was used to measure emotional symptoms (secondary outcome). The DASS-21 has strong internal consistency (α = .87 - .94) and concurrent validity in mixed clinical and non-clinical samples (Antony et al., 1998).

Potential Mechanisms

Emotion Regulation Ability. Cognitive reappraisal and expressive suppression were measured using the Emotional Regulation Questionnaire, which comprises 10 items and provides a seven-point rating scale ranging from 1 (strongly disagree) to 7 (strongly agree; Gross & John, 2003). The cognitive reappraisal (ERQ-CR) and expressive suppression (ERQ-ES) subscales have good internal consistency (α = .89 - .90 and α = .76 - .80, respectively) and concurrent validity in general community samples (Preece et al., 2020).

Self-Compassion. The Self-Compassion Scale Short Form (SCS) comprises 12 items and provides a five-point rating scale ranging from 1 (almost never) to 5 (almost always) and was used to assess self-compassion (Raes et al., 2011). The SCS has excellent internal consistency (α = .87) and convergent validity (*r* = .97) in university samples (Raes et al., 2011).

Emotional Self-Efficacy. The 10-item ‘using and managing one’s emotions’ subscale (Dacre Pool & Qualter, 2012) of the Emotional Self-Efficacy Scale (Kirk et al., 2008), which provides a five-point response scale ranging from 1 (not at all confident) to 5 (very confident), was used to measure emotion regulation self-efficacy. Items from remaining subscales were not administered as they measure non-self or non-regulatory emotional self-efficacy (Dacre Pool & Qualter, 2012). The ESES’s using and managing one’s emotions subscale (ESES-UM) has excellent internal consistency (α = .89) in mixed community and university samples (Dacre Pool & Qualter, 2012).

Dissociation. A single-item question, “during the past week, how often have you dissociated (felt disconnected or detached from the world around you or yourself)?”, was developed by the authors to measure dissociation symptoms using a five-point response scale that ranged from 0 (never) to 4 (a lot).

Weekly Symptoms

A short battery of five single-item questions was developed by authors to assess weekly symptoms. The first item, “how many trauma-related intrusions (i.e., nightmares, flashbacks) did you experience in the past week?”, asked participants to estimate the total number of PTSD re-experiencing symptoms. The second item, "in the past week, including today, how frequently did you experience voices?”, measured voice frequency on a seven-point rating scale ranging from 0 (voices not present or present less that once a week) to 6 (voices occur continuously or almost continually). The third item, “on average, over the past week (including today), how distressed did you get by your voices?”, measured voice distress using a rating scale that ranged from 0 (no distress) to 100 (maximum distress). The fourth and fifth items, “in the past week, how often were your voices positive?” and “in the past week, how often were your voices negative?”, measured positive and negative voices content using a five-point response scale that ranged from 0 (never) to 4 (a lot).

Procedure

Ethical approvals were obtained from Murdoch (2016/089) and Curtin University (HRE2019-0525) Human Research Ethics Committees. The number of sessions were based on Medicare’s (Australian national insurance scheme) funding model for private clinical psychology services. At the start of the trial, Medicare funded 10 sessions per year, which were used for one assessment session, one psychoeducation and ImRs preparation session, seven weekly rescripting sessions (i.e., of one memory), and one wrap-up session. In August 2020, Medicare-funded sessions were increased to 20 per year in response to the impact of Covid-19, and participants who commenced treatment after this time received between seven to 17 ImRs sessions, depending on their clinical needs (see Appendix J for a summary). Sessions were delivered via telehealth or face-to-face.

Session Content

Session one (assessment) involved assessment of current and past mental health history (primarily voices and trauma), inclusion and exclusion criteria, and trauma-voice associations (Hardy et al., 2005). Session two (ImRs preparation) occurred two weeks after session one and involved psychoeducation, sequencing of selected trauma memories for rescripting, and a homework visualisation task of imagining themselves soothing their former child self. Sessions three to 19 (rescripting) occurred weekly and involved rescripting of one memory per session In the rescripting protocol (detailed protocol available on request), initially the participant brings a trauma memory to mind and describes in present tense, from the perspective of their former child self, what is happening in the image, their sensory, cognitive, and emotional experiences at the start of

the memory. Once the client is connected to the feelings evoked by the memory, but typically before the “hot” part of the trauma has taken place, the therapist intervenes in the event and supports the participant to meet their needs. The therapist describes how they are intervening and instructs the participant to imagine them carrying out these actions. The therapist provides comfort, reassurance, and explicitly tells the child they are not guilty and that the offender should be ashamed. The therapist continues to intervene until the participant feels safe. Due to the complexity of trauma amongst voice hearers and increased likelihood of dissociation in later stages of ImRs, this trial did not include the second and third stages of ImRs that involve participants (adult self) intervening in the imagined event (Arntz & Weertman, 1999). The final post-treatment (wrap up) session occurred one week after the final rescripting session and involved treatment review, relapse prevention, and discussion of future goals. All interventions were delivered by G. P (author).

Assessment Timepoints

Assessment of full-scale measures occurred at six time-points: baseline one (BL1; session one), baseline two (BL2; between session one and two), baseline three (BL3; session two), mid-treatment (MT; before session six; based on initial Medicare-funded treatment plan), post-treatment (PT), and three-month follow-up (FU). Consent for service evaluation data to be used in research was requested at baseline two. To limit participant burden, the secondary outcome (DASS-21) and full-scale mechanism measures (SCS, ERQ, ESES) were excluded from baselines two and three. Assessment of single-items occurred at all baselines, all active rescripting sessions (IR1 – IR17), mid-treatment, post-treatment, and follow-up. Appendix K summarises session and timepoint information.

Participants completed baselines two and follow-up at home. Participants completed single items in-session and were encouraged to complete full-scale measures in the waiting room; some participants completed full-scale assessments at home before or after their session. Participants completed assessments online using Qualtrics survey software, which was used to monitor timely completion of assessments. Researchers sent text message and email reminders for at-home assessments and provided phone reminders to participants who requested hardcopy assessments. Data collection occurred between September 2019 and December 2022.

Data Analysis

A statistical analysis plan was uploaded to Open Science Framework during the final stages of data collection (https://osf.io/pqyrt; the temporal precedence analyses outlined in this plan will be reported elsewhere). A G*Power (Faul et al., 2007) a priori

power analyses, assuming medium effects (*f* = .25), 80% power, five measurement occasions for primary outcomes, and alphas of .05 indicated 24 participants were needed to test the first and second hypotheses. Analyses were conducted using SPSS 28.0.

Treatment Efficacy

A series of linear mixed models (LMMs) using data from the full intention-to-treat sample were used to test the impact of ImRs on primary and secondary outcomes, potential mechanisms, and weekly symptoms. Full information estimation used all available data at each timepoint to account for missing data. As the total number of treatment sessions varied between participants, there was a large proportion (≥38.8%) of missing cases from IR8 – IR17 (see Appendix J), so only data from IR1 – IR7 (all ≤ 4.1% missingness) were included in models with weekly assessment timepoints (dissociation and weekly symptoms).

Time was entered as categorical fixed factor and the number of active rescripting sessions (IR) was entered as a fixed covariate. To account for individual differences in baseline scores, a random intercept was included for each participant. Time was entered as a random slope but was removed from the models if it caused convergence issues. The fit of models with (AR1) and without (unstructured) autoregressive residual covariance structure was compared using BIC statistic. Covariance structures with the best fit were retained. Partial eta-square was used to index the effect size for the main effect of time. Cohen's *d* was used to index effect sizes for least significant difference contrast coefficients, which were used to test differences between model-estimated marginal means across assessments, including assessment of baseline stability.

Reliable and Clinically Significant Change

To evaluate whether individual change in PTSD and voice hearing severity from B1 to MT, PT, and FU were statistically significantly higher than chance due to measurement error, Jacobson and Truax's (1991) reliable change index (RCI) scores were calculated for the PDS and HPSVQ. Jacobson and Truax's (1991) clinically significant change (CSC) statistic was used to evaluate clinically meaningful change in voice hearing severity from B1 to MT, PT, and FU. The threshold for clinically significant change was two standard deviations (*SD* = 6.00) below the clinical mean (*M* = 18.80; van Lieshout & Goldberg, 2007). As no disaggregated clinical versus non-clinical norms are available for the PDS, change in probably clinical cut-off for PTSD diagnostic (PDS total score = 28) was calculated.

Results

Treatment Outcomes Across Time

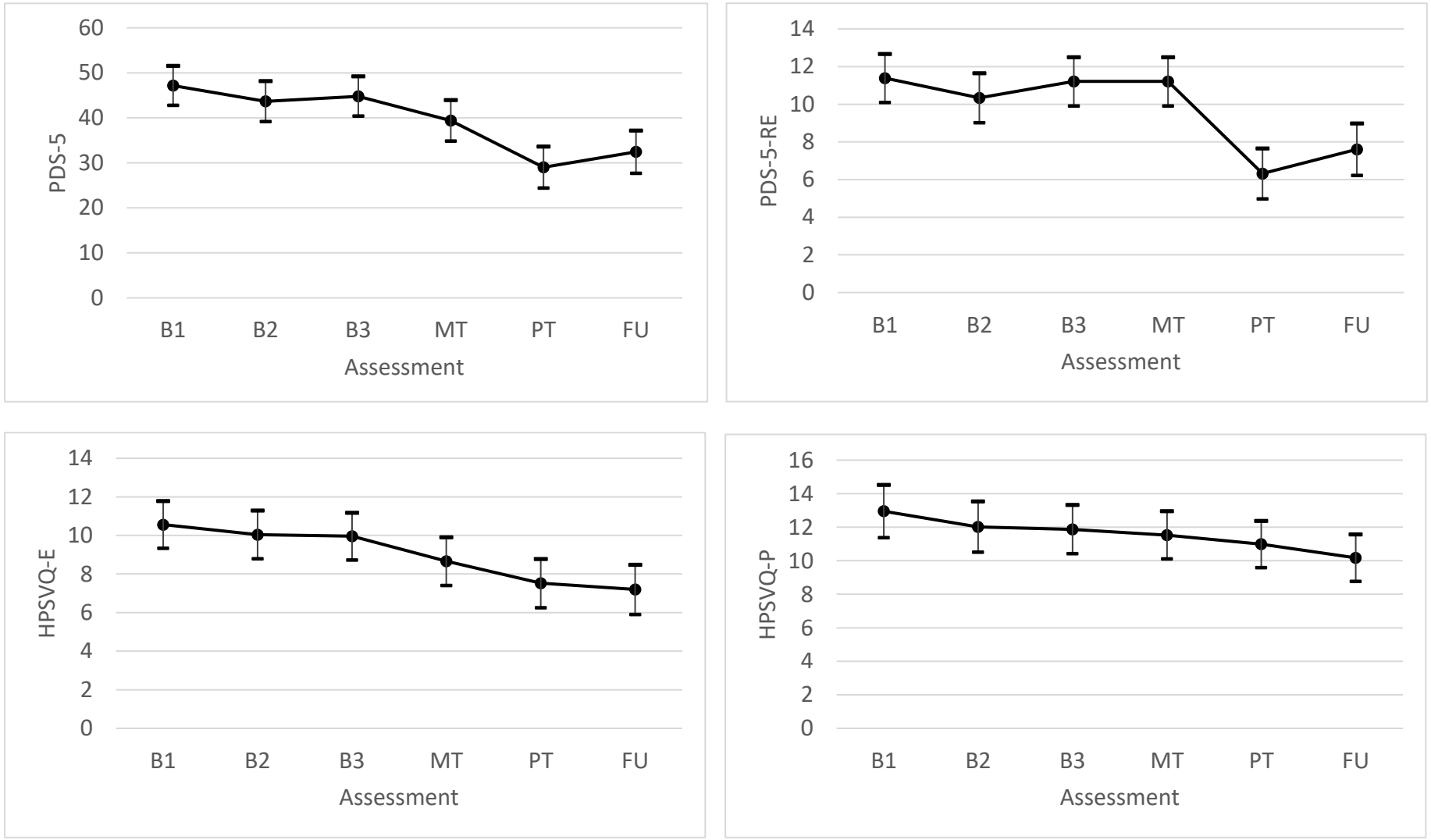
All models met normality assumptions. A random slope for time was retained in the physical characteristics of voices (HPSVQ-P), cognitive reappraisal (ERQ-CR), expressive suppression (ERQ-ES), self-compassion (SCS), dissociation, and intrusions models, but was removed from the remaining models due to convergence problems. The number of ImRs sessions covariate was non-significant in all models (*p*s ≥ 0.06). LMM outputs are available at https://osf.io/pqyrt and raw means, standard deviations, and Cronbach's alphas are presented in Appendix L. Model-estimated means for each assessment point are plotted in Figure 6.3 and reported in Appendix M. Bivariate correlations between all variables at baseline one assessment are provided in Appendix N.

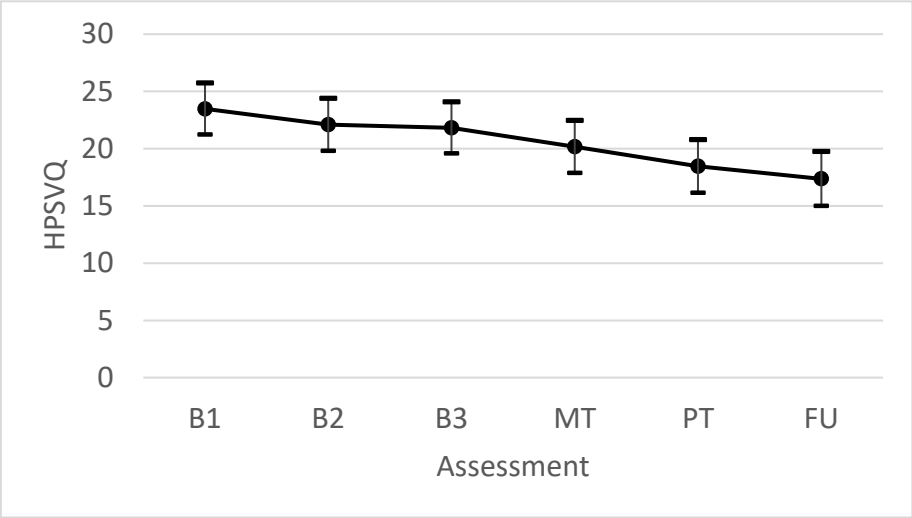
Baseline Stability

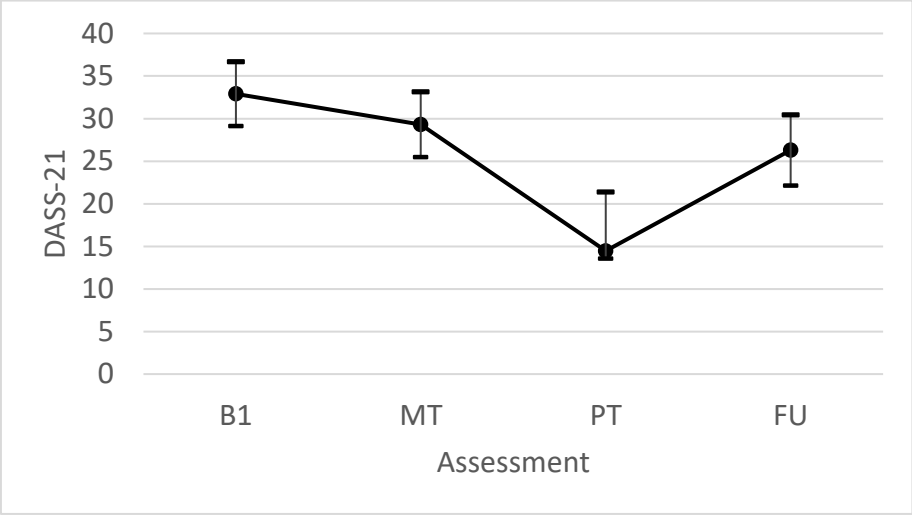
Across the three baselines, there were two significant changes in the physical characteristics of voices and weekly intrusions, and one in weekly voice frequency, which were small (*d*s = 0.02 – 0.27). There were no other significant baseline differences, which suggests that all outcomes were relatively stable prior to active ImRs sessions. Mean change and effect sizes across baseline assessments are presented in Table 6.2.

Figure 6.3

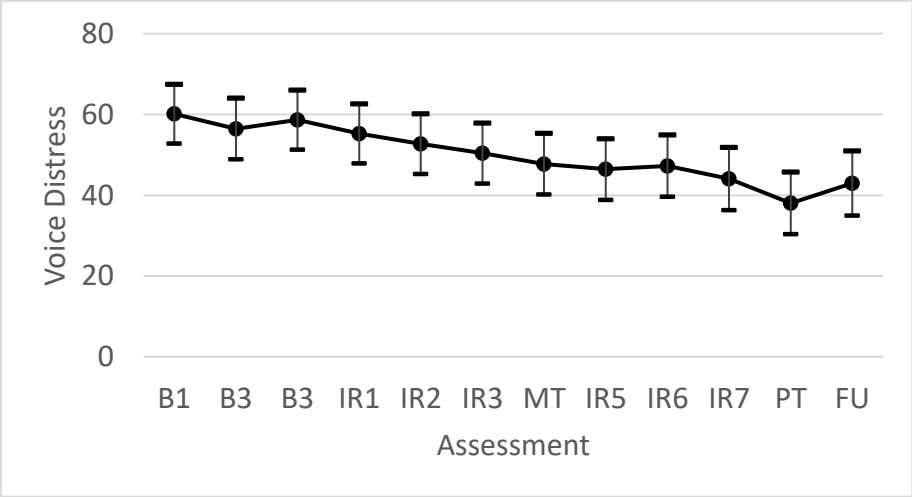
Plots of Model-Predicted Means for Primary, Secondary, Weekly, and Mechanism Outcomes

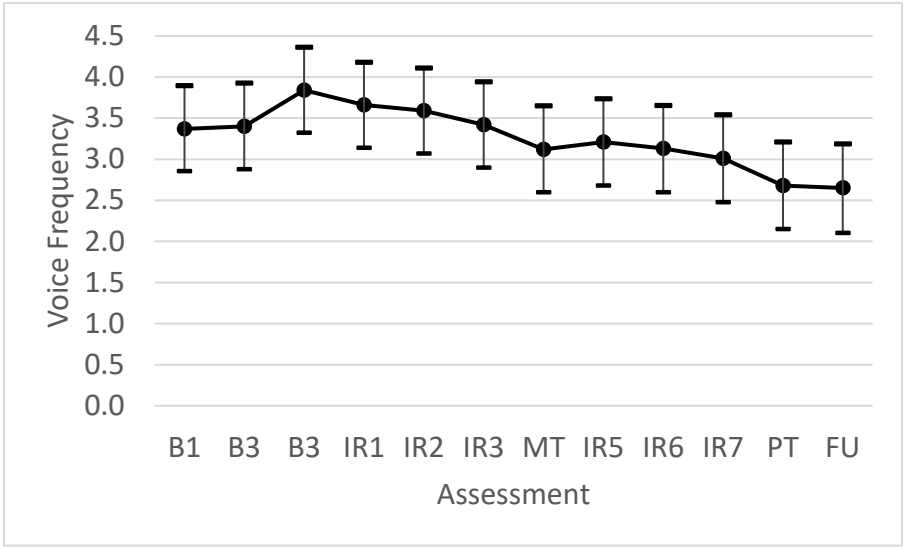


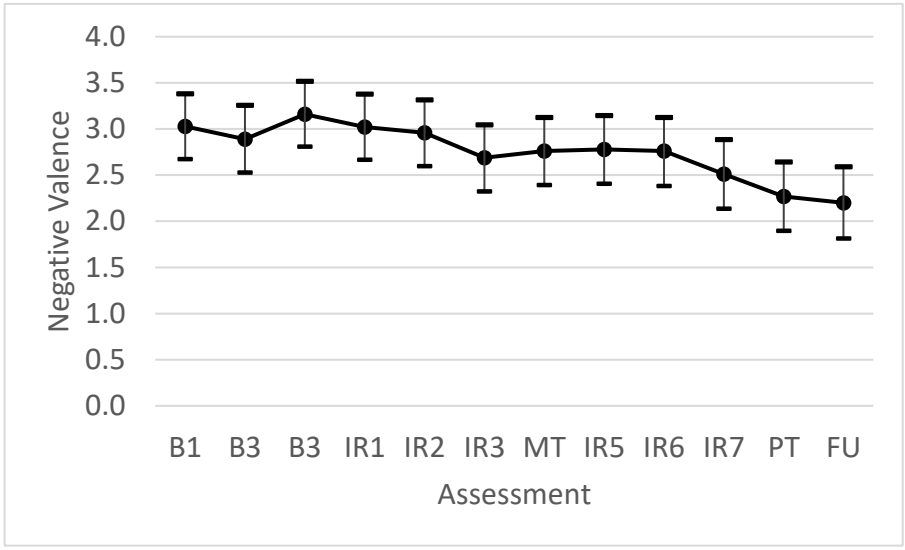

HPSVQ
30
25
20
15
10
5
0
B1
B2
B3
MT
PT
FU
Assessment

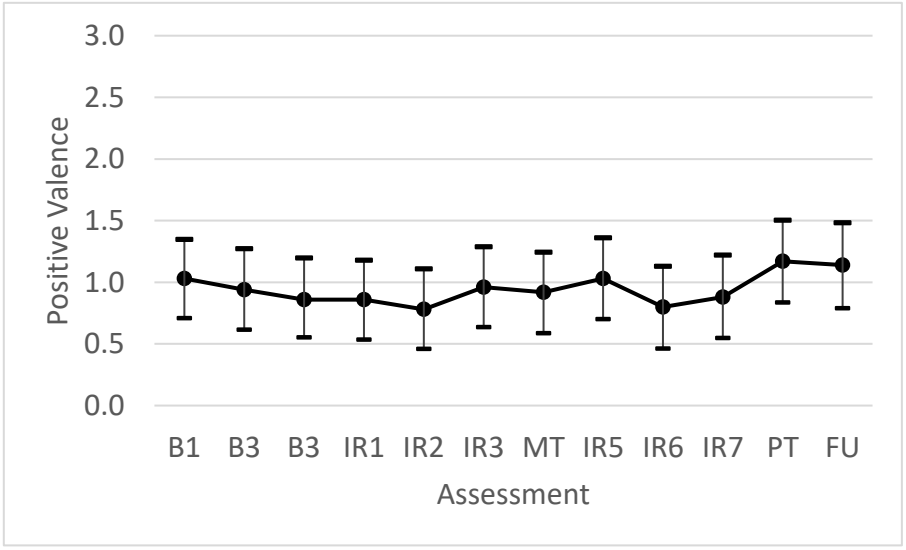

DASS-21
40
35
30
25
20
15
10
5
0
B1
MT
PT
FU
Assessment

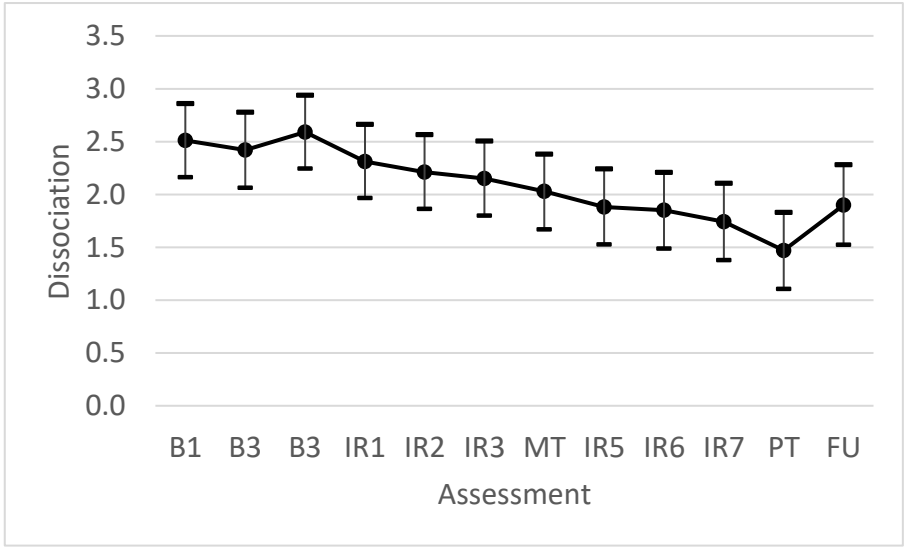

Intrusions
30
25
20
15
10
5
0
B1
B3
B3
IR1
IR2
IR3
MT
IR5
IR6
IR7
PT
FU
Assessment

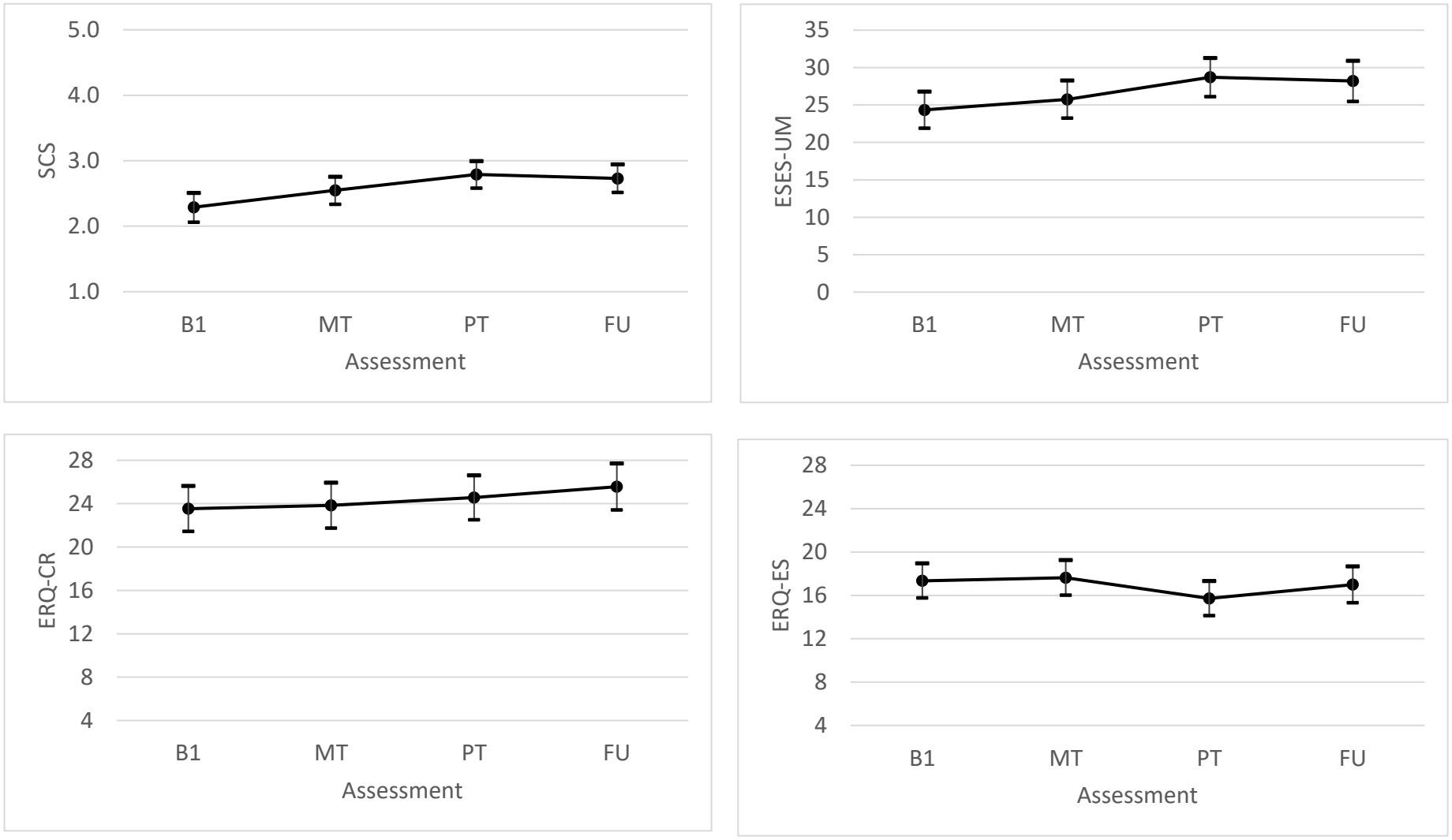

Voice Distress
80
60
40
20
0
B1
B3
B3
IR1
IR2
IR3
MT
IR5
IR6
IR7
PT
FU
Assessment


Voice Frequency
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
B1 B3 B3 IR1 IR2 IR3 MT IR5 IR6 IR7 PT FU
Assessment


Negative Valence
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
B1 B3 B3 IR1 IR2 IR3 MT IR5 IR6 IR7 PT FU
Assessment


Positive Valence
3.0
2.5
2.0
1.5
1.0
0.5
0.0
B1 B3 B3 IR1 IR2 IR3 MT IR5 IR6 IR7 PT FU
Assessment


Dissociation
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
B1 B3 B3 IR1 IR2 IR3 MT IR5 IR6 IR7 PT FU
Assessment



Note. BL = baseline; MT = mid-treatment; PT = post-treatment; FU = three-month follow-up; PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; PDS-5-RE = Posttraumatic Diagnostic Scale for DSM-5; HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire; HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale; HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics

subscale; DASS = Depression Anxiety and Stress Scales-21; ERQ-CR = Emotion Regulation Questionnaire – Cognitive Reappraisal subscale; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression subscale; ESES-UM = Emotional Self-Efficacy Scale – Understanding and Managing subscale; SCS = Self-Compassion Scale Short Form; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voice distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.

Table 6.2

Model-Estimated Mean Changes with Effect Sizes Across Baselines

	Mean Change From BL1						Mean Change from BL2		
	BL2			BL3			BL3		
	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*
PDS-5	-3.51 (1.93)	0.07	0.22	-2.37 (1.89)	0.21	0.15	1.14 (1.95)	0.56	0.07
PDS-5-RE	-1.05 (0.55)	0.06	0.22	-0.18 (0.34)	0.74	0.03	0.87 (0.55)	0.06	0.19
HPSVQ	-1.38 (0.86)	0.11	0.17	-1.66 (0.83)	0.05	0.21	-0.28 (0.86)	0.75	0.04
HPSVQ-E	-0.52 (0.78)	0.28	0.12	-0.60 (0.46)	0.19	0.14	-0.08 (0.48)	0.86	0.02
HPSVQ-P	-0.92 (0.36)	0.01	0.17	-1.07 (0.42)	0.01	0.20	-0.15 (0.36)	0.67	0.03
Dissociation	-0.09 (0.17)	0.60	0.07	0.08 (0.17)	0.63	0.06	0.17 (0.17)	0.33	0.13
Intrusions	4.48 (2.09)	0.03	0.22	5.19 (2.22)	0.02	0.27	0.71 (2.06)	0.73	0.04
Voice distress	-3.68 (3.51)	0.30	0.14	-1.46 (3.40)	0.67	0.06	2.22 (3.53)	0.53	0.08
Voice frequency	0.03 (0.17)	0.87	0.02	0.47 (0.17)	.006	0.26	0.44 (0.17)	0.78	0.24
Positive valence	-0.08 (0.15)	0.57	0.08	-0.15 (0.15)	0.29	0.13	0.07 (0.15)	0.65	0.05
Negative valence	-0.14 (0.18)	0.46	0.11	0.13 (0.18)	0.45	0.10	0.27 (0.19)	0.14	0.21

Note. M_{ch} = estimated mean change; BL = baseline; PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; PDS-5-RE = Posttraumatic Diagnostic Scale for DSM-5; HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire; HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale; HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics subscale; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voice distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.

Primary Outcomes

There were significant and very large main effects of time on the severity of PTSD re-experiencing symptoms and the emotional characteristics of voices: PDS-5-RE, $F(5, 211.01) = 26.87$, $p < .001$, $\eta^2_p = .39$, and HPSVQ-E, $F(5, 205.57) = 15.01$, $p < .001$, $\eta^2_p = .27$. Both primary outcomes showed significant medium-large to very large reductions at post-treatment and follow-up (*d*s = 0.69 – 2.23). Whilst there was no change in the emotional characteristics of voices from post-treatment to follow-up, there was a significant and large increase in PTSD re-experiencing symptoms (*d* = 1.18). Mean change and effect sizes between baseline one, mid- and post-treatment, and follow-up for all variables are reported in Table 6.3.

Secondary Outcomes

There were significant and very large main effects of time on the severity of total PTSD symptoms, total voices, the physical characteristics of voices, and emotional symptoms: PDS, $F(5, 205.89) = 24.11$, $p < .001$, $\eta^2_p = .37$, HPSVQ, $F(5, 204.61) = 12.66$, $p < .001$, $\eta^2_p = .24$, HPSVQ-P, $F(5, 205.57) = 15.01$, $p < .00$, $\eta^2_p = .27$, and DASS-21, $F(3, 112.73) = 29.65$, $p < .001$, $\eta^2_p = .44$. There was a significant medium to large reduction (*d*s = 0.47 – 1.15) on all secondary outcomes at post-treatment and follow-up. From post-treatment to follow-up there was a significant medium-large (*d* = 0.62) increase on the DASS-21 and small (*d* = 0.17) reduction the HPSVQ physical characteristics of voices, but no change on the remaining secondary outcomes.

Weekly Outcomes

There was a significant and medium-large to large main effect of time on negatively valenced voices, $F(11, 461.15) = 4.52$, $p < .001$, $\eta^2_p = .10$, intrusions, $F(11, 269.19) = 4.36$, $p < .001$, $\eta^2_p = .15$, voice distress, $F(11, 457.82) = 6.69$, $p < .001$, $\eta^2_p = .14$, and voice frequency, $F(11, 457.57) = 7.84$, $p < .001$, $\eta^2_p = .16$. There was no main effect of time on positively valenced voices, $F(11, 460.35) = 1.20$, $p = 0.28$, $\eta^2_p = .03$. At post-treatment and follow-up, there were significant small to large reductions (*d*s = 0.11 – 0.83) in all outcomes, except for a non-significant small-medium reduction (*d* = 0.25) in intrusions at post-treatment. There was a significant small-medium increase (d = 0.37) in intrusions from post-treatment to follow-up, with no change post-treatment to follow-up change on remaining outcomes.

Mechanisms

There were no significant main effects of time on cognitive reappraisal or expressive suppression: ERQ-CR, $F(3, 105.16) = 1.07$, $p = 0.37$, $\eta^2_p = .03$, and ERQ-ES, $F(3, 110.16) = 1.80$, $p = 0.15$, $\eta^2_p = .05$. There were significant large to very large main

effects of time on dissociation, $F(11, 453.19) = 6.99$, $p < .001$, $\eta^2_p = .15$, and emotional self-efficacy and self-compassion: ESES-UM, $F(3, 110.11) = 4.77$, $p = .005$, $\eta^2_p = .12$, and SCS, $F(3, 93.83) = 8.87$, $p < .001$, $\eta^2_p = .24$. There was a significant medium to large reduction (*d*s = 0.47) in dissociation at post-treatment and follow-up, with a significant small-medium increase (*d* = 0.33) from post-treatment to follow-up. There were small-medium to medium (*d*s = 0.41 – 0.83) increases in emotional self-efficacy and self-compassion at post-treatment and follow-up, with no changes from post-treatment to follow-up.

Reliable and Clinically Significant Change

Table 6.4 presents the proportion of participants who showed reliable and clinically significant change on the PDS-5 and HPSVQ at mid-treatment, post-treatment, and follow-up. There were high rates of reliable change on the PDS-5 (>49%), low rates of reliable deterioration (<8%), and the proportion of participants who met the cut-off for probable PTSD had halved (<39%). There were lower rates of reliable improvement (>20%) and deterioration (2%) on the HPSVQ, and 24% and 16% of participants experienced clinically significant change at post-treatment and follow-up, respectively.

Discussion

This study aimed to examine the impact of ImRs for trauma memories on the severity of PTSD symptoms and trauma-related voices and is the first study examine the impact of ImRs on dissociation, emotional self-efficacy, and self-compassion, as potential mechanisms of trauma-related voices. The findings from this study support the first hypothesis, providing further evidence that ImRs effectively reduces PTSD symptoms and distressing voices amongst trauma-affected voice hearers (Clarke et al., 2022; Ison et al., 2014; Paulik, Steel, et al., 2019). The findings partially support the second hypothesis as ImRs was associated with reductions in dissociation and increases in self-compassion and emotional self-efficacy, but was not associated with changes in cognitive reappraisal or expressive suppression. This study extended past ImRs studies in several ways. The transdiagnostic sample was larger than that of past ImRs studies (*n*s < 12) and provided evidence that ImRs effectively reduces voices and PTSD symptoms across a range of disorders. The multiple baseline design demonstrated that changes were the result of the intervention rather than natural effects of time (Hawkins et al., 2007) and the three-month follow-up assessment demonstrated relatively stable medium-term treatment effects (Llewellyn-Bennett et al., 2016).

Table 6.3

Model-Estimated Mean Changes with Effect Sizes for All Variables Across Treatment and Three-Month Follow-Up Assessments

	Mean Change from BL1									Mean Change from MT						Mean Change from PT		
	MT			PT			FU			PT			FU			FU		
	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*	M_{ch}	*p*	*d*
PDS-5	-7.77 (1.98)	<.001	0.49	-18.15 (2.01)	<.001	1.14	-14.73 (2.10)	<.001	0.89	-10.38 (2.06)	<.001	0.64	-6.96 (2.15)	.001	0.42	3.42 (2.17)	0.12	0.21
PDS-5-RE	-0.18 (0.54)	0.74	0.03	-5.07 (0.57)	<.001	1.08	-3.78 (0.59)	<.001	2.23	-4.89 (0.57)	<.001	1.05	-3.60 (0.59)	<.001	2.24	1.30 (0.61)	0.04	1.18
HPSVQ	-3.32 (0.86)	<.001	0.42	-5.01 (0.88)	<.001	0.62	-6.12 (0.92)	<.001	0.74	-1.69 (0.89)	0.06	0.21	-2.80 (0.93)	.003	0.34	-1.10 (0.94)	0.24	0.13
HPSVQ-E	-1.90 (0.48)	<.001	0.44	-3.04 (0.49)	<.001	0.69	3.37 (0.51)	<.001	0.74	-1.14 (0.50)	0.02	0.26	-1.47 (0.52)	.005	0.33	-0.33 (0.53)	0.54	0.07
HPSVQ-P	-1.42 (0.48)	.003	0.27	-1.97 (0.52)	<.001	0.38	-2.78 (0.57)	<.001	0.57	-0.55 (.38)	0.15	0.11	-1.36 (0.47)	.004	0.28	-0.81 (0.40)	0.04	0.17
DASS-21	-3.61 (1.66)	0.03	0.28	-15.43 (1.71)	<.001	1.15	-6.61 (1.86)	<.001	0.47	-11.82 (1.69)	<.001	0.87	-3.00 (1.84)	0.11	0.21	8.82 (1.86)	<.001	0.62
ERQ-CR	0.31 (1.01)	0.86	0.04	1.03 (1.09)	0.35	0.14	2.03 (1.19)	0.09	0.27	0.72 (1.06)	0.50	0.10	1.72 (1.19)	0.15	0.23	1.01 (1.12)	0.37	0.13
ERQ-ES	0.28 (0.83)	0.74	0.05	-1.62 (0.88)	0.07	0.29	-0.36 (0.96)	0.71	0.06	-1.90 (0.88)	0.03	0.34	-0.63 (0.97)	0.51	0.11	1.27 (0.92)	0.17	0.22
ESES-UM	1.41 (1.27)	0.27	0.16	4.36 (1.31)	.001	0.49	3.6 (1.38)	.006	0.41	2.95 (1.30)	0.03	0.33	2.45 (1.37)	0.08	0.26	-0.50 (1.39)	0.72	0.05
SCS	0.26 (0.09)	.005	0.34	0.50 (0.10)	<.001	0.68	0.45 (0.11)	<.001	0.60	0.24 (0.09)	0.01	0.33	0.19 (0.10)	0.09	0.23	-0.06 (0.10)	0.55	0.08
Dissociation	-0.49 (0.17)	.005	0.38	1.04 (0.18)	<.001	0.83	-0.61 (0.19)	.001	0.47	-0.56 (0.18)	.002	0.44	-0.12 (0.19)	0.51	0.10	0.44 (0.19)	0.02	0.33
Intrusions	-2.18 (2.61)	.40	0.11	-11.01 (2.76)	<.001	0.58	-4.47 (2.88)	0.12	0.25	-8.83 (2.57)	<.001	0.50	-2.29 (2.75)	0.41	0.13	6.54 (2.29)	.005	0.37
Voice distress	-12.36 (3.52)	<.001	0.47	-22.10 (3.60)	<.001	0.83	-17.18 (3.78)	<.001	0.62	-9.74 (3.68)	0.01	0.36	-4.82 (3.86)	0.21	0.17	4.92 (3.91)	0.21	0.18
Voice frequency	0.25 (0.18)	0.15	0.14	-0.70 (0.18)	<.001	0.37	-0.73 (0.19)	<.001	0.38	-0.44 (0.18)	0.12	0.24	-0.48 (0.19)	0.01	0.25	-0.03 (0.19)	0.86	0.02
Positive valence	-0.11 (0.15)	0.45	0.10	0.14 (0.15)	0.36	0.74	0.11 (0.16)	0.50	0.09	0.25 (0.16)	0.11	0.63	0.22 (0.16)	0.18	0.18	-0.03 (0.17)	0.84	0.79
Negative valence	-0.27 (0.19)	0.15	0.21	-0.76 (0.19)	<.001	0.59	-0.83 (0.20)	<.001	0.61	-0.49 (0.19)	0.01	0.37	-0.56 (0.20)	0.18	0.41	-0.07 (0.20)	0.74	0.05

Note. M_{ch} = estimated mean change; BL = baseline; MT = mid-treatment; PT = post-treatment; FU = three-month follow-up; PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; PDS-5-RE = Posttraumatic Diagnostic Scale for DSM-5; HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire; HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale; HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics subscale; DASS = Depression Anxiety and Stress Scales-21; ERQ-CR = Emotion Regulation Questionnaire – Cognitive Reappraisal subscale; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression subscale; ESES-UM = Emotional Self-Efficacy Scale –

Understanding and Managing subscale; SCS = Self-Compassion Scale Short Form; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voice distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.

Table 6.4

Proportion (Percentage) of Total Sample (N = 49) with Reliable Change, Clinically Significant Change, and Probably Post-traumatic Stress Disorder at Mid-treatment, Post-treatment, and Three-month Follow-up

	BL1	MT	PT	FU
HPSVQ	-	*n* = 42	*n* = 39	*n* = 34
Reliably improved	-	11 (22%)	12 (24%)	10 (20%)
Reliably deteriorated	-	0 (0%)	0 (0%)	1 (2%)
Clinically significant change	-	0 (0%)	12 (24%)	8 (16%)
PDS	-	*n* = 42	*n* = 40	*n* = 35
Reliably improved	-	17 (35%)	28 (57%)	24 (49%)
Reliably deteriorated	-	3 (6%)	2 (4%)	4 (8%)
Probable PTSD[c]	*n* = 40	*n* = 39	*n* = 40	*n* = 35
	36 (73%)	29 (59%)	19 (39%)	17 (35%)

Note. BL = baseline; MT = mid-treatment; PT = post-treatment; FU = three-month follow-up; *n* = number of participants included in calculation; PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire.
[c]As normative data for the PDS-5 in disaggregated clinical vs non-clinical populations has not been published, clinically significant change was unable to be calculated for the PDS. Change in clinical cut-off for probable PTSD (PDS-5 total score = 28) was calculated as an alternative index of clinical change.

ImRs was associated with medium reductions in the physical characteristics of voices, with a further small reduction from post-treatment to three-month follow-up, which suggests that there are continued reductions in the loudness, duration, frequency, and clarity of voices in the months after ImRs is ceased. The medium-large to large reductions in the severity of voices, the emotional characteristics of voices, and voice distress were comparable to the findings of past ImRs studies (Paulik et al., 2019), as was the rate of reliable change in the severity of voices (Ison et al., 2014). The observed effect sizes are somewhat smaller than those reported by Paulik et al. (2019), which may be due to the use of different voices measures. Consistent with past findings (Paulik, Steel, et al., 2019), there were large reductions in the severity of total PTSD symptoms at post-treatment and three-month follow-up, and medium to large reductions in emotional symptoms. Whilst the rate of reliable change in PTSD symptoms at post-treatment was somewhat lower than that in past ImRs studies with trauma-affected individuals with psychotic spectrum disorders (57% vs 83.3%; Clarke et al., 2022), the proportion of participants who fell below the cut-off for PTSD at post-treatment was comparable across studies. Furthermore, 65% of participants fell below the cut-off for PTSD at three-month follow-up, which is more than double the proportion who no longer met criteria for PTSD at one-month follow-up in past studies (Clarke et al., 2022). In relation to PTSD re-experiencing symptoms specifically, at post-treatment there were medium-large reductions on the weekly frequency of trauma-related intrusions single-item, which is consistent with past findings (Paulik et al., 2019), and large reductions on the validated full-scale measure of PTSD re-experiencing symptoms. Unlike Paulik et al. (2019), who found further reductions in weekly trauma-related intrusions from post-treatment to three-month follow up, we found medium and large increases in weekly trauma-related intrusions and the severity of PTSD re-experiencing symptoms, respectively, across these timepoints. Whilst this suggests that gains in PTSD re-experiencing symptoms were not fully maintained at three-month follow-up, the overall reduction in re-experiencing symptoms at follow-up was nevertheless very large.

ImRs was not associated with changes in expressive suppression or cognitive reappraisal, which suggest that the use of expressive suppression or cognitive reappraisal as specific emotion regulation strategies does not explain the reductions in PTSD symptoms or trauma-related voices associated with ImRs. Given that ImRs was associated with increased self-compassion and emotional self-efficacy, it may be that reductions in harsh self-judgements and poor confidence in one's ability to understand and regulate emotions is more important in explaining trauma-related voices than the use of

specific regulation strategies. Alternatively, it may be that trauma-related voices are maintained by other unmeasured emotion regulation strategies. Emotion regulation strategies such as rumination, thought suppression, and experiential avoidance are strongly associated with PTSD symptoms (Seligowski et al., 2015) and, although few studies have examined these specific strategies in relation to voices, there is some evidence that experiential avoidance is associated with hallucinations and other “psychotic-like" symptoms (O'Driscoll et al., 2014; Varese et al., 2011) and that thought suppression is associated with hallucination proneness (Jones & Fernyhough, 2006). Past studies have found that dissociation is not associated with expressive suppression or cognitive reappraisal, but is positively associated with experiential avoidance, thought suppression, and rumination (Cavicchioli et al., 2021). Similarly, self-compassion is negatively associated with all three regulation strategies (Ferrari et al., 2019; Neff, 2003; Thompson & Waltz, 2008). Together, these findings suggest that experiential avoidance, thought suppression, and rumination emotion regulation strategies may better explain dissociative reactions in trauma-affected voice hearers than expressive suppression and cognitive reappraisal, and may be modified during ImRs.

Experiential avoidance and thought suppression have been theorised to interact with ruminative processes, whereby avoiding or suppressing unwanted internal experiences paradoxically increases unwanted thoughts, which in turn exacerbates avoidance and suppressive strategies (Abramowitz et al., 2001; Wenzlaff & Wegner, 2000). The theorised oscillation between these regulation strategies corresponds with the feedback loop between dissociative coping (which may be a function of experiential avoidance or thought suppression) and intrusive inner dialogue (which may have similar qualities to rumination) within the TRV model. Should this be the case, the interactive relationship between these factors may explain why the observed reduction in dissociation was accompanied by an increase in self-compassion (compassionate inner dialogue).

Future Research Directions

Given that negative inner dialogue, poor emotion regulation ability, and dissociation are theorised to be key underlying factors of indirect trauma-related voices (Strachan, Paulik, et al., 2022b), which were experienced by 93% of our sample, the observed changes in self-compassion, emotional self-efficacy, and dissociation could explain the reductions in the severity and negative content of trauma-related voices. However, future studies are needed to gather evidence of temporality by examining whether early changes in these factors precede later changes in symptoms. Furthermore, given these factors may interact to maintain psychopathology (Abramowitz et al., 2001; Wenzlaff & Wegner, 2000),

future studies are needed to examine how the theorised associations between these factors may predict trauma-related voice and PTSD symptoms.

Future studies are needed to understand how ImRs modifies self-compassionate inner dialogue, emotional self-efficacy, and dissociation. Self-compassion and emotional self-efficacy both involve self-referential appraisals, and past ImRs studies found that ImRs was associated with reductions in core beliefs (Ison et al., 2014) and self-referential trauma-related appraisals (Clarke et al., 2022), so the increases in these factors may be consistent with suggestions that ImRs modifies unhealthy representations of the self (Arntz, 2011). However, it has also been suggested that ImRs facilitates emotional processing in participants with complex trauma, which involves the development of a healthier perception of emotions (e.g., appraised meaning) and more adaptive ways of regulating emotions (Arntz, 2011; Mancini & Mancini, 2018). As such, it may be important for future studies to examine the impact of ImRs on trauma-related beliefs, emotional knowledge and beliefs, and different types of emotion regulation.

It may also be important to examine which aspects of ImRs are most important in producing changes in symptoms and potential mechanisms, and how ImRs and CBT may differ in their modification of such mechanisms. Past ImRs studies each used different ImRs protocols (Clarke et al., 2022; Ison et al., 2014; Paulik, Steel, et al., 2019) that differed to the current protocol and, whilst the findings across studies are largely consistent, future studies could examine whether variations in the inclusions of specific content are associated with differential effects on symptoms and potential mechanisms. Additionally, qualitative studies of trauma-affected voice hearers' explanations of their processes of change during ImRs may offer insights into the working mechanisms of trauma-related voice and ImRs.

This study did not control for treatment mode (face-to-face versus telehealth). However, past research found that the effectivenes of ImRs in treating PTSD symptoms and trauma-related voices did not vary between participants who received face-to-face, telehealth, or a comibnation of both treatment modes (Paulik et al., 2021). Whilst non-signifcant change across multiple baselines suggests that the observed effects are due to ImRs, the lack of a control group means that we cannot firmly conclude that ImRs produced these changes. Furthermore, although past studies suggest that CBT has limited effectiveness in treating voices and PTSD in trauma-affected voice hearers (Brand et al., 2018; Paulik, Hayward, et al., 2019; Thomas et al., 2014), the lack of a direct comparsion between CBT and ImRs precludes strong conclusions about the relative effectiveness of

each intervention. Thus, randomised controlled trials are needed to compare the effectiveness of ImRs to current treatments.

Conclusion

This study provides further evidence that ImRs is a safe and effective treatment for reducing trauma-related voices and PTSD symptoms in people with a range of diagnoses. ImRs increases self-compassion and emotional self-efficacy, and reduces dissociation, which suggests these factors may maintain trauma-related voices. Whilst these findings provide some support for these factors within the TRV model (Strachan, Paulik, et al., 2022b), future research is needed to examine whether change in these factors temporally precede change in symptoms, and randomised controlled trials are needed to directly compare the efficacy of ImRs to existing CBT treatments.

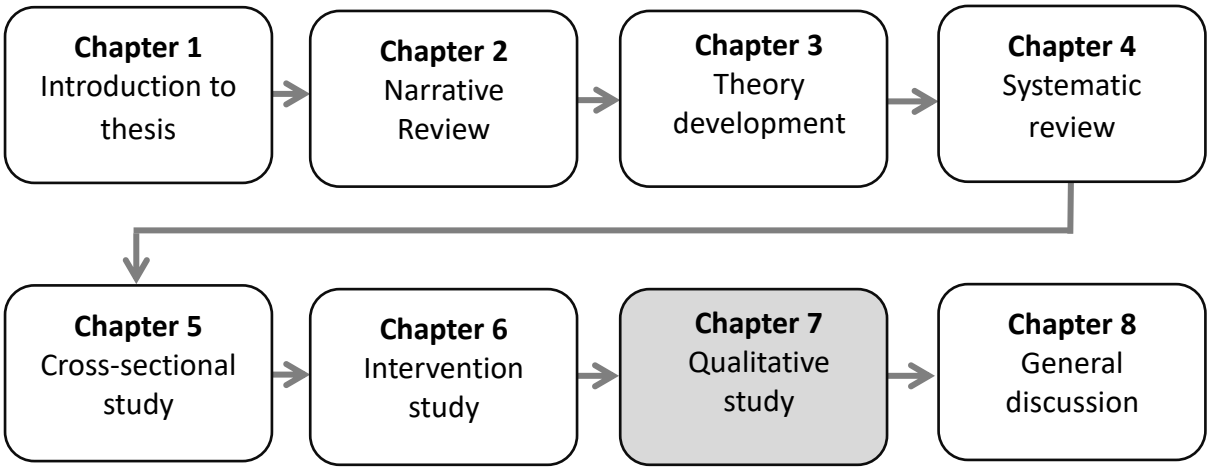
Chapter 7 (Study 6): Voice Hearers Explanations of Trauma-Related Voice Hearing, Post-Traumatic Stress Symptoms, and Imagery Rescripting: A Qualitative Study

Introduction to Chapter 7

The results of chapter six provided further evidence that ImRs effectively reduces the severity of trauma-related voices and PTSD symptoms in voice hearers, and provided evidence that ImRs was associated with hypothesised changes in dissociation, emotional self-efficacy, and self-compassion. Whilst these findings may support elements within the TRV model (chapter 3), it is unclear how these factors may interact to maintain trauma-related voices and PTSD, how ImRs produced change in these factors, and how ImRs more effectively manipulates these factors compared to other interventions, such as CBT. Chapter seven (study 6) examines potential explanations of these mechanistic processes by qualitatively exploring voice hearers' explanations of trauma-related voices and processes of change throughout ImRs. This chapter is under review for publication in a peer-reviewed journal. Figure 7.1 outlines the location of this chapter within the overall structure of this thesis.

Figure 7.1

Flow Diagram of Thesis Structure: Chapter Seven



Citation for Chapter 7

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Introduction

Voices (auditory verbal hallucinations) are a diverse transdiagnostic phenomenon (Choong et al., 2007; Lorente-Rovira et al., 2020). Although not always problematic (Lorente-Rovira et al., 2020), voices are often associated with significant distress and psychosocial disruption (Alonso et al., 2018). Despite under-reporting and under-detection of trauma and post-traumatic stress disorder (PTSD) symptoms amongst voice hearers (Mueser et al., 1998), the prevalence of PTSD amongst voice hearers (16 - 21%) is considerably higher than the general population (4 - 8%; de Bont et al., 2015; Hardy et al., 2016), and many voice hearers experience clinically significant PTSD symptoms that do not meet diagnostic criteria for PTSD (Hardy et al., 2019).

Some researchers suggest that voices may be a distinct subtype of PTSD (Shevlin et al., 2010) and preliminary evidence suggests that, for some, trauma may have a causal role in voices (Hardy et al., 2019; Varese et al., 2012). There is evidence of trauma-related voices, whereby the phenomenology of voices is linked to trauma (Hardy et al., 2005). Seventy percent of voice hearers report that the onset of their voices was precipitated by trauma (Escher et al., 2004) and 57.5% perceive the content of their voices to be thematically linked to past trauma (indirect voices), whilst 12.5% experience voices that repeat perpetrator's comments (direct voices; Hardy et al., 2005).

Cognitive behaviour therapies that are based on cognitive models of positive symptoms or PTSD have shown inconsistent (Paulik, Hayward, et al., 2019; Thomas et al., 2014) and no effectiveness (Brand et al., 2018), respectively, in treating voices. Imagery rescripting (ImRs) is therapeutic technique that uses mental imagery to modify the meaning of memories associated with current psychological problems (Arntz, 2012; Strachan et al., 2020). Preliminary evidence indicates that, compared to cognitive behaviour therapies for PTSD and psychosis, ImRs more effectively reduces PTSD symptoms and voice-related distress in transdiagnostic samples (Ison et al., 2014; Paulik, Steel, et al., 2019). These findings suggest that there may be similarities and differences in the mechanisms that underlie trauma-related voices, non-trauma-related voices, and PTSD symptoms, and that ImRs more effectively modifies those associated with trauma-related voices.

Strachan, Paulik, and McEvoy (2022) recently developed the TRV model, which outlines multiple pathways to trauma-related voices. Studies of ImRs for anxiety, personality, and post-traumatic stress disorders suggest that maladaptive appraisals and beliefs, inhibitory learning, and memory re-consolidation, which appear in the TRV model (Strachan, Paulik, & McEvoy, 2022), may be targeted by ImRs (see Boterhoven de Haan

et al., 2021; Strachan et al., 2020). However, no known studies have examined potential mechanisms of trauma-related voices in relation to ImRs. The lived experience of people who received ImRs for voices may offer valuable insights into the phenomenology of, and change pathways for, this complex phenomenon (Corstens et al., 2014), which can inform theory and guide future quantitative research. As such, the aim of this study is to understand how people describe their trauma-related voices and experiences of change throughout ImRs. In doing so, this study seeks to uncover voice hearers' insights into potential mechanisms of trauma-related voices, and how ImRs may influence these mechanisms.

Method

Design

Semi-structured interviews explored participants' explanations of trauma-related voices and processes of change associated with ImRs. Reflexive thematic analytical methodology was chosen due to its congruence with the critical epistemological framework of the research (Braun & Clarke, 2021).

Participants

Recruitment occurred via the research and evaluation registry of Perth Voices Clinic, whereby clients register their consent to be contacted about research. Purposive sampling identified participants who completed 10-18 weekly ImRs sessions (see Paulik, Steel, et al.'s, 2019 protocol) within four months prior to recruitment. Eighteen registry members were contacted; three did not respond and five declined to participate. The final sample (n = 10) was aged between 18 to 59 years (M = 38, SD = 15.56; see Table 7.1 for demographics).

Procedure

Ethics approval was obtained from Human Research Ethics Committee (HRE2020-0265). After providing consent, participants received a $20 voucher in acknowledgment of time to participate, then commenced a face-to-face (n = 8) or telehealth (n = 2) audio-recorded interview. All interviews were conducted by LS, ranged from 32 – 115 minutes (M = 63 minutes), and flexibly followed a semi-structured interview guide (publicly available at https://osf.io/w2sc9), which comprised open-ended questions to explore relationships between trauma and voices, and experiences of change and stability throughout ImRs. Data collection occurred between November 2020 and June 2022, and analysis occurred between February 2021 and August 2022. Data collection ceased as the information power of ten interviews was evaluated to be sound, due to the study's narrow aim and highly specific sample (Malterud et al., 2016).

Table 7.1

Participant Demographics and Clinical Characteristics

	Number of Participants (*N* = 10)
Gender	
Female	9
Non-binary	1
First language	
English	9
Other	1
Relationship status	
Single	6
Married/ De-facto	4
Employment status	
Full-time	1
Part-time	2
Unemployed	7
Trauma History	
Physical assault	6
Sexual assault	1
Child non-sexual abuse	7
Child sexual abuse	8
Accident	1
Bullying	6
Domestic violence in adulthood	3
Other interpersonal trauma	5
Multiple Traumas	10
Mean (SD)	3.6 (1.26)
Range	2 - 6
Age of Voice Onset	
Mean (SD)	15.5 (11.98)
Range	5 - 35
Trauma-voice association	
Indirect[a]	3

Indirect and direct[b]	7
Referrers' diagnostic impressions	
Dissociative identity disorder	1
Complex PTSD	2
PTSD	2
Borderline personality disorder	2
Schizophrenia spectrum disorder	4
Schizoaffective disorder	1
Bipolar disorder	1
Anxiety with hallucinatory features	1
Depression	1
Anxiety	1
Comorbid diagnoses	4

Note.

[a]Indirect trauma-related voices are characterised by voice content that is thematically linked to past trauma.

[b]A combination indirect and direct trauma-related voices; direct voices repeat comments made by perpetrators at the time of the trauma.

Analysis

Inductive thematic analysis (Braun & Clarke, 2006) of interview transcripts was conducted using NVivo 12 Pro by LS. Data familiarisation via repeated readings of transcripts was followed by line-by-line coding of a subset of transcripts, whereby initial codes were developed from the data. To enhance credibility (Nowell et al., 2017), two transcripts were independently coded by LR, an experienced qualitative researcher, and PM, who has knowledge of trauma-related voices and ImRs. Codes were largely cohesive across coders and differences were discussed between the research team. Themes were developed using a semantic approach to interpret broader significances of surface-level meanings (Braun & Clarke, 2006), followed by refinement of themes and thematic relationships. Initial coding, development, and refinement of themes was an iterative process that involved repeated data re-engagement. To enhance dependability, credibility, and confirmability, participants were invited provide feedback on initial findings, LS completed ongoing reflexive journalling, and the research team regularly engaged in reflexive discussions to manage the influence of subjectivities on the research (Nowell et al., 2017).

Findings

Eight themes were developed, which have been separated into three clusters. The first cluster describes the meaning of voices and includes two themes, "*internalised outlets*", and *"they're trying to keep me safe – but safe is a loose word"*. The second cluster captures psychological processes experienced during ImRs and includes three themes, "*freedom to feel and express emotions", "justice brings a sense of closure", and "allowing oneself to grieve"*. The third cluster describes outcomes associated with ImRs and includes three themes, "*I don't need to be afraid anymore", "active coping",* and "*voices don't have the same power anymore*". Themes are described below along with an overview of key thematic relationships.

Internalised Outlets

This theme describes the emergence of voices in the context of neglectful or abusive relational experiences to vent supressed aspects of themselves. Participants explained that self-expression "*would come with a cost*" (P8), which created a need to supress one's personality or emotions but, in contrast, voices embraced emotions.

> *I didn't allow myself to [feel emotions] and people around me caused issues as well. Like, around mum, most emotions were, and many still are, hidden . . . The one [voice] that doesn't want to be named possibly just came out just so that we…I have a lot of trouble feeling anger or any type of…that type of strong emotion, but she is different, she is quite comfortable with those emotions . . . So, I guess she kind of became an outlet for them* (P1).

Some participants felt that being left alone was, linked to the emergence of voices, "*I think that my voices have something to do with, I don't know, my parents just abandoning me.*" (P2), whereas others felt lonely and alone with their problems, and believed that voices came about to act as friends, confidants, or protectors.

> *. . . I started to really internalise a lot of stuff . . . And so it was like I had all these emotions and I didn't have anyone to talk to. And I was debilitatingly lonely and I just desperately needed someone. And so I don't know if I necessarily consciously understood what I was doing, but I kind of just created someone I could talk to* (P10).

Other participants thought that their voices emerged as they began to internalise perpetrator's comments and, despite being harsh and cruel, voices appeared to alleviate distress in some way. Some felt voices created distance from unacceptable ideas about themselves, "*I see it [the voice] as a part of me . . . parts of me have disintegrated, detached, or shut down. . . I've definitely disowned lots of parts of myself over the years*

because I didn't like myself very much" (P4), whilst others thought they constructed a powerful persona in the image of their abuser to feel less powerless, "*maybe part of me thought that if I could have that strong persona, I wouldn't be so much of a victim. So maybe, it was taking power back*" (P8).

Voices were described as having intimate knowledge about participants and although some participants depicted their voices as being intertwined with their own personality, "*I also have bad social skills, so that's probably where he gets it from*" (P10), the degree of connectedness between the self and voices varied, "*we're all separate. There's levels of connection between each of us. Some of us are closer than others. But with all of us there is definitely separation*" (P1). Four participants expressed uncertainty about the origin of their voices and described voices as entities separate to themselves, such as historical figures or ghosts.

They're Trying to Keep Me Safe – But Safe is a Loose Word

This theme describes how voices evolved to become domineering, disruptive, and interfering, due to their preoccupation with threat. Participants felt that in drawing attention to potential threats, providing guidance, or problem-solving, voices may be well intentioned. However, this intent is often unclear, misguided, or counterproductive.

> *I guess, she's more so strictly keeping me safe in her own way, but safe is a loose word. Because keeping me safe could be trying to get me to try to hurt myself, try to kill myself, because that would get me help from somewhere else* (P1).

Some participants described their voices as being direct in their communication, whereas others described their voices as subtle or metaphoric. Some felt this was a strategy that better prepared them to hear important messages, *"maybe I wasn't ready to hear it before and it would've crushed me in some way. . . all these years, unravelling slowly, to prepare me for the impact of that maybe"* (P4), whereas others thought their voices lacked compassion.

> *So yeah, he's very mocking and very sort of cruel, but I think. . .His heart is in the right place and he is trying to communicate something valuable to me, which is primarily that I'm not coping and I need support. However, he really does not know how to go about it . . . he's just someone with really fucking bad social skills* (P10).

Three participants expressed doubt about whether voices were being deceitful or protective, "*I can't differentiate whether it's true or a lie*" (P3), and described voices as ill-intentioned, "*they sabotage everything that's positive*" (P6). Overall, there were mixed feelings about voices, "*it's almost like a blessing and a curse at times*" (P4).

Three participants described voices that would physically take control to help them cope, which was sometimes welcomed, "*I think that's more when I get upset, or distressed or something. It is just more a defence thing. So, they can deal with what's going on and I can just have me time*" (P2), but could be dangerous and distressing.

> *I started experiencing dissociative states where [my voice] would take over . . . if he had control…it would pretty much just be that he'd be like, "I want to cause as much harm as possible". . . And basically, I connected again. . . I had hurt myself pretty bad in a public bathroom and there was blood basically everywhere. And that was terrifying* (P10).

Participants explained that although voices may be attempting to help, they cause more problems than they solve, creating a vicious cycle of distress, "*it's trying to be protective, but what it's putting out there, it's very counterproductive. . . It just keeps me stuck in a loop going around, going short of nowhere"* (P8)*.* Participants said that voices talk about upsetting things, "*[the voice says]* "*don't put yourself in that position again because this is what can happen and this and this and this and this and this" and it just gets bigger and bigger and bigger"* (P8)*,* and can be distracting, "*. . . and it's like, "God, can you shut up?"* (P9)*.* Participants explained that voices feed off negative emotions, *"if I'm feeling down, they're worse*" (P5), emotional lability, *"when my emotions are particularly volatile all of the time, it's back, it's intensive"* (P10), and psychotic symptoms, "*My psychosis has gotten worse lately . . . so you kind of got me at a time when [the voices are] really bad"* (P9).

Freedom to Feel and Express Emotions

This theme describes how ImRs facilitates deeper access to the subconscious and, therefore, reconnection and reprocessing of trauma and supressed emotions. Participants felt that imagining oneself immersed in memories made it difficult to detach from emotions, which made reprocessing more powerful, "*I think you need to go to that scary place to get cotton candy, sunshine and rainbows"* (P2), and convincing compared to talk-based therapies.

> *Rather than just kind of sitting going, "this kind of upsets me, I guess", and then I kind of would shut myself down in those kinds of conversations and just, I'd discuss it, but I wouldn't properly process it much because I didn't want to. . .I guess like, someone saying to you that you shouldn't feel bad about something is different than being shown through your memory that you don't need to feel bad. It's easier to dismiss* (P1).

Participants felt that the therapist's actions meaningfully counteract past problematic actions of others. Some participants were no longer alone and unprotected, "*rather than being alone, there was somebody there you could go for help and there is somebody that come in for help as well*" (P6), others got help to understand their trauma, "*. . . it has helped me to frame what was happening*" (P4), whereas others felt emotionally validated , "*it's like validating my emotions in a situation where I would have been gaslit or was gaslit into being like, "No, I shouldn't be feeling this""* (P1), or felt it was safe, normal, and acceptable to express emotions, "*and I thought, "She's saying the things that I really wanted to say to my dad, but I was too frightened to, because I knew that it would come with a cost"* (P8). Participants described the therapist's own genuine expression of emotion as important in facilitating this, both toward participants, "*[the therapist] actually gave a shit, she was angry when I told her what happened"* (P3), and perpetrators.

> *Doing the rescripting and having [the therapist] str*aight up *just be like, "this is a terrible thing to do to anyone. What the fuck is wrong with you?". . . we did a lot of rescripting of [her] just coming in and telling people off and I think she kind of enjoys doing that to be honest*" (P10).

Some participants said that their voices were present during rescripts, "*they all kind of stayed there just in case, as like a protection"* (P1), and the therapist earned participants' and voices' trust, which helped them to feel safe revisiting distressing memories and expressing themselves.

> *I think, for the first time, those voices have been heard or that part of me has been heard. Whereas, in the past, it's never been heard, and it feels like it's safe to be able to look at why all these voices are here . . . And then, one of the voices was, "At last! I'm being heard. Somebody's listening!". . . And I cried and it was that child crying. My mum would never let me cry. So, it was the child in me being allowed to cry, because I never ever would cry* (P8).

Justice Brings a Sense of Closure

This theme captures how ImRs brought closure by contextualising trauma by placing blame on perpetrators and taking action to right past wrongs. Participants explained that unlike talk-based therapies, they were shown rather than told this information, and could take action.

> *I think it was more the fact that I could see what happened, what should have happened . . . I think that was probably most important thing, like me closing my eyes and actually taking myself back there. Because well, otherwise, what's the point of just talking about it? Because I've been in therapy since I was 10 years old.*

And all I've ever done is talk about it. And this time, I actually did something about it. (P2).

Participants described a sense of resolution in their perpetrators being held accountable in a way that was just and addressed their own and others' needs.

. . . she didn't really need to be punished in the rescripting, she needed to be given help. . . How can you have a go at people who are broken themselves? . . . So for me, they needed to get the help. And that helped me a lot. It really, really helped me a lot (P8).

Participants explained this experience of justice "*was tackling the source of those feelings that would make the voices worse*" (P10) in a way that was soothing to them, "*all those burden is lifted off me*" (P6), and their voices, ". . . *it sort of started changing in my mind, sort of like calmed the voices down"* (P7), and addressed, "*those unresolved feelings that I had. That anger and that hurt*" (P4), which brought a sense of closure.

I think just going back and going over the memory again, but just in a calmer way, without all the anger and all the emotions attached to it, and then rewriting the ending or rewriting the memory itself. That just brings closure. (P9).

Allowing Oneself to Grieve

This theme describes how for some participants, past attempts to forgive and forget were unhealthy and unrealistic, but experiencing justice and closure facilitated healthier grieving. One participant explained that forgiving is risky, because it creates more opportunity to unfairly blame themselves.

I guess, it's a common idea that in order to get past abuse, you have to forgive the abuser. . . And I always struggled with that a lot. . . it's not healthy for me personally to get too into that and actually forgive him because in my brain, it's like someone has to be responsible for it and I know if I forgive him, then I will make excuses for things that he did and I will go back to hating myself for it (P10).

Others said that forgetting is "*easier said than done*" (P3) and diminishes the reality that trauma is "*really very, very, very deeply embedded and entrenched"* (P8), and painful, "*. . . those memories have scarred me deeply. . . [forgetting] doesn't change what happened. The scars are still real, it still hurts* (P3). Participants said that ImRs encouraged acknowledgement of their trauma and what was taken from them, "*I know that with abuse and things like that, it takes the rites of passage away of a woman growing from child into teens into adulthood, because I was so badly damaged and that . . .* (P8), and gave them freedom not to forgive and forget, ". . . *just being given permission to be like, "Nope, I do not forgive him and I will not forgive him,"* (P10). Participants described

more compassion toward themselves, which was associated with a commitment to live according to their authentic selves, "*it helps me to be my true self, who I was meant to be in the first place before all the trauma happened*" (P8), and reclaim what they have lost.

> *. . . allowing myself to feel sad about things that I missed and trying to do the thing where I connect with things that I feel like I missed out on . . . there's no reason why you can't do those things now* (P10).

I Don't Need to be Afraid Anymore

This theme describes how ImRs increased participants' sense of safety and self-confidence. Participants felt that they "*don't have to be afraid anymore*" (P5), which was accompanied by a reduction in jumpiness, nightmares, flashbacks, and fear of distressing memories, "*I guess it kind of made [the voices] more comfortable with the idea of looking at past memories. It's kind of safer than they previously thought"* (P1). Participants felt less fearful of others, "*I'm not as frightened of other people. I used to get quite defensive and demonise people if they were challenging me"* (P4), and more self-worth, "*I put more value on myself. I don't have as much shame"* (P4), which was linked to confidence in self-expression, *"I'm kind of more comfortable to feel and express my emotions guilt free. Or beat myself up less for that, I guess. Or for having a thought about something or feeling a certain way about a situation or something like that"* (P1), and a stronger sense of belonging.

> *I'm just feeling worthless and feeling not confident, but now that feeling sort of changing. . . I feel my freedom is been suppressed. And isolate in the world and that's part of the reason before why I feel I wasn't real, I was feeling I wasn't fit in with the world around me* (P6)*.*

Some participants attributed an improvement in mood to their increased sense of safety, "*if I meet someone new, I don't automatically think they know everything about me and they're going to hate me. . . it makes me less anxious and worried about new people and things like that*" (P5). For others, feeling safe and not alone increased their engagement in mood-enhancing activities, "*it elevate me into feeling more positive, more energised, more happier, more easy for me to enjoy things . . . I realise it's important for me to live in that way"* (P6).

Active Coping

This theme describes how ImRs brought about new ways to cope with distressing post-traumatic stress symptoms, thoughts, and voices. Two participants said their original trauma memory is still intact, but one actively recalls their ImRs memories to cope with flashbacks, "*the memory is still there, but I just like to put that little memory that I have*

made there instead and try and play that out in my head instead of what happened" (P2), whilst the other believed the ImRs memory automatically overrides the original memory.

> *It's like I replaced the memory with a better one. So, it's almost like I have rewritten the memory. [The original memory is] still there, but I don't have any feelings of being anxious and I don't have any of the physical symptoms of anxiety, and I don't feel anxious about talking about it.* (P9).

Some said that they use ImRs content as evidence to remind themselves that the things perpetrators and voices say is not true, "*the imagery rescripting was like, just because they say this doesn't mean it's actually true . . . being reminded that people care . . . reminded that I'm not that anymore"* (P5), whilst others model the therapist's actions to challenge negative thoughts and voices, "*. . . [the therapist] really execute it for me very well. And I've learned how to see, execute it, in my own way of doing it as well" (P6).* Others reflect on their ImRs experiences to reframe distressing thoughts and manage emotions,

> *It was really, really, helpful to have those moments [in the rescripts] and I still think of those a lot. . . the main thing I'd say is that being able to actually empathise and understand why I didn't do the things . . . and actually be a bit like, "Yeah, there's nothing you could have done differently or at least, not without your current knowledge, you couldn't have done it another way"* (p10).

Some participants said that voices started reinforcing the messages from ImRs sessions, which can be communicated sensitively, "*the voice says, "You have just as much right to be here as other people. . . "* (P8), or in a way that may seem harsh, but is ultimately more effective.

> *. . . [my voice] has become a lot nicer whenever I get those particular thoughts, in his own way. I don't think he has an ability to be nice in a normal way . . . he'll be like, "What the fuck do you think you could have done at eight? Tell me exactly what you think you could have done that was so ground-breaking" . . . and sometimes I find when I'm in those states, when people are nice to me, it's hard to take that on board, because it feels like I don't deserve that. Whereas having [my voice] who's a bit more blunt and harsh, it can be a bit like, "all right, yeah, shut up"* (P10).

Voices Don't Have the Same Power Anymore

This theme captures the diverse changes in voices amongst participants that, overall, suggest that voices lost some of their power due to ImRs. One participant said that they no longer experience voices, another reported no change in their voices, others described a reduction in the location, loudness, or frequency of certain negative voices, "*. .*

. she's not as loud. . . I don't really hear her anymore. She's talking less" (P6), and one participant felt their voice was becoming more cohesive with their own consciousness, "*. . . in form it's changed . . . and the voice does say this to me, that the more work I do on recovery, the less it'll be there. And it'll become more like an inner voice"* (P4). Some participants explained that their positive voices now have a stronger supportive presence.

> *. . . the better voices are coming in more. . . There's the nerdy one and it's, "What can you learn from this experience? Don't see it as all black and white. What can you take that's beneficial from it?" . . . Or another one is, "How about you put down a list system? You put your list down of things that you got to do, and then you go through." And then, at the end of the week or at the end of the day, I'd go through and tick. And I think the voice says, "Well, look at that. You've got nine things out of the 10 that you were going to do. Oh, that's pretty good," or, "Oh, you only got two today. What's going on for you today that might be making you feel like that?" So the voices are stepping in like that* (P8).

Overall, participants reported that their voices are easier to cope with. One participant said they now negotiate with their voices, "*[the voice would say] if [you] get an apple or yogurt afterwards, I won't give you hard time"* (P6), whilst others find it easier to challenge and dismiss what voices say.

> *. . . there was this one voice that used to always say pretty much like, "You deserve to be raped,". . . And now [I'm] just like, "Well, I don't, I didn't, but cool for you thinking that, but I don't think that anymore* (P2).

Other participants found that their negative voices suddenly lost traction, which they attributed to a sense of empowerment that came with emotional validation during ImRs.

> *. . . the real nasty, horrible one that wants me to suicide. . . Now, it just fizzles out. It's there, but it fizzles out . . . The way I felt helped change the voices, the way I felt emotionally, the way I felt being validated, the way I felt with the rescripting, it was empowering for me. Before, I felt powerless and at the mercy of all this clamour in my head* (P8).

Three participants described increased control over how their voices took control of their physical body. One participant reported that they now retain awareness during these experiences, and another said voices take control less often because there is less need for them to do so.

> *. . . and it's not common, especially not now that I've done the rescripting and I've done lots of different therapies, so that I have a bit more of an understanding that I can cope with things and I don't need to always get him to take over"* (P10).

Thematic Relationships

Three thematic relationships were identified. Each relationship represents a spectrum of experience within a particular domain; "*alone versus supported and connected", "emotionally suppressed versus released"*, and "*unsafe versus secure and confident".* The eight themes appear across the top of the thematic map (Figure 7.2) in columns and the three relationships appear as grey arrows that move left to right across the map, demonstrating movement across each spectrum of experience throughout ImRs. The features of themes that demonstrate its relationship with each spectrum of experience are listed at the point in which each relationship intersect with that theme.

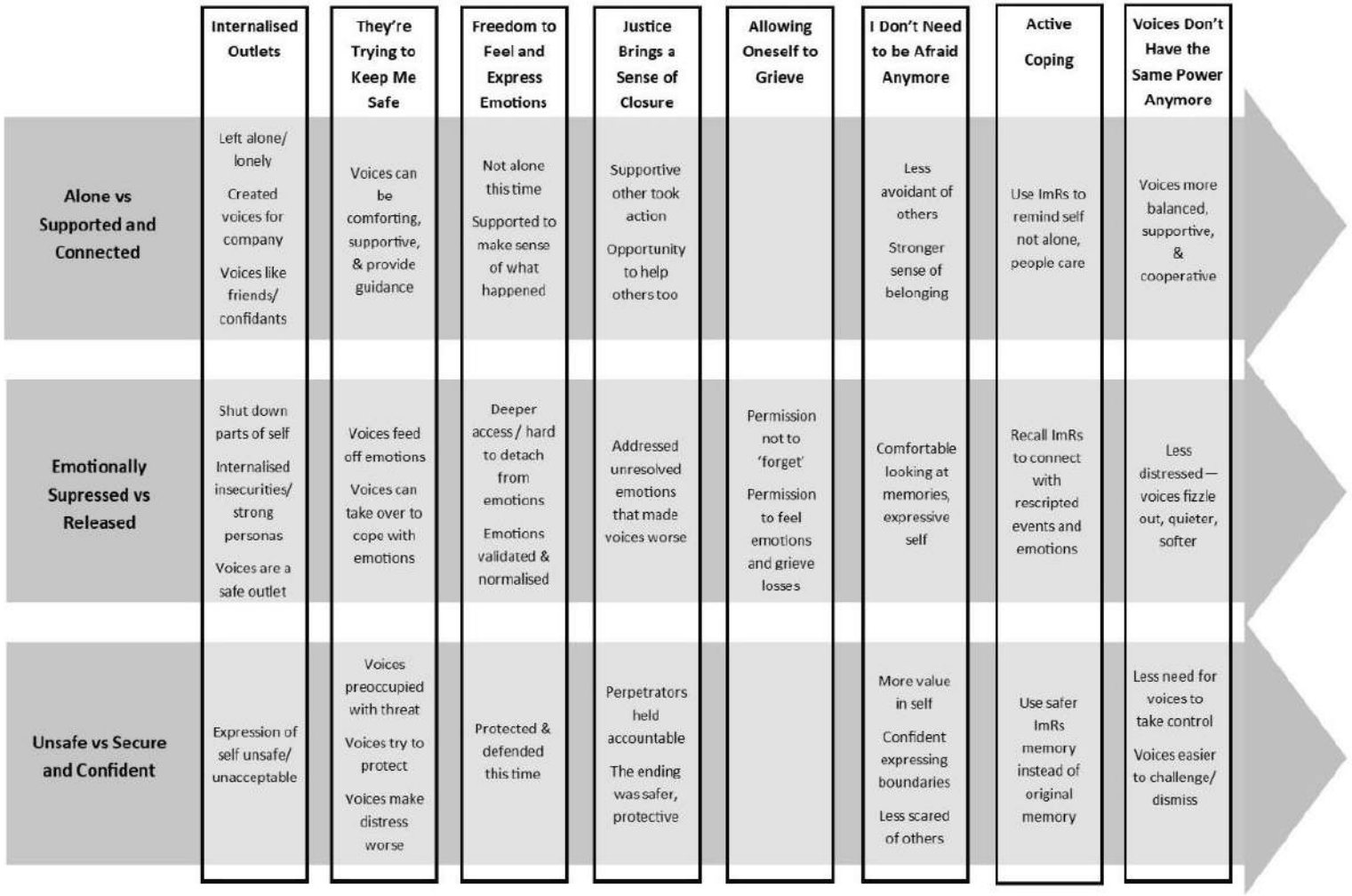
Discussion

This study sought to uncover insights into potential mechanisms of trauma-related voices and how ImRs may influence such mechanisms by exploring voice hearers' explanations of voices and experiences of change throughout ImRs. Voices were described as having an underlying protective function, which is consistent with past studies that found voices developed as a way to survive (Anketell et al., 2010). We found that although voices became distressing and disruptive, they may be an ineffective coping strategy. Past qualitative findings suggest trauma-focussed treatments enhance skills to constructively cope with distress (Feary et al., 2022) and stand up for oneself (Bosch & Arntz, 2021). Similarly, we found increased ability and confidence in one's ability to cope with distress and voices, increased self- and emotional expression, and reduced distress and avoidance, following ImRs. Additionally, some participants described less need for voices to take control due to improved coping abilities. These findings support suggestions that emotion regulation deficits and poor coping self-efficacy underlie trauma-related voices (Strachan, Paulik, & McEvoy, 2022), and non-clinical evidence that negative affect and emotion regulation deficits mediate the pathway from trauma to unusual perceptual experiences (Strachan, Paulik, Preece, et al., 2022).

Expressive suppression is a less adaptive emotion regulation strategy that involves attempts to inhibit observable expressions of emotion (Gross, 2015). Expressive suppression is overused by trauma-affected and voice hearing individuals and is positively associated with voice severity (Badcock et al., 2010; Lang et al., 2012; Short et al., 2018), and thus may characterise the experiences of our participants. Cognitive reappraisal is an adaptive emotion regulation strategy that involves considering less distressing appraisals of events (Gross, 2015), and parallels the cognitive restructuring of maladaptive trauma-

Figure 7.2

Thematic Map Outlining the Relationships Between Themes that Demonstrate Changes Throughout ImRs



beliefs in cognitive behaviour therapies (Barlow, 2014). Similar to our findings, past qualitative participants experienced emotional release during ImRs (Bosch & Arntz, 2021). Extending on Dibbetts and Arntz's (2016) suggestion that expression of responses that were suppressed at the time of trauma may be an underlying mechanism of ImRs, we suggest ImRs may have interrupted a prolonged pattern of emotional suppression, which has been theorised to underlie trauma-related voices (Strachan, Paulik, & McEvoy, 2022). Thus, ImRs may have facilitated a shift from expressive suppression to cognitive reappraisal emotion regulation strategies, which may explain improved ability to cope with distress and voices. Furthermore, as maladaptive trauma appraisals are theorised to maintain trauma-related voices (Strachan, Paulik, & McEvoy, 2022), correctly placing responsibility on the perpetrator during ImRs may explain reduced distress and increased self-confidence (Bosch & Arntz, 2021; Long et al., 2011). Additionally, poor coping self-efficacy is a maladaptive trauma-related belief that may maintain voices (Strachan, Paulik, & McEvoy, 2022). Bandura (1997) suggests that encouragement from credible others, experiences of successful performance, and physiological feedback influence self-efficacy. Consequently, repeated ImRs experiences that involved support from the therapist, practice of cognitive reappraisal strategies, and concluded with calmer and safer endings may explain participants' confidence in their ability to use such strategies to cope with post-traumatic stress symptoms, distress, and voices.

We found that relational safety was a key element of our themes, which supports suggestions that attachment underlies trauma-related voices (Berry & Bucci, 2016; Berry et al., 2017; Strachan, Paulik, & McEvoy, 2022). Participants described early experiences of being alone, lonely, and unprotected, and voices that unpredictably soothe or distress. In contrast, participants felt heard, understood, and protected during ImRs, which counteracted earlier relational experiences and fostered trust, security, and self-confidence. As attachment style guides appraisals of events and emotion regulation (Mikulincer & Shaver, 2005), the ImRs therapist may have created a "secure base" for participants that reduced distress, encouraged emotional expression, and supported adaptive cognitive restructuring and reappraisal. Additionally, mental imagery produces stronger emotional activation than verbal techniques (Holmes & Mathews, 2010), which supports our finding that the "realness" of rescripts was difficult to emotionally detach from and made adaptive appraisals more convincing. Similarly, mental imagery may have facilitated a sense of genuine emotional security in the therapeutic alliance. There is some evidence that insecure attachment, distress, and emotion regulation difficulties mediate the

pathway from trauma to unusual perceptual experiences (Strachan, Paulik, Preece, et al., 2022). However, future studies should explore these pathways in relation to trauma-related voices specifically.

This study extended on existing qualitative research with trauma-affected individuals with voices (Anketell et al., 2010) and non-voice hearing individuals' perceptions of change throughout ImRs (Bosch & Arntz, 2021; Boterhoven de Haan et al., 2021) by simultaneously exploring constructed meanings of voices and processes of change during ImRs, and by investigating trauma-related voices specifically. Although participants provided perceptive accounts of voices and therapeutic change associated with ImRs, it is possible that an accumulation of therapeutic effects or psychoeducation from past treatment influenced our findings. Although our transdiagnostic sample supports transferability of findings to diverse trauma-affected voice hearing population, all participants were female, which may limit transferability to other genders, and the diversity of participant experiences suggests there may be multiple pathways to voices (Strachan, Paulik, Preece, et al., 2022), which require further investigation.

Conclusion

Trauma-related voices may have an underlying protective function, and ImRs may support emotional validation, expression, and processing, which could alter participants' perspective of their traumatic experiences, their self-worth, and improve their ability and confidence to cope with distress and voices. It is possible that the therapeutic alliance in ImRs provides a secure attachment base (Mikulincer & Shaver, 2005), which supports the effective cognitive reappraisal and restructuring in lieu of less adaptive expressive suppression strategies (Gross, 2015). Therapist support, along with experiential and emotion-based feedback during ImRs, may enhance coping self-efficacy and, therefore, confidence to independently use such strategies to cope with distress and voices. Future studies are needed to test the relationships between attachment, emotion regulation, and coping self-efficacy within clinical samples experiencing trauma-related voices.

Chapter 8: General Discussion

Voices are a transdiagnostic symptom with high prevalence rates across psychotic spectrum and trauma-related disorders (Lim et al., 2016; Niemantsveriet et al., 2017; Sar & Ozturk, 2008; Shinn et al. 2020). There are high rates of trauma amongst voice hearers and high rates of voices within PTSD populations (de Bont et al., 2015; Hardy et al., 2016; Lindley et al., 2000), and most trauma-affected voice hearers experience trauma-related voices (Hardy et al., 2005; Peach et al., 2021). Whilst there is preliminary evidence to suggest the relationship between trauma and voices may be causal (Varese et al., 2012), existing theories of PTSD and voices do not adequately explain the pathways from trauma to voices. Current treatments have inconsistent or no effectiveness in treating voices and PTSD symptoms amongst trauma-affected voices hearers (Paulik, Hayward, et al., 2019; Thomas et al., 2014), which highlights the need for more effective treatments for such populations. The overarching aim of this thesis was to increase understanding of the mechanisms of maintenance and change that may underlie different types of voices in trauma-affected people, which may ultimately improve treatment outcomes.

Given the scarcity of literature specific to trauma-related voices, the first study (chapter 2) aimed to identify potential mechanisms of trauma-related voices by reviewing prominent stand-alone theories of PTSD, positive symptoms, and non-trauma-related voices. This review identified 21 potential mechanisms of trauma-related voices, which were categorised as being unique or common to PTSD or positive symptoms, and found that no existing model included all mechanisms. Whilst there were two trauma-informed models of voices that extend on stand-alone models of PTSD and positive symptoms, neither could explain why CBT has limited effectiveness in treating voices in trauma-affected individuals (Brand et al., 2018), nor could they generate novel hypotheses beyond those that can be made from stand-alone models. These findings suggested that in order to generate novel research that may lead to more effective treatments for trauma-affected voices hearers, there is a need to explain the interactions between the mechanisms identified in the review.

The second study (chapter 3) aimed to address the key limitations of existing models that were identified in chapter two. This study presented the TRV model, which was developed by integrating all 21 mechanisms from existing models and explaining the mechanistic processes, interactions, and feedback loops between different mechanisms. In doing so, the TRV model outlines multiple mechanistic pathways to different types of voices, thereby generating novel hypotheses that may inform more effective treatments for trauma-related voices. The TRV model maps on to DSM-5 and the 11th edition of the

International Classification of Diseases (ICD-11) diagnostic criteria for PTSD and complex PTSD (APA, 2013; World Health Organisation [WHO], 2018), and is appropriate for conceptualising voices in trauma-affected people who do not meet full diagnostic criteria for PTSD. This study outlined a comprehensive research agenda, which identified the need for multiple types of evidence to test the structure of the TRV model. The remaining studies in this thesis were informed by this research agenda and gathered cross-sectional (chapters 4 and 5), prospective (chapter 6), and qualitative (chapter 7) evidence to test and refine the mechanistic pathways in the TRV model.

The third study (chapter 4) examined cross-sectional evidence for the associations between the proposed mechanisms within the TRV model and PTSD symptoms, and hallucinations (including voices). The results of this study indicate that few studies have examined the association between the TRV mechanisms, PTSD symptoms, and hallucinations, and that many mechanisms within the TRV model have not been tested. There was some evidence that the stability of schemas, trauma appraisals, thought suppression, and avoidance may be associated with both sets of symptoms. Additionally, there was evidence that different types of dissociation are associated with both PTSD and voices. However, there were several methodological limitations across studies that restrict the ability to draw firm conclusions from these findings. The findings from this study highlight the need for future studies to examine potential mechanisms in relation to a spectrum of trauma and hallucinatory symptoms, rather than comparing diagnostic groups, and to examine the interactions between different mechanisms in relation to different symptoms.

The fourth study (chapter 5) tested a subset of relationships within the TRV model. This study provided cross-sectional evidence of an indirect relationship between trauma and the frequency of UPEs (including voices), whereby insecure attachment links trauma to negative affect and emotion regulation deficits, which are linked to UPEs by dissociation. This study extended on past research by testing these factors in combination, rather than individually, and by testing the theorised associations between these individual factors. The results of this study suggest that diverse interpersonal traumas are associated with a spectrum of UPEs in unselected samples, which is consistent with continuum models of trauma and positive symptoms (Cloitre, 2020; van Os et al., 2000). Whist these findings provide preliminary support for a subset of relationships in the TRV model, this study emphasised a need to gather stronger evidence of temporality between the modelled factors, and to test these associations amongst trauma-affected individuals with clinically distressing UPEs.

The fifth study (chapter 6) examined the impact of ImRs on PTSD symptoms, trauma-related voices, and several mechanisms within the TRV model: self-compassion, emotional self-efficacy, dissociation, cognitive reappraisal, and expressive suppression. ImRs was associated with medium to large reductions in PTSD symptoms, trauma-related voices, and dissociation, and medium to large reductions in emotional self-efficacy and self-compassion. These findings provide further evidence that ImRs effectively modifies the mechanisms that underlie trauma-related voices. Additionally, these findings suggest that dissociation, emotional self-efficacy, and self-compassion may be mechanisms of trauma-related voices, and therefore, provide some support for the TRV model. Future studies are needed to examine whether changes in these factors temporally precede change in symptoms and randomised controlled trials are needed to directly compare the efficacy of ImRs to CBT. Additionally, future studies are needed to understand how ImRs may differ from CBT in modifying these and other possible underlying factors of trauma-related voices.

The final study (chapter 7) explored voice hearers' explanations of their trauma-related voices and experiences of change during ImRs. Eight themes were identified that describe potential underlying mechanisms of trauma-related voices, and how ImRs may influence these mechanisms. Two themes captured explanations of voices, which suggested that voices may be a way of safely processing, experiencing, and expressing internal experiences, and that voices may have an underlying protective function but become distressing and disruptive due to a preoccupation with threat. Three themes captured the psychological experiences that occurred during ImRs, which described experiences of emotional validation, safety to experience and express emotions, being supported to understand trauma, and experiencing justice, closure, and healthy grieving. Finally, three themes described the outcomes of ImRs, which included increased confidence, coping, perceived safety, and voices becoming less powerful. Across these themes, there were three intersecting relationships that captured key processes of change across time. The first captured a shift from being alone and lonely to feeling supported and having a sense of belonging. The second described a move from internalising and detaching from emotions to increased comfort feeling and expressing emotions. The third involved a shift from being unsafe to being defended, protected, safe, and confident. Together, key factors in the TRV model are reflected in these findings, including emotion regulation, coping ability, attachment, and maladaptive schemas.

In summary, the findings from this thesis identified a comprehensive inventory of potential mechanisms of trauma-related voices, which was used to develop an integrative

model of trauma-related voices. The TRV model was used to develop a comprehensive future research agenda to test novel hypotheses about trauma-related voices. The cross-sectional, treatment, and qualitative findings from this thesis provide preliminary evidence for a subset of mechanistic relationships within the TRV model.

Theoretical Implications

Complex Trauma

There are important theoretical implications of this thesis. The results of this thesis emphasise the need for broader conceptualisations of trauma and post-traumatic stress symptoms. Diverse interpersonal traumas, such as childhood bullying and separation from attachment figures, were common in the transdiagnostic clinical sample with trauma-related voices, and there was evidence that such traumas were indirectly associated with the frequency of UPEs in the unselected sample. Of the Criterion A traumas reported in the clinical sample, interpersonal traumas, such as childhood sexual and non-sexual abuse, were common. These findings are consistent with those from past studies (Bailey et al., 2018; Hardy et al., 2005) and suggest that voices may have a specific relationship with interpersonal trauma, which may not necessarily meet DSM-5 criteria for PTSD.

There may be several implications associated with this finding. First, whilst it is not recommended that participants be excluded from samples based on diagnostic status, given that interpersonal traumas are often repeated or ongoing experiences, it may be important for future studies to assess for and include participants with complex trauma experiences or DSM-5 Criterion A traumas. Second, should trauma-related voices be associated with complex PTSD, this may explain why existing models of PTSD, which do not account for complex trauma symptoms, do not adequately explain trauma-related voices. Importantly, the TRV model maps onto DSM-5 diagnostic criteria for PTSD (APA, 2013) and ICD-11 diagnostic criteria for complex PTSD (WHO, 2018). Complex PTSD is diagnosed in the context of single or chronic, repeated, or prolonged traumas, and includes detrimental relational experiences (Cloitre, 2020; WHO, 2018), which appear in the TRV model as trauma, negative caregiving experiences, and other negative life events. Complex PTSD includes three additional symptom domains that extend beyond those associated with DSM-5 definitions of PTSD, which map onto the TRV model: (a) disturbances in emotion regulation are represented by emotion regulation deficits; (b) a distorted view of the self is represented by personal semantic memory (including negative schemas); and (c) difficulty maintaining relationships is represented by insecure attachment (WHO, 2018). The cross-sectional findings of this thesis provide some evidence that complex traumas may be indirectly linked to UPEs via insecure attachment

and emotion regulation deficits, which are complex PTSD criteria. Additionally, the qualitative findings suggest that ImRs may alleviate distressing voices and PTSD symptoms by influencing attachment, emotion regulation, and negative schemas, which are also factors associated with complex PTSD. Likewise, the reductions in dissociation observed in the treatment study may be associated with emotion regulation deficits, whilst the increase in self-compassion and emotional self-efficacy may be associated with modification of negative schemas. Future research is needed to explore the prevalence of complex trauma amongst voice hearers and test the associations between mechanisms in the larger TRV model, complex PTSD symptoms, and different types of voices.

Insecure Attachment

The TRV model suggests that insecure attachment may be an important maintaining factor in the pathway to trauma-related voices, due to its influence on multiple other factors. Past studies provide evidence that insecure attachment mediates the relationship between childhood maltreatment and the severity of voices, as well as voice-related distress (Pilton et al., 2016), and that attachment is indirectly linked to psychosis symptoms via emotion regulation deficits, negative affect, and schemas (Partridge et al., 2021). The cross-sectional findings of this thesis extend on these findings by indicating that insecure attachment links trauma to negative affect, emotion regulation deficits, and dissociation in the pathway to UPE frequency, and appear to be consistent with the qualitative findings in this thesis. Participants explained that the ImRs therapist's actions facilitated a genuine sense of emotional security, counteracted past problematic relational experiences, and earned participants' trust, which made it easier for them to (a) explore their trauma, which may map onto adaptive trauma appraisals in the TRV model, and (b) process and express previously suppressed emotions, which may map onto emotion regulation strategies. Thus, it is possible that overlooking insecure attachment may limit effective modification of these mechanisms, which may explain why CBT treatments that aim to modify trauma beliefs and avoidant-based coping, but do not specifically aim to promote secure attachment (Zalta, 2015), have limited effectiveness in treating voices and PTSD symptoms in trauma-affected voice hearers (Paulik, Hayward, et al., 2019; Thomas et al., 2014).

Whilst ImRs does not specifically aim to promote secure attachment, the qualitative findings from this thesis suggest the relational experiences during ImRs may influence trauma-related beliefs. Participants described their experience of being defended, protected, validated, and supported "this time" as important, and stated that ImRs gave them an opportunity to witness what should have happened, which was more influential in

shifting their appraisal of the event than verbally discussing such concepts. Thus, it may be that ImRs modifies trauma-related attachment beliefs (i.e., interdependent beliefs about the self and others) or promotes secure attachment, which facilitates effective modification of independent trauma-related beliefs about the self and others (Shaver & Mukulincer, 2012). Another possibility is that the temporal timing and contextual detail of rescripted content may influence attachment-related beliefs. Given that the development of attachment style predominantly occurs across childhood (Shaver & Mukulincer, 2012), and participants adopted the same-aged perspective of their child self during rescripting of (usually) childhood traumas, rather than discussing past experiences from the current adult perspective, it may be beneficial to adopt the corresponding age-perspective. Whilst future treatment studies are needed to support stronger causal inferences by exploring the importance of temporality of attachment-based content during ImRs and the relationship between imagery and attachment and other trauma-related beliefs, the findings of this thesis suggest that it may be important to promote a secure attachment base within the therapeutic alliance more generally, but also within the imagined interpersonal exchanges during ImRs sessions. For example, facilitating a secure base from which clients can safely become aware of, explore, and understand their internal experiences and ways of being with others may be a key element of therapy (Costello, 2013). Clinicians may prioritise attunement to their clients by (a) engaging in attentive moment-to-moment tracking to accurately and promptly identify verbal and non-verbal signals that may reflect a shift in emotional experiences, (b) making active and non-intrusive elicitations of clients' such experiences, and (c) providing empathetic, non-directive, and helpful responsiveness to experiences and needs, whilst (d) providing genuine emotional warmth and positive regard (Costello, 2013; Dallos, 2006; Heard et al., 2012).

Trauma-Related Cognitions

The TRV model suggests that trauma-related appraisals and cognitions are a key factor in the pathway to indirect voices. Whilst the systematic review uncovered mixed evidence for the relationship between trauma-related beliefs, PTSD symptoms and voices, the qualitative findings of this thesis suggest that ImRs promoted healthier perspectives of trauma experiences, which may have contributed to change in distressing voices. Whilst trauma-related cognitions were not explicitly tested in the clinical study, the increase in self-compassion and emotional self-efficacy associated with ImRs may be associated with changes in trauma-related beliefs. For example, trauma-related beliefs may influence how a person treats themselves (self-critically vs self-compassionately) and emotional self-efficacy may be influenced by one's appraisal of their post-traumatic reactions (Dalgleish,

2004). Past studies have found that ImRs is associated with reductions in trauma-related beliefs amongst trauma-affected voice hearers (Clarke et al., 2022) and other trauma populations (Arntz, 2012). However, some types of CBT for PTSD also target maladaptive trauma-related beliefs (Zalta, 2015) and meta-analytic evidence suggests that CBT for PTSD is generally ineffective in treating voices (Brand et al., 2018). Whilst this could suggest that trauma-related beliefs do not maintain voices, there are several other possible explanations for these findings.

First, the results of Brand et al.'s (2018) meta-analysis were based on the combined effectiveness of a small number of trauma-focussed psychological interventions that collectively target a range of different mechanisms of PTSD. As no known studies have compared the effectiveness of CBTs that specifically target trauma-related beliefs versus those that target other mechanisms of PTSD in treating voices (e.g., memory-based mechanisms), it is possible that both ImRs and other trauma-focussed treatments that specifically aim to modify maladaptive beliefs are effective in treating voices. Similarly, Brand et al.'s (2018) meta-analysis included interventions that predominantly use language-based strategies and interventions that incorporate imagery-based strategies. However, no known studies have compared the effectiveness of CBTs that use imagery-based versus language-based strategies in reducing voices and PTSD symptoms in voice hearers. As imagery-based interventions have a strong impact on beliefs (Holmes & Mathews, 2010), it is possible that compared to trauma-affected people without voices, trauma-affected voice hearers hold stronger trauma-related beliefs, and that both ImRs and other imagery-based CBT techniques are effective in modifying firmly held beliefs compared to language-based CBT techniques. Thus, more research is needed to compare the effectiveness of different types of CBTs in reducing trauma-related beliefs, PTSD symptoms, and voices in trauma-affected voice hearers.

Second, trauma-related voices may be maintained by specific types of trauma-related beliefs that are more effectively targeted by ImRs than CBT. Shame is a central emotional symptom amongst people with complex relational trauma (Budden, 2009; Zhu et al., 2020) and is associated with chronic post-traumatic stress symptoms (Feiring & Taska, 2005). Shame is positively associated with the severity of voices (Volpato et al., 2022) and compared to non-voice hearers and healthy voice hearers, clinically distressed voice hearers have significantly higher shame and self-criticism in relation to their trauma (Brand et al., 2023). The clinical findings in this thesis found that ImRs was associated with increased self-compassion (i.e., reduced self-criticism) and emotional self-efficacy. As shame is maintained by maladaptive self-critical beliefs about blame and responsibility in

relation to trauma or secondary appraisals about one's emotional responses during or after their trauma (Dolezal & Gibson, 2022; Ehlers & Clark, 2008), it is possible that ImRs more effectively targets shame-related beliefs than CBT for PTSD.

No known studies have examined the impact of ImRs versus other treatments on shame amongst trauma-affected voice hearers. Two studies have compared the efficacy of ImRs plus imaginal exposure versus imaginal exposure alone in reducing shame amongst trauma-affected individuals and found that both interventions effectively and equally reduce shame in full intention-to-treat samples (Arntz et al., 2007; Øktedalen et al., 2015). However, Arntz et al. (2007) found that amongst treatment completers, imaginal exposure plus ImRs was superior to imaginal exposure alone at post-treatment and at one- and three-month-follow-ups. Furthermore, due to the sample sizes of both studies, the authors were unable to test whether the reduction in shame differed between people with complex relational trauma versus other non-relational traumas, which suggests this may be a key future research direction.

Emotion Regulation and Dissociation

The cross-sectional findings of this thesis provided some evidence that global emotion regulation deficits link trauma to the frequency of UPEs (including voices) and the clinical study found ImRs was associated with increased confidence in the ability to understand and manage one's own emotions. Dissociation has been described as a form of emotion over-regulation, whereby dissociative processes create psychological avoidance or escape from aversive internal or external stimuli due to disrupting normal integration of cognition, memory, and perception (Kennedy & Kennerley, 2013). The findings from the systematic review and cross-sectional study in this thesis are consistent with the findings from large meta-analyses of cross-sectional studies that found a large positive relationship between dissociation and voices across a range of clinical populations, and that dissociation mediates the relationship between trauma and voices (Longden et al., 2020; Pilton et al., 2015; Williams et al., 2018). Together with the clinical study, which provided evidence that ImRs was associated with a large to very large reduction in voices and dissociation, these findings suggest that dissociation may be a mechanism that underlies trauma-related voices. However, stronger evidence of temporality is needed, and future treatment studies should examine whether change in dissociation precedes change in voices.

Examining the relationships between ImRs, emotion regulation, dissociation, and voices is an important avenue for future research. Given that emotion regulation and dissociation are complex multi-faceted constructs, understanding the interplay between

specific elements within these constructs may be important in understanding trauma-related voices and developing effective treatments. For example, continuum models suggest that dissociation is a unitary trait-like construct, whereby small “amounts” of dissociation are normal and pervasive dissociative experiences are pathological (Brown, 2006; Loewenstein, 2018). However, categorical models argue that dimensional approaches overlook important phenomenological differences in dissociative experiences, and group pathological dissociative symptoms into two qualitatively distinct categories; detachment and compartmentalisation, which are theorised have different underlying mechanisms (Holmes et al., 2005). Detachment is theorised to be maintained by automatic neurobiological reactions to threat and incorporates dissociative symptoms characterised by subjective separation from the external word (derealisation), one’s sense of self (depersonalisation), or one’s physical body (out-of-body experiences), and emotional numbing (Brown, 2006; Holmes et al., 2005). Compartmentalisation is theorised to be maintained by deficits in the ability to effectively control the normally controllable mental process that underlie conscious action and awareness, and includes dissociative symptoms of amnesia associated with memory retrieval deficits, unexplained neurological and physical sensations, and “made” thoughts, feelings, and actions (perceived to be controlled by a force other than oneself; Brown, 2006; Holmes et al., 2005).

Whilst a small number of studies suggest there may be a specific association between voices and absorption (linked to unitary trait-like dissociation), and depersonalisation (linked to detachment; see Pilton et al., 2015), no known studies have examined the relationships between different types of dissociation and trauma-related voices. Given that the processes that underlie detachment and compartmentalisation differ, a specific relationship between trauma-related voices and particular types of dissociation may refine conceptualisations of trauma-related voices within the TRV model and identify specific treatment targets. For example, according to Holmes et al. (2005), interventions for compartmentalisation should aim to promote conscious awareness and effective control of mental processes, whereas interventions for detachment should aim to prevent the activation of neurobiological detachment states and enhance recovery from such states. Thus, future research is needed to explore the relationships between ImRs and symptoms of detachment and compartmentalisation, and to examine how ImRs may influence the theorised mechanisms of each.

Given that the cross-sectional, qualitative, and clinical studies in this thesis suggest that dissociation and emotion regulation ability are associated with voices, it may be important to examine the relationship between specific types of emotion regulation,

dissociation, and voices. Gross' (1998, 2015) Process Model of Emotion Regulation provides a temporal account of emotion regulation that includes four stages of emotion generation: situation (exposure to a stimulus), attention (focus toward a stimulus), appraisal (evaluation of the stimulus), and response (physical, experiential, and behavioural experiences of emotion). Recently, Cavicchioli et al. (2021) developed an integrative model of emotion generation and regulation processes with dissociation, which maps different types of detachment and compartmentalisation symptoms onto Gross' (1998, 2015) Process Model of Emotion Regulation. According to Cavicchioli et al. (2021), detachment-based dissociation may occur at the situation stage to facilitate avoidance of aversive stimuli, or at the response stage to avoid aversive emotions, whereas compartmentalisation may be involved in the attention stage due to a disruption in the conscious awareness of information. In support of this theory, there is evidence that trait dissociation is associated with rumination, experiential avoidance, and expressive suppression, which are emotion regulation strategies that occur within the situation, attention, and response stages of emotion regulation (Cavicchioli et al., 2021) and some evidence that these strategies are associated with voices (Jones & Fernyhough, 2006; O'Driscoll et al., 2014; Varese et al., 2011).

Understanding the relationship between different types of dissociation and emotion regulation strategies across different stages of emotion generation may have important theoretical implications for trauma-related voices. For example, detachment-based dissociation during the situation stage may characterise avoidance of aversive external and internal trauma-related stimuli (e.g., inner dialogue), which may support the theorised pathways within the TRV model. However, detachment-based dissociation during the response stage may suggest that dissociation occurs in response to distressing emotions. In this instance, it may be important to examine the relationship between voices, different types of emotion, dissociation, and emotion regulation. As noted earlier in this discussion, clinically distressed voice hearers experience higher shame than healthy voice hearers and non-voice hearers (Brand et al., 2023), and shame is positively associated with both chronic PTSD symptoms (Feiring & Taska, 2005) and the severity of voices (Volpato et al., 2022). Additionally, a recent meta-analysis found a moderate relationship between dissociation and shame (Rudy et al., 2022). As such, future studies could explore the relationship between shame (and other emotions), emotion regulation strategies, and trauma-related voices.

Clinical Implications

A key clinical implication of this thesis relates to the assessment and formulation of trauma-related voices. The results of this thesis provide further evidence that voices that are a transdiagnostic trauma-related symptom are distinct from other psychotic-like symptoms and psychotic spectrum disorders (Carpenter, 2016; Murray, 2017). It is important that clinicians use a trauma-informed approach to the assessment of voices and be aware that diagnostic screening tools that are based on DSM-5 definitions of PTSD (e.g., Structured Clinical Interview for DSM-5 disorders; First et al., 2016) may not identify clinically relevant traumas that are commonly experienced by voice hearers, such as bullying or traumatic separation from attachment figures, or complex post-traumatic stress symptoms, such as trauma-related voices. To avoid overlooking clinically relevant symptoms, it may be important to routinely assess for diverse trauma histories and complex post-traumatic stress symptoms in people who hear voices, and for voices in clients who with trauma histories. Whilst future studies are needed to replicate and extend the studies in this thesis, and gather evidence for broader factors within the TRV model, the TRV model maps onto DSM-5 and ICD-11 criteria for PTSD and complex PTSD (APA, 2013; WHO, 2018), and may provide a helpful framework for complex case conceptualisation.

Clinicians commonly express a fear of increasing clients' distress and working with comorbidities as barriers to the provision of trauma-focussed treatments to clients with complex trauma or psychotic-like symptoms (Chadwick, 2020). PTSD symptoms are rarely treated in clinical settings, particularly in clients with psychotic-like symptoms (Becker et al., 2004). Unfortunately, even when trauma-focussed CBT treatments are delivered to people with psychotic-like symptoms, they have limited effectiveness in reducing distressing voices and PTSD symptoms (Brand et al., 2018). However, the clinical findings of this thesis provide further evidence that ImRs is a safe and effective treatment for both PTSD symptoms and distressing voices in people with complex trauma histories, a range of diagnoses, and various comorbidities (Clarke et al., 2022; Ison et al., 2014; Paulik et al., 2019). Additionally, voice hearers rate ImRs as a highly acceptable intervention (Clarke et al., 2022), and the qualitative findings indicate although voice hearers find ImRs difficult, they believe that experiencing and processing painful emotions was an important part of therapeutic change. Whilst there is a need to directly compare the efficacy of ImRs to other trauma-focussed interventions, these findings suggest that ImRs is an appropriate and effective intervention for trauma-affected voice hearers, regardless of their diagnostic profile.

Similarly, the findings from this thesis suggest that imagery-based techniques more generally may be effective in treating psychotic-like symptoms. Mental imagery has a powerful effect on emotion (Holmes & Mathews, 2005, 2010) and there is growing evidence that imagery-based interventions are effective in treating a range of emotional disorders (Strachan et al., 2020). Whilst no known studies have compared the effectiveness of imagery- versus verbal-based interventions for people with voices and other psychotic-like symptoms, there is evidence that imagery-based interventions are safe, acceptable, and associated with positive mental health outcomes amongst people with psychotic-like symptoms (Clarke, 2019). Together, these findings suggest that the presence of voices and other psychotic-like symptoms is not a contraindication to imagery-based interventions.

Whilst future studies are needed to gather stronger evidence for the role of insecure attachment, emotion regulation, and dissociation as mechanisms of trauma-related voices, the findings of this thesis suggest these factors may be important to consider when treating trauma-affected voice hearers. The relationship between diverse relational trauma and insecure attachment suggests that a sensitivity towards clients' attachment needs may be important in facilitating a strong therapeutic alliance (Diener & Monroe, 2011). Additionally, the results of this thesis suggest that trauma-affected voice hearers are likely to experience difficulties regulating distress and may experience pathological dissociation symptoms. Thus, it may be beneficial for clinicians to focus on building a client's emotion regulation ability and confidence using a range of emotion regulation strategies. Similarly, it is possible that trauma-affected voice hearers may dissociate during trauma-focussed therapies (Newman-Taylor & Sambrook, 2013), which may delay the effects of treatment (Paulik et al., 2020). Grounding, self-soothing, and relaxation techniques are effective in preventing and ceasing dissociation in trauma-affected voice hearers during ImRs (Paulik et al., 2020). As such, clinicians should monitor symptoms of dissociation, and pre-prepare and prompt clients to use such strategies to manage dissociation during stress inducing therapeutic strategies.

Strengths of the Thesis

The development a transdiagnostic theoretical model that explains different types of trauma-related is a key strength of this thesis. A detailed consideration of the strengths and limitations of the TRV model are discussed in chapter three, and suggests that a key contribution of the TRV is its detailed overview of interactions and pathways between different mechanisms, and the theorised directionality of such relationships. Whilst this degree of specificity increases the theoretical complexity of this phenomenon, such

complexity is necessary to meaningfully extend existing stand-alone theories and generate a novel research agenda that may enhance our understanding of the mechanisms of trauma-related voices.

The remaining chapters within this thesis tested novel hypotheses based on the TRV model using a range of research methods and designs that provide different types of evidence for the factors and pathways within the TRV model. The systematic review provided cross-sectional examined evidence for the relative strength of associations between individual mechanisms within the TRV model and PTSD symptoms versus voices, whereas the cross-sectional study tested the associations between a combination of individual mechanisms, and provided evidence for a theorised pathway from trauma to UPEs (including voices). There is very little evidence of prospective changes in potential mechanisms of trauma-related voices (Clarke et al., 2022; Ison et al., 2014), so the clinical study provided novel and robust evidence that ImRs is associated with change in a number of potential mechanisms within the TRV models. Finally, qualitative studies play a key role in uncovering unique insights about complex phenomena (Austin & Sutton, 2014) and the qualitative evidence from this study identified perceptions of the factors that may underlie trauma-related voices and processes of change during ImRs.

Limitations and Future Research Directions

The studies within this thesis tested a relatively small number of factors within the TRV model and there is a need for future studies to test hypotheses based on the larger structure of the model. Chapter two provides a comprehensive future research agenda that identifies the need for multiple types of evidence to test the hypothesised pathways outlined in the TRV model and provides a detailed recommendations for specific research designs that may be best suited to testing key hypotheses. Additionally, the limitations of individual studies within this thesis identify several avenues for future research directions, which are discussed throughout previous chapters of this thesis and within the theoretical implications section of the current chapter. These limitations and future research suggestions will not be repeated here, however, there are several broader limitations to this thesis that need to be addressed in future studies, which are discussed below.

Understanding the differences between trauma-related voices, non-trauma-related voices, and PTSD symptoms may be central to the development of effective treatments for trauma-affected voice hearers. Whilst the participants in the clinical and qualitative studies all experienced trauma-related voices, there is currently no psychometrically valid measure of trauma-related voices and none of the studies in this thesis examined potential differences across different voice hearing and PTSD symptoms. Similarly, there are no

established protocols for the assessment of trauma-related voices, which may affect clinicians' and researchers' ability to reliably identify trauma-related voices. Additionally, it is possible that trauma affected people may hear non-trauma-related voices, and the lack of established protocols for assessing voices may reduce the ability to reliably differentiate between trauma-related and non-trauma-related voices. Future studies are needed to clearly operationalise and develop protocols for assessing trauma-related voices, and to develop psychometrically valid measures of trauma-related voices.

The results of this thesis suggest that complex trauma, insecure attachment, emption regulation, and dissociation may be key factors in the pathway from trauma to trauma-related voices, and several recommendations for future research have been made with regards to these constructs throughout this thesis. However, these are all complex multi-faceted phenomena and there is considerable debate over the definitions and structure of these constructs (Brown, 2006; Cavicchioli et al., 2021; Fraley, 2019; Holmes et al., 2005; Loewenstein, 2018). This suggests that it may be important for future studies to examine different facets of these constructs in relation to trauma-related voices. For example, it may be important to examine differences in trait versus state attachment (Gillath et al., 2009), temporal-based (Gross, 1998, 2015), strategy-based (Aldao & Nolen-Hoeksema, 2012; Aldao et al., 2010), and ability-based models of emotion regulation (Berking et al., 2008; Gratz & Roemer, 2004), and unitary versus pathological categories of dissociation (Brown, 2006; Holmes et al., 2005; Loewenstein, 2018).

Conclusion

Trauma-related voices are a transdiagnostic symptom that occurs across a range of psychological disorders and in non-clinical populations (de Leede-Smith & Barkus, 2013; Larøi et al., 2012). Existing theories are insufficient in explaining trauma-related voices and current treatments are ineffective in treating voices and PTSD symptoms in trauma-affected voice hearers (Brand et al., 2018; Thomas et al., 2014). Understanding the mechanisms that underlie trauma-related voices is important for developing effective treatments. This thesis presents the TRV model, which provides significant unique theoretical contributions to current conceptualisations of trauma-related voices and generates novel hypotheses about the mechanisms of trauma-related voices. A detailed and comprehensive future research agenda based on the TRV is presented and the results of such studies will inform more effective interventions for trauma-affected voice hearers. A mixture of cross-sectional, prospective, and qualitative evidence provided preliminary support for a subset of factors within the TRV model. Future studies are needed to test the larger structure of the TRV model, associations between different

mechanisms within the model, and to examine the relationship between trauma-related voices and specific types of emotion, insecure attachment, dissociation, and emotion regulation processes. The findings of this thesis suggest that ImRs is a safe, acceptable, and effective treatment for trauma-affected voice hearers, regardless of diagnostic status or the presence of comorbidities. The findings of this thesis suggest that randomised controlled trails are needed to directly compare the effectiveness of ImRs versus other trauma-focussed interventions, as well as imagery-based versus verbally-based trauma-focussed interventions. It is hoped that this program of research will increase clinicians' confidence to work with trauma-affected voice hearers and stimulate ongoing research that will continue to improve interventions that enhance voice hearers' quality of life.

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Appendix A

Ethics Approvals for All Studies

Curtin University

Research Office at Curtin

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

17-Jun-2020

Name: Peter McEvoy
Department/School: School of Psychology
Email: Peter.Mcevoy@curtin.edu.au

Dear Peter McEvoy

RE: Ethics approval
Approval number: HRE2020-0333

Thank you for submitting your application to the Human Research Ethics Office for the project **Individual differences in cognitive mechanisms of post-traumatic stress and unusual perceptual and hallucinatory experiences**.

Your application was reviewed by the Curtin University Human Research Ethics Committee at their meeting on **07-Apr-2020**.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **17-Jun-2020** to **16-Jun-2021**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
McEvoy, Peter	CI
Strachan, Laura	Co-Inv
Paulik-White, Georgie	Co-Inv
Roberts, Lynne	Co-Inv

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
   - proposed changes to the approved proposal or conduct of the study
   - unanticipated problems that might affect continued ethical acceptability of the project
   - major deviations from the approved proposal and/or regulatory guidelines
   - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project

5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) and the Curtin University Research Data and Primary Materials policy
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the Australian Code for the Responsible Conduct of Research, the National Statement on Ethical Conduct in Human Research, applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Special Conditions of Approval

Special Condition of Approval:
It is the responsibility of the Chief Investigator to ensure that any activity undertaken under this project adheres to the latest available advice from the Government or the University regarding COVID-19.

This letter constitutes ethical approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely

Sharyn Burns

Associate Professor Sharyn Burns
Chair, Human Research Ethics Committee

Curtin University

Research Office at Curtin

GPO Box U1987
Perth Western Australia 6845

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27-May-2020

Name: Peter McEvoy
Department/School: School of Psychology
Email: Peter.Mcevoy@curtin.edu.au

Dear Peter McEvoy

RE: Ethics approval
Approval number: HRE2020-0265

Thank you for submitting your application to the Human Research Ethics Office for the project **Voice-hearers' explanations of trauma-related voice hearing and mechanisms of symptom change during Imagery Rescripting**.

Your application was reviewed by the Curtin University Human Research Ethics Committee at their meeting on **07-Apr-2020**.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **27-May-2020** to **26-May-2021**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Strachan, Laura	Co-Inv
McEvoy, Peter	CI
Roberts, Lynne	
Paulik-White, Georgie	

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
   - proposed changes to the approved proposal or conduct of the study
   - unanticipated problems that might affect continued ethical acceptability of the project
   - major deviations from the approved proposal and/or regulatory guidelines
   - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project

5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) and the Curtin University Research Data and Primary Materials policy
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the Australian Code for the Responsible Conduct of Research, the National Statement on Ethical Conduct in Human Research, applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Special Conditions of Approval

It is the responsibility of the Chief Investigator to ensure that any activity undertaken under this project adheres to the latest available advice from the Government or the University regarding COVID-19.

This letter constitutes ethical approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely

Sharyn Burns

Associate Professor Sharyn Burns
Chair, Human Research Ethics Committee

Murdoch
UNIVERSITY

Wednesday, 10 July 2019

Division of Research & Development
Research Ethics and Integrity

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Dr Vance Locke
School of Psychology and Exercise Science
Murdoch University

Dear Vance,

Project No. 2016/089
Project Title Perth Voices Research and Evaluation Participant Registry

AMENDMENT: **Update date of completion, reciprocal approval from Curtin University, digital presentation of Information Sheet and Consent Form, minor changes to Participant Information Sheet and Consent Form**

Your application for an amendment to the above project was reviewed by the Murdoch University Human Research Ethics Committee and was;

APPROVED – with the following note;

(a) The term of this ethics approval expires on 31st May 2020, the project can be extended via a re-submission at this date
(b) Ensure all information contained in the Information Letter and Consent Form is incorporated into the landing page of the Qualtrix survey

Approval is granted on the understanding that research will be conducted according the standards of the ***National Statement on Ethical Conduct in Human Research* (2007),** the ***Australian Code for the Responsible Conduct of Research* (2007)** and **Murdoch University** policies at all times. You must also abide by the **Human Research Ethics Committee's standard conditions of approval**. All reporting forms are available on the Research Ethics and Integrity web-site.

I wish you every success for your research.

Please quote your ethics project number in all correspondence.

Kind Regards,

Dr. Yvonne Haigh
Chair
HREC Committee

Dr. Erich von Dietze
Manager
Research Ethics and Integrity

cc: Prof Johanna Badcock, Dr Georgie Paulik-White, Prof Peter McEvoy, Ms Laura Smith, Eloise Wilson , Laura Strachan

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14-Aug-2019

Name: Peter McEvoy
Department/School: School of Psychology
Email: Peter.Mcevoy@curtin.edu.au

Dear Peter McEvoy

RE: Reciprocal ethics approval
Approval number: HRE2019-0525

Thank you for your application submitted to the Human Research Ethics Office for the project Perth Voices Research and Evaluation Participant Registry.

Your application has been approved by the Curtin University Human Research Ethics Committee (HREC) through a reciprocal approval process with the lead HREC.

The lead HREC for this project has been identified as Murdoch University HREC.

Approval number from the lead HREC is noted as 2016/089.

The Curtin University Human Research Ethics Office approval number for this project is **HRE2019-0525**. Please use this number in all correspondence with the Curtin University Ethics Office regarding this project.

Approval is granted for a period of one year from **14-Aug-2019** to **31-May-2020**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
McEvoy, Peter	CI
Strachan, Laura	Co-Inv

You must comply with the lead HREC's reporting requirements and conditions of approval. You must also:

- Keep the Curtin University Ethics Office informed of submissions to the lead HREC, and of the review outcomes for those submissions
- Conduct your research according to the approved proposal
- Report to the lead HREC anything that might warrant review of the ethics approval for the project
- Submit an annual progress report to the Curtin University Ethics Office on or before the anniversary of approval, and a completion report on completion of the project. These can be the same reports submitted to the lead HREC.
- Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
- Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
- Data and primary materials must be managed in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) and the Curtin University Research Data and Primary Materials policy
- Where practicable, results of the research should be made available to the research participants in a timely and clear manner

- The Curtin University Ethics Office may conduct audits on a portion of approved projects.

This letter constitutes ethical approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely

Amy Bowater
Ethics, Team Lead

Appendix B

Published Article: Imagery Rescripting for Anxiety Disorders and Obsessive-Compulsive Disorder

Current Psychiatry Reports (2020) 22: 17
https://doi.org/10.1007/s11920-020-1139-4

ANXIETY DISORDERS (A PELISSOLO, SECTION EDITOR)

Imagery Rescripting for Anxiety Disorders and Obsessive-Compulsive Disorder: Recent Advances and Future Directions

Laura P. Strachan[1] · Matthew P. Hyett[1] · Peter M. McEvoy[1,2]

Published online: 19 February 2020

Abstract

Purpose of Review This review describes imagery rescripting (ImRs) and its clinical application to anxiety disorders and obsessive-compulsive disorder (OCD). Variations in ImRs delivery, clinical evidence, and theories of potential mechanisms of change are also reviewed. Finally, we propose a future research agenda.

Recent Findings There is some evidence that ImRs affects memory processes and schemas. ImRs is associated with reductions in cognitive-affective, physiological and behavioural symptoms of social anxiety disorder and reductions in OCD-related distress and OCD symptoms. ImRs for other anxiety disorders has not been evaluated.

Summary While ImRs appears to be an effective intervention for social anxiety disorder and OCD, more research is needed to (a) systematically compare ImRs to established interventions, (b) evaluate ImRs for other anxiety disorders, (c) test theorized mechanisms of change, and (d) evaluate the impact of moderating factors and treatment variations on therapeutic outcomes.

Keywords Imagery rescripting · Social anxiety disorder · Obsessive-compulsive disorder · Anxiety disorders · Review

Introduction

Anxiety disorders are the most prevalent of all mental disorders globally [1, 2]. Obsessive-compulsive disorder (OCD) and anxiety disorders are associated with significant disability burden [2–4] and high rates of comorbidity with psychological (e.g., mood, other anxiety, substance use disorders) and physical disorders [3, 5, 6]. Such comorbidity is associated with chronicity of mental disorders, greater functional disability, and increased use of healthcare services [7–9]. Thus, the development of effective treatments is essential [10].

According to cognitive theory, cognitions (e.g., thoughts) determine affective experiences and represent a central maintaining factor in psychological disorders [11]. Mental imagery is one aspect of cognition that reflects internally generated perception, which is represented across sensory modalities [12]. Intrusive and distressing mental images are associated with a range of psychological problems [13, 14] and cognitive therapy has long-emphasized the use of mental imagery to correct maladaptive cognitions [11, 15]. Imagery rescripting is one imagery-based technique with a burgeoning evidence-base for the treatment of emotional disorders. This paper will describe the key features of imagery rescripting, summarize recent evidence for its clinical applications to anxiety disorders and OCD, outline theories describing potential mechanisms of change and review experimental evidence for these mechanisms, before proposing potential future research directions.

This article is part of the Topical Collection on *Anxiety Disorders*

✉ Peter M. McEvoy
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[2] Centre for Clinical Interventions, Perth, Australia

What Is Imagery Rescripting?

Imagery Rescripting (ImRs) is a therapeutic technique that uses mental imagery to modify the meaning of distressing autobiographical memories that are associated with current psychological problems [16]. ImRs integrates benign or positive imagery into aversive memories to alter the context of the event that is represented in that memory [17] and differs from imaginal exposure techniques. Although both techniques repeatedly activate aversive memories, exposure to distressing aspects of memories is minimized during ImRs and instead, individuals are required to focus on inserting information that

redirects the course of events, and allows the individual to experience fulfilment of their previously unmet needs [16]. By 'rescripting' the context surrounding aversive memories, ImRs is proposed to modify the meaning associated with those memories, thereby reducing its impact on negative affective experiences [18, 19]. ImRs was originally developed to treat trauma-related psychopathology, and most research has been conducted with post-traumatic stress disorder (PTSD; for a review see Morina and colleagues [20]). Recently, ImRs has been used to treat intrusive memories associated with a range of emotional disorders [20, 21•, 22•, 23].

Imagery Rescripting of Autobiographical Memories

Three Phases of Imagery Rescripting

ImRs protocols typically involve three phases [24, 25•]. During the exposure phase, clients assume the perspective of their child self, at the same age that the target event occurred, and re-experience the memory of the event from this perspective. The second phase involves rescripting, whereby the client's adult self enters the memory and fulfils the unmet needs of their child self. The third phase also involves rescripting; the client re-experiences the event from their child perspective, observes their adult self meeting their needs, and communicates any remaining needs, which are fulfilled by their adult self until their child self feels safe and calm. Clients narrate their experiences aloud from the perspective they have adopted within each phase [25•]. Many studies use these three phases, but there are variations in components and mode of delivery.

Imagery Rescripting With and Without Cognitive Restructuring

A common modification to this ImRs protocol involves the inclusion of a brief cognitive restructuring activity immediately prior to phase one. During cognitive restructuring, individuals challenge the validity of the unhelpful beliefs encapsulated in the memory and identify alternative perspectives. New perspectives are then used in phases two and three to direct the content of the rescripted material [26, 27]. ImRs, both with [27, 28•, 29] and without [21•, 28•, 30, 31, 32•, 33] cognitive restructuring, has been used to treat social anxiety disorder (SAD) and OCD. Sessions are typically 30 to 90 min long and most are single-session interventions [28•, 29–31, 32•], although lengthier interventions have been reported. Lee and Kwon treated SAD with weekly 2-h ImRs sessions for 3 weeks [27]. Frets and colleagues [33] treated SAD with weekly ImRs sessions until the client and therapist were satisfied with the results and found that the number of sessions ranged from five to 17 ($M = 11.2$). Similarly, Maloney and colleagues [21•] treated OCD using one to six sessions, which were delivered weekly until a 35% reduction in symptoms was achieved and found that around half of the clients (46%) required just one session.

Clinical Studies of Imagery Rescripting

Our review of clinical evaluations of ImRs is limited to SAD and OCD, as no studies were identified that evaluated ImRs for separation anxiety disorder, panic disorder, agoraphobia, specific phobias, or generalized anxiety disorder.

Imagery Rescripting Delivered in Individual Format

Social Anxiety Disorder ImRs has most frequently been administered in a one-on-one format [20]. Four studies have tested the impact of a single ImRs session on SAD symptoms. One study found that a single ImRs session was associated with significant and large reductions in fear and avoidance immediately after ImRs ($d = 1.13$), and in fear and avoidance ($d = .99$) and fear of negative evaluation ($d = 1.08$) 1 week later [29].[1] Other studies found that compared to waitlist [31] and reading task [30] controls, one ImRs session was associated with significantly larger reductions in social anxiety, fear and avoidance, and fear of negative evaluation. Reimer and colleagues [31] found that compared to waitlist controls, a significantly higher proportion of ImRs participants achieved reliable improvement (i.e., not attributable to measurement error; 38%), and clinically significant change (achieved reliable improvement and shifted from clinical to non-clinical range on specific measures; 23%). Furthermore, Norton and Abbott [28•] found that compared to controls (who completed a puzzle task), both the cognitive restructuring alone group (no ImRs) and ImRs group showed significantly greater reductions in social anxiety (ImRs vs. control, $d = 0.72$; cognitive restructuring vs. control $d = 0.65$), and the active interventions yielded large within-group effect sizes (cognitive restructuring $d = 1.46$, ImRs $d = 1.70$). Although cognitive restructuring produced larger reductions in fear of negative evaluation than ImRs, the moderate interaction effect was not significant ($d = .61$, $p = .06$).

Lengthier ImRs interventions have been tested. Lee and Kwon [27] found that three, weekly ImRs sessions were associated with significant and very large reductions in social anxiety symptoms ($d = 1.53$) and fear of negative evaluation ($d = 1.61$) compared to supportive therapy controls ($d = 0.69$ and $d = 0.34$, respectively). Furthermore, a single case series found that five to 17 ($M = 11.2$) ImRs sessions were

[1] Cohen's d effect size calculated as M_{pre}-M_{post}/SD_{pre}

associated with reductions in social and performance anxiety, as well as avoidance [33].

Obsessive-Compulsive Disorder Using a single-case experimental design, Veale and colleagues [32•] found that a single ImRs session was associated with large reductions in OCD-related distress ($d = .80$) and very large reductions in symptom severity ($d = 1.90$) at 3-month follow-up. One week after ImRs, 67% of participants achieved reliable improvement in symptom severity and 42% achieved clinically significant change. Three months later, these proportions increased to 75% and 58%, respectively [32•]. Another study found that following one to six weekly sessions of ImRs, 92% of participants achieved clinically significant change, 61% achieved clinical wellness (scored < 12 on the Yale-Brown Obsessive-Compulsive Scale), and 100% reliably improved [21•]. Furthermore, 46% achieved clinically significant change, 38% achieved clinical wellness, and 69% reliably improved after only one session [21•]. These treatment gains were largely maintained; 1 month after ImRs, 100% maintained reliable improvement, 92% maintained clinically significant change, 77% were clinically well, and 3 months after ImRs, 92% maintained reliable improvement and clinically significant change, and 67% maintained clinical wellness [21•].

Imagery Rescripting within Multi-Component Interventions

Social Anxiety Disorder ImRs has been used within broader cognitive behavioural therapy (CBT) interventions to treat SAD. Wild and colleagues [34] evaluated a single session of ImRs as an adjunct to cognitive therapy, whilst Takanashi and colleagues [26] administered one to two ImRs sessions during the later stages of a 16-session course of CBT. In both interventions, ImRs sessions lasted 30–45 min. These multi-component interventions were associated with significant reductions in the frequency and severity of social anxiety cognitions, and fear of negative evaluation, with very large ($d = 1.03$ [34]) and medium-large ($d = 0.76$ [34] and $r = .70$ [26]) effects, respectively.

Obsessive-Compulsive Disorder A single ImRs session has also been used as an adjunct to CBT for OCD [35]; however, symptom changes were not assessed.

Imagery Rescripting Delivered in Group Formats

Social Anxiety Disorder Two studies have explored ImRs as part of a multi-component group CBT intervention [12, 36•], and one has evaluated a single ImRs group session [37•] to treat SAD. The multi-component intervention [12, 38•] comprises 12, 2-h weekly sessions of imagery-enhanced group CBT—including one session of group-based ImRs during session 9. Groups comprised 9–12 participants and ImRs involved several key modifications. Participants identified a self-soothing strategy prior to each rescript to be employed if they felt overwhelmed. Rather than working one-on-one with clinicians, group members were guided through the ImRs procedure and were required to modify the imagery on their own. Participants raised their hand as they reached each new phase, so therapists could ensure everyone transitioned to each new phase without disrupting others' experiences. Immediately after each phase, participants recorded their affect (and its intensity) and bodily sensations, and had a brief group discussion at the end of the session where participants' experiences were normalized and validated. Before rescripting, participants identified core beliefs related to the rescripted memory, and after rescripting they re-rated these beliefs and identified new beliefs associated with the final image. Finally, participants only focussed on memories of social experiences to minimize the likelihood that unrelated traumas would be raised within the group. McEvoy and Saulsman [12] found that compared to non-imagery CBT, imagery-enhanced CBT was associated with significantly lower social interaction anxiety at post-treatment ($d = 0.51$) and 1-month follow-up ($d = 0.93$), as well as higher rates of reliable improvement at post-treatment and clinically significant change in social interaction anxiety at 1-month follow-up. However, there were no group differences in rates of reliable improvement for performance anxiety [12].

McEvoy et al.'s [38•] group ImRs requires participants to take substantially more responsibility for the rescripting process than during individual applications. Ahn and Kwon [36•] addressed this issue by completing ImRs individually within a group context. Their multi-component group intervention involved 12 sessions with ImRs of the same early social memory being completed at sessions 2 and 8. ImRs sessions were recorded and participants listened to these recorded sessions every day for homework. Conventional group CBT and enhanced-group CBT were comparable on performance anxiety, as well as reliable and clinically significant change in social interaction anxiety and performance anxiety at post-treatment, and reliable improvement in social interaction anxiety and performance anxiety at 3-month follow-up. However, enhanced-group CBT was associated with significantly higher rates of clinically significant change in social interaction anxiety (76% vs. 44%) and performance anxiety (89% vs. 58%) at 3-month follow-up [36•].

Hyett and colleagues [37•] adapted an imagery-enhanced CBT group protocol [38•] to develop a single 90-min group ImRs intervention. Groups included four to eight participants ($M = 5.5$). Participants reflected on their emotional and physical reactions throughout the intervention and identified any shifts in the meaning encapsulated in their memory. This study found no significant differences in self-reported social anxiety symptoms or skin conductance responding (an index of

sympathetic arousal) between a single session of group verbal restructuring, group ImRs, and waitlist controls. However, compared to controls and verbal restructuring, ImRs was associated with larger increases on heart rate variability parameters indexing emotion regulation capacity and anxiety tolerance [37•].

Proposed Mechanisms of Change

Behavioural Theories

Learning theories have been used to conceptualize the impact of ImRs on psychopathology [39]. Such theories frame memories of aversive events as unconditioned stimuli, which associatively link people, places, objects, and events as conditioned stimuli, and symptoms of psychopathology as conditioned responses to memories [39, 40]. The strength of a conditioned response is affected by the strength of association between conditioned stimuli and an unconditioned stimulus, as well as the appraisal of the unconditioned stimulus (original event). Several potential mechanisms of change have been suggested based on learning theories.

For example, according to emotional processing theory (see [41]), repeated exposure to aversive memories in the absence of aversive outcomes, along with the integration of corrective information during rescripting phases, activates and updates the 'fear network', reducing psychological distress through habituation processes [24]. Other authors have referred to inhibitory learning theory (see [42, 43]) and suggested that exposure causes extinction learning; conditioned stimuli are presented in the absence of the unconditioned stimulus (traumatic event), which leads to new associative learning that inhibits existing conditioned fear responses [39]. However, learning theories do not explain why ImRs reduces non-fear-based reactions such as self-disgust, self-blame, and helplessness [24]. Thus, some researchers have speculated that the mechanisms that underlie ImRs differ to those that underlie habituation and extinction.

As memories are least stable during retrieval, an alternative mechanism is that inserting 'corrective information' into memories causes the original memory to be re-consolidated with new, less distressing information [31, 44]. However, Brewin's retrieval competition hypothesis [45] suggests that rather than altering the original memory, ImRs may consolidate a new adaptive memory representation that outcompetes the original memory [39, 44].

Cognitive Theory: Reappraisal of Formative Experiences

Schema theorists propose that problematic memory representations ('maladaptive schemas') develop from early experiences and, when activated, can trigger psychopathology [46]. ImRs aims to guide individuals to identify and fulfil their unmet childhood needs by inserting corrective information and positive self-representations into influential memories. The outcomes of this process may be more realistic reappraisals about the meanings encapsulated in memories of the original experience [16], which may prompt the maladaptive schemas that are associated with those events to become less coherent, negative, or self-relevant [47] and, therefore, encourage healthy changes in an individual's views of the self and others [31, 48•]. Consequently, positive changes to maladaptive schemas may weaken the associated negative cognitions that maintain psychopathological symptoms [31].

Extending on the concept of reappraisal, changes in the meanings derived from early experiences have been conceptualized using Gross's process model of emotion regulation [49]. Based on this model, several emotion regulation strategies can alter the course of emotions [49]. Of these, cognitive reappraisal is most strongly associated with healthy psychosocial functioning [50] and involves altering the trajectory of emotions by modifying how one evaluates the meaning of an aversive experience [49]. Thus, the corrective information applied to emotion-inducing memories during ImRs may facilitate cognitive reappraisal, which assists individuals to achieve healthier emotion regulation and reduced negative affect [31].

Experimental Studies of Imagery Rescripting

Whilst advocates of mechanistic research in this field argue that we should seek to explore fundamental processes within clinical populations [51], most experimental work into ImRs has been conducted with non-clinical individuals. Thus, to date, there is limited evidence for change mechanisms during ImRs for psychopathology. One of the major difficulties with mechanistic work in this field is that the neural representations of memory storage, consolidation, and retrieval/reconsolidation are profoundly complex and dynamically influenced by conscious and subconscious processes [52, 53]. Accordingly, to understand the true underlying 'mechanisms' of ImRs, we must, in parallel, arrive at a consensus regarding the basic properties of cognition and behaviour and their attendant neuronal representations. Such a thesis is outside the scope of this article, but nonetheless has its place (i.e., emphasizing the need for carefully planned experiments spanning neuroscience and the clinical domain) prior to discussing the existing experimental literature regarding ImRs (e.g., as previously detailed in Hyett & McEvoy [54]).

Siegesleitner and colleagues [55] examined the impact of ImRs on consolidated emotional memories of an aversive film (the 'trauma film paradigm') and showed that rescripting was associated with less distress, fear, and non-fear emotions than imagery rehearsal alone. This is consistent with the work of

Dibbets and Arntz [56] who also used a trauma film paradigm and revealed that subsequent imaginal exposure (cf. rehearsal) alone was associated with higher distress than ImRs but concluded that there is likely benefit in incorporating aversive material in ImRs. The inclusion of key aversive detail may maximize outcomes by more accurately updating the fear network [41] or by creating a more comprehensive memory representation that is more likely to outcompete the original decontextualized memory [45].

A study in non-clinical individuals also demonstrated that ImRs led to less intrusive autobiographical memories, greater reductions in sadness and distress, and increased mastery [57]. The effects of ImRs on memory outcomes was also examined in individuals with social anxiety disorder [48•]. Consistent with the findings in non-clinical individuals, ImRs led to reductions in memory intrusiveness, vividness, memory-related negative effect, and updating of maladaptive core beliefs about self. Furthermore, this study found that ImRs had a unique impact on memory content. Supportive counselling (which did not directly target specific memories) did not promote memory detail and imaginal exposure increased all memory detail; however, ImRs increased positive and neutral but not negative memory detail. Another study in socially anxious individuals found that ImRs led to significant reductions in the strength of negative self-beliefs and distress associated with aversive memories [58•]. Enhanced memory detail may reflect re-contextualisation [41] or consolidation of memories [45], while reduced intrusiveness, vividness, and negative affect may indicate positive changes in memory appraisals [16]. Changes in perceived mastery and core beliefs suggest that ImRs promotes change to schematic beliefs [31, 47].

Future Directions

Early findings from ImRs for anxiety disorders and OCD are promising, but this review has revealed several gaps in the literature. Evaluations of ImRs for disorders other than PTSD are very limited, including for SAD and OCD. We did not identify any studies investigating ImRs for generalised anxiety disorder, specific phobias, separation anxiety disorder, panic disorder, or agoraphobia. Highly effective interventions already exist for these disorders [59–61], and it is unknown whether ImRs meets or exceeds these benchmarks. Current evidence suggests that ImRs may be effective for SAD and OCD as a stand-alone intervention, so it is important for future research to investigate whether it is effective for other disorders. The specific imagery and meanings targeted for each disorder need to be carefully considered. For instance, where early traumatic experiences associated with disorder onset cannot be identified, it is unknown whether ImRs should focus on the earliest memories of when disorder symptoms began impacting the client's life, and/or early memories related to broader core vulnerabilities associated with fears of physical or emotional harm.

It is unknown for whom ImRs is most effective. ImRs may be most effective for individuals with discrete historical trauma(s) related to their current clinical presentation, but may also be effective for historical anxiety-provoking events that are not necessarily 'traumatic'. Most studies have included relatively small sample sizes and were not designed to investigate clinical or sociodemographic moderators, so this is an important future research direction. It is unknown whether clients' preferred mode of cognition (i.e., verbal vs. imagery-based processing) influences outcomes from ImRs. Likewise, it is unknown whether clients' coping style (e.g., avoidant coping) may affect their ability to engage effectively in ImRs. It is also unknown whether ImRs targeting cognitive and emotional change for one disorder generalizes to comorbid disorders. Relatedly, anxiety and related disorders are associated with non-fear emotions. Although there is some evidence that ImRs is associated with reductions in disgust within PTSD (e.g., [19, 32]), further research is required before generalizing results from the PTSD literature, or before assuming that ImRs is superior to verbally based processes transdiagnostically or trans-emotionally.

There is limited evidence for purported mechanisms of change for ImRs. Given the historical nature of trauma memories, there are challenges with investigating inhibitory learning and reconsolidation. Investigations of cognitive mechanisms are arguably more straightforward and generalizable in clinical populations than lab-based analogue studies; self-report measures of core beliefs, assumptions, attributions, and appraisals associated with traumatic memories can be administered before and after ImRs. Further investigations into impacts on the content of the memories and the meanings of traumatic experiences, as well as on core beliefs about the self, others and the world, would be informative. Shifts in attentional and interpretation biases could also be assessed using cognitive bias assessment procedures [62–66]. The degree to which ImRs modifies these processes, and that these modifications are associated with symptom relief, would provide some experimental evidence that these biases contribute to therapeutic outcomes. Only one study has investigated changes in psychophysiological processes associated with adaptive emotion regulation [37•], so further research on the impact of ImRs across multiple units of analysis would increase our understanding of the complex, multi-dimensional processes associated with therapeutic outcomes [67].

Questions about the relative efficacy of ImRs compared to established treatments need to be systematically evaluated. Few studies that have directly compared ImRs to alternative evidence-based treatments, and those that have did not necessarily demonstrate superiority of ImRs [28•, 58•]. In fact, cognitive restructuring has compared favourably to ImRs on fear

of negative evaluation in SAD [28•]. Component studies that either omit elements of ImRs (dismantling studies) or add components (additive studies) [68] would be informative for identifying (a) necessary and sufficient elements of ImRs to optimize therapeutic outcomes and (b) common and distinct mechanisms of change across different therapeutic procedures.

The optimal dose and mode of delivery for ImRs is yet to be determined. While some studies have investigated predetermined number of rescripts, other studies have continued the intervention until a criterion for change has been met [21, 33]. Studies investigating predictors of trajectories of change with respect to individual differences in clinical factors would be informative (e.g., types, frequencies, and ages of past traumas, diagnoses). Most studies have investigated individually delivered ImRs, although recent studies have investigated group ImRs [12, 36•, 37•]. It is important that future research investigates the cognitive-affective changes that occur across individual and group-based ImRs. It is difficult to identify the contribution ImRs makes to multi-component interventions, so dismantling studies with and without ImRs would help to elucidate whether ImRs enhances outcomes. Another important issue to consider within multi-component interventions is the timing of ImRs. It is unclear whether early ImRs could facilitate more rapid change, or whether early change in other cognitive products and processes (e.g., negative automatic thoughts and images via cognitive restructuring, avoidance and safety behaviours via behavioural experiments, attentional biases via attention training) facilitate engagement and change in ImRs later in treatment.

Conclusions

ImRs for separation anxiety disorder, panic disorder, agoraphobia, specific phobias and generalized anxiety disorder has not yet been tested. Whilst preliminary evidence suggests that ImRs may be an effective intervention for SAD and OCD, research is needed to compare variations in treatment modality and dose, and to compare the effectiveness of ImRs to established evidence-based interventions for SAD and OCD. The theoretical underpinnings of ImRs remain unclear. The few studies that have tested potential mechanisms of change suggest that ImRs may facilitate memory updating processes, memory appraisal, and changes to maladaptive schemas. Future studies are needed to identify which variants and elements of ImRs most efficiently produce therapeutic change, to determine the most potent autobiographical memories to target, to establish whether the effects of ImRs generalize to comorbid symptoms, and to explore potential moderating factors on therapeutic outcomes.

Compliance with Ethical Standards

Conflict of Interest Laura P. Strachan and Matthew P. Hyett each declare no potential conflicts of interest. Peter M. McEvoy receives royalties from Guilford Press for his co-authored book "Imagery-enhanced CBT for social anxiety disorder."

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- • Of importance
- •• Of major importance

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Appendix C

Published Article: A Narrative Review of Psychological Theories of Post-Traumatic Stress Disorder, Voice Hearing, and Other Psychotic Symptoms

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COMPREHENSIVE REVIEW

WILEY

A narrative review of psychological theories of post-traumatic stress disorder, voice hearing, and other psychotic symptoms

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Abstract

Background: Most voice hearers report childhood trauma. Many voice hearers report comorbid post-traumatic stress symptoms and that the content of their voices (auditory verbal hallucinations) is directly (voices repeat phrases spoken by perpetrators) or indirectly (voice content and trauma is thematically similar) related to their trauma. The factors that maintain trauma-related voices are unknown, and there is limited research in this area. This study aimed to identify potential maintaining factors of trauma-related voices by reviewing models of post-traumatic stress disorder (PTSD) and positive symptoms of psychosis.

Method: Models of PTSD and positive symptoms were reviewed to identify potential factors that are unique and common to both sets of symptoms.

Results: We reviewed 10 models of PTSD, 4 models of positive symptoms, and 2 trauma-informed models of voice hearing. One model provided a theoretical explanation of different types of trauma-related voices. Twenty-one factors were extracted from 16 theoretical models. No existing model incorporated all these factors.

Discussion: Existing PTSD and positive symptom models present a range of common and unique factors. There may be value in extending existing integrative models to include a broader range of potential factors that could explain different pathways to, and expressions of, trauma-related voices. A future research agenda is presented to investigate how such an extension could lead to more complete individualized case formulations and targeted treatments.

KEYWORDS
post-traumatic stress disorder, trauma, auditory hallucinations, mechanisms, voice hearing, voices

1 | INTRODUCTION

Voice hearing (auditory verbal hallucinations) is the most common type of unusual perceptual experience, whereby an individual hears a voice(s) when the source of that voice is not directly present and does not perceive the voice to be self-generated mental activity (Upthegrove et al., 2016). Although voices are typically associated with psychosis and psychotic disorders, they are also associated with a range of other mental illnesses, such as post-traumatic stress disorder (PTSD), depression, anxiety disorders, personality disorders, dissociative disorders, and neurological conditions (McCarthy-Jones, 2012; McCarthy-Jones et al., 2017; Schultze-Lutter et al., 2019). Voices are

also reported amongst psychologically healthy individuals (Baumeister et al., 2017). Approximately 20% of voice hearers do not meet criteria for psychological disorder (Johns et al., 2002), and 10–28% of the general population report hearing a voice at some point in their lives (de de Leede-Smith & Barkus, 2013; Sommer et al., 2010). Consequently, researchers have highlighted the need to study psychotic-like symptoms, such as voices, separately from psychotic diagnoses (Carpenter, 2016; Murray, 2017).

Voices can be associated with significant psychological distress and psychosocial impairment (Alonso et al., 2018), and voice hearers frequently report a history of trauma (de de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016). The presence of PTSD symptoms amongst people with a psychotic disorder is common and is associated with an increased severity of psychotic symptoms and suicidality, as well as poorer social functioning, treatment engagement and adherence, and therapeutic benefit from psychological and pharmacological treatments (Hassan & De Luca, 2015; Schneeberger et al., 2014; Seow et al., 2016; Trotta et al., 2015). Furthermore, there is often a link between trauma and the content of voices; *direct voices* repeat phrases spoken by perpetrators of trauma, and the content of *indirect voices* is thematically similar to past trauma (Hardy et al., 2005). Although existing theoretical models explain voices and PTSD symptoms separately, and trauma-informed models of voices support complex case conceptualization, there is currently no integrative theory to guide research into the factors that maintain different types of trauma-related voices. Identifying and understanding the psychological factors that maintain trauma-related voices, and interactions between factors, is critical for the development of effective psychological treatments.

The aim of this review is to identify potential psychological factors that may maintain trauma-related voices and will be presented in three sections. The first section will describe the relationship between trauma and voices and present the rationale for reviewing theoretical models of PTSD and positive symptoms (including voices). In the second section, models of PTSD and positive symptoms will be reviewed to examine how our understanding of post-traumatic stress and voices within the psychotic spectrum may inform our understanding of trauma-related voice hearing outside the psychotic spectrum. Factors that are unique or common to each set of symptoms will be summarized. The third section will discuss the key contributions and limitations of theories reviewed in section two, and will suggest future research directions based on these observations.

2 | THE RELATIONSHIP BETWEEN TRAUMA AND VOICES

Preliminary evidence suggests that, at least for some people, trauma has a causal role in voices (Hardy et al., 2019; Varese et al., 2012). Compared to the general population, people with psychotic disorders are four to six times more likely to have experienced victimization trauma (abuse and/or neglect; de de Vries et al., 2019; Matheson et al., 2013). Approximately 70–75% of voice hearers report a history of trauma (de de Bont et al., 2015; Escher et al., 2004; Hardy et al., 2016), and childhood sexual abuse is most strongly related to voices (Bailey et al., 2018). It is perhaps not surprising then that 16.0–21.5% of voice hearers meet diagnostic criteria for PTSD (de de Bont et al., 2015; Hardy et al., 2016), which is elevated compared to the 3.9–5.6% prevalence rates within the general population (Koenen et al., 2017), and that many more experience clinically significant PTSD symptoms that do not meet full diagnostic criteria for PTSD (Hardy et al., 2019). Furthermore, phenomenological studies have found evidence for trauma-related voices; approximately 57.5% of voice hearers report indirect associations between the content of their voices and past trauma, and 12.5% report a combination of indirect and direct associations (Hardy et al., 2005).

There is symptomatic overlap between PTSD and the positive symptoms of psychosis (Morrison et al., 2003). Both cognitive intrusions (re-experiencing symptoms) and dissociation are key diagnostic features of PTSD but do not form part of the diagnostic criteria for psychotic disorders (APA, 2013). However, people with schizophrenia spectrum disorder who hear voices experience significantly more intrusions compared to both healthy controls and people with schizophrenia spectrum disorder who do not hear voices (Morrison & Baker, 2000), and dissociation is commonly reported by people with psychotic disorders (Moskowitz et al., 2005; Ross, 2007; Vogel et al., 2013). Furthermore, people diagnosed with PTSD report high rates of positive symptoms (Butler et al., 1996; Sautter et al., 1999), which may be due to the considerable phenomenological similarities between PTSD and psychosis symptoms (see Seedat et al., 2003). These findings have led some researchers to theorize that positive symptoms may be complex forms of PTSD re-experiencing or dissociation (Moskowitz & Corstens, 2008; Read et al., 2003) and voices have been conceptualized as a dissociative processes causing a person to perceive trauma-related memory intrusions as an egodystonic voice (Longden et al., 2012).

Key Practitioner Messages

- Trauma and post-traumatic stress symptoms should be assessed amongst clients who hear voices, and voices should be assessed amongst clients with post-traumatic stress symptoms
- PTSD and the positive symptoms of psychosis have both unique and common maintaining factors
- Stand-alone models of PTSD and voices provide limited scope for the conceptualization of voices in the context of trauma
- People who hear trauma-related voices would likely benefit from individualized psychological therapies that target maintaining factors common and unique to both sets of symptoms

2.1 | The need for an integrative theoretical approach to trauma-related voices

Historically, trauma-related voices have been explained via cognitive models of PTSD (Steel et al., 2005), which suggest that normal encoding is disrupted during highly traumatic events, thereby causing memories of trauma to be encoded with limited contextual information. Intrusive de-contextualized trauma memories may be misinterpreted by the individual to be disturbing external stimuli from the present (i.e., voices) rather than distressing memories (Morrison, 2001; Steel et al., 2005). However, whilst this conceptualization may explain direct trauma-voice associations, most people who report a link between their trauma and voices experience indirect voices (Hardy et al., 2005), which suggests that voices are different to PTSD intrusions, at least for those with indirect trauma-voice associations.

Berry and Bucci (2016) suggest that indirect voices may occur due to dissociation in response to trauma-related or self-critical thoughts, whereby disruption to perceptual and memory processes causes an individual to perceive such thoughts as egodystonic voices. Hardy (2017) suggests that indirect voices occur due to dissociation during the construction of novel mental imagery (i.e., mental perceptions across all sensory modalities) that is informed by trauma-informed personal semantic memory (i.e., beliefs that are informed by memory; Hackmann et al., 1998), thereby causing the individual to hear voices that are thematically linked to past trauma.

PTSD symptoms in voice hearers are currently treated using cognitive behavioural treatments (CBT), which are based on cognitive models of PTSD that are theorized to re-contextualize trauma memories, or via eye movement desensitization and reprocessing treatment, which was not developed from an established theory (Shapiro, 1989). Whilst these treatments effectively reduce trauma symptoms, they have shown limited effectiveness in reducing voices and psychosis symptoms (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017). On the other hand, preliminary evidence suggests that imagery rescripting, a novel intervention that uses mental imagery techniques to modify the meaning of distressing memories, effectively reduces post-traumatic stress, unwanted memory intrusions, voice frequency, voice-related distress, and negative affect amongst voice hearers (Ison et al., 2014; Paulik, Steel, & Arntz, 2019). Together, these findings suggest that there may be commonalities and differences in the factors that maintain PTSD and voices. Compared to traditional CBT interventions, it may be that imagery rescripting more effectively targets the psychological factors common to both sets of symptoms or may target multiple factors that are unique to each set of symptoms. There is no established theory of trauma-related voices that explains these findings. As a first step toward developing an integrative theory that could provide a more comprehensive explanation of the aetiology, maintenance, and modification of trauma-affected voices, established models of PTSD and positive symptoms (including trauma-informed models of voices) will now be reviewed before common and unique factors across the models are outlined.

3 | REVIEW OF KEY THEORETICAL MODELS OF PTSD

3.1 | Behavioural models of PTSD

3.1.1 | Theories of associative fear-learning

Classical conditioning is a key process in associative fear-learning theories. The unconditioned feared stimulus that is central to the person's trauma experience (e.g., being assaulted by a tall man at night) is paired with neutral stimuli (e.g., tall men and dark environments). As a result, previously neutral stimuli become conditioned stimuli that produce conditioned responses that are similar to those produced by the unconditioned stimulus (e.g., fear; Lissek & van Meurs, 2015). Fear conditioning can be altered via extinction, whereby an individual acquires new learning; conditioned responses decline with repeated exposure to conditioned stimuli in the absence of the unconditioned stimuli and/or aversive outcomes (Lissek & van Meurs, 2015).

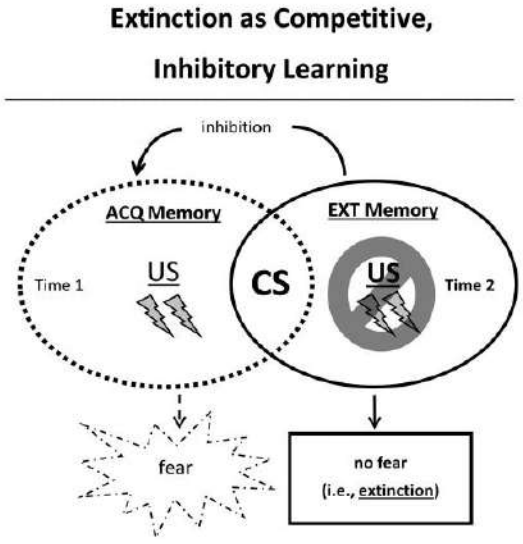

FIGURE 1 *Competition theory. Note.* In this example, the acquisition memory is associated with the pairing of an unconditioned stimulus (US; e.g., being assaulted) with a neutral stimulus, which becomes a conditioned stimulus (CS; e.g., tall men) that produces a conditioned response (CR; e.g., fear). Encoding of the extinction memory occurs due to subsequent repeated exposure to the CS in the absence of the US (e.g., non-aggressive/threatening tall men). Future exposures to the CS result in a competition between the activation of the two memories. Extinction learning occurs when the extinction memory outcompetes the acquisition memory, thereby inhibiting the CR. From "learning models of PTSD: Theoretical accounts and psychobiological evidence", by Lissek and van Meurs (2015), *International Journal Of Psychophysiology*, 98, p. 597 (https://doi.org/10.1016/j.ijpsycho.2014.11.006). Copyright 2014 by Elsevier. Reprinted with permission

The main tenet of associative fear-learning models is that PTSD is the result of extinction failure, whereby conditioned fear responses to non-threatening stimuli do not decline with repeated non-aversive exposures to conditioned stimuli (Lissek & van Meurs, 2015). Competition theory (for a review, see Bouton, 2004) suggests that extinction learning does not erase original fear conditioning but outcompetes the original fear-acquisition learning; extinction is only successful if the extinction learning is stronger than the fear-acquisition learning (see Figure 1). Some have suggested that individuals with PTSD may have (a) hyper-conditionability, which results in strongly acquired fear-based learning (Orr et al., 2000), and/or (b) inhibitory learning deficits that impair their ability to inhibit fear-based learning in favour of extinction learning (Jovanovic & Ressler, 2010). Others have suggested that some conditioned responses are distressing enough to serve as unconditioned stimuli, which causes normal extinction processes to be inhibited and repeated fear responses during extinction learning to strengthen reactivity to conditioned stimuli (Eysenck, 1979).

Mowrer (1947) suggests that PTSD involves a two-stage learning process, and that the second stage is primarily responsible for extinction failure. The first stage involves classical conditioning. The second stage involves the person actively avoiding and escaping conditioned stimuli to alleviate distress, which leads to negative reinforcement; the reduction in distress increases the likelihood of future avoidance, which thwarts opportunities for extinction learning. Others have suggested that people with PTSD have an inability to suppress fear when presented with safety cues, and as extinction relies on fear-inhibition, people who fall into this category experience extinction failure (Jovanovic & Ressler, 2010).

Contrary to the theory of hyper-conditionability, the associative-learning deficits model suggests that people with PTSD have difficulty identifying realistic associations between unconditioned and associated stimuli, which leads to difficulties identifying real danger cues (Grillon, 2002). Consequently, these people may associate the unconditioned trauma stimulus with the general environment in which the trauma occurred, which may lead to generalized contextual anxiety and a chronic state of arousal. Furthermore, people with PTSD may overgeneralize, whereby they readily associate neutral stimuli to conditioned stimuli, which results in fear responses to safe stimuli that are seemingly unrelated to the traumatic event (Grillon, 2002).

3.1.2 | Theories of non-associative fear learning

Non-associative fear-learning theories conceptualize PTSD as changes in a person's reactivity to fear-relevant stimuli due to problematic habituation and sensitization processes (for a review, see Lissek & van Meurs, 2015). Habituation describes a gradual decline in autonomic and psychological arousal after repeated exposure to fear-inducing stimuli (Groves & Thompson, 1970). Failure to habituate, whereby individuals experience persistent startle responses to non-threatening stimuli, may maintain hyperarousal symptoms of PTSD. In contrast to habituation, sensitization describes the process of a person experiencing increasing autonomic and psychological reactivity with repeated exposure to fear-related stimuli (Groves & Thompson, 1970). Sensitization is suggested to result from previous activation of a person's fear system, which results in the fear system becoming hypersensitive to new, unusual, or fear-relevant stimuli (Lissek & van Meurs, 2015).

3.2 | Schema-based and social cognitive models of PTSD

3.2.1 | Model of stress response

Schema theorists (see Rafaeli et al., 2011; Young, 2006) suggest that information, knowledge, and beliefs about oneself, others, and the world is organized in the mind as units of knowledge called schemas, and that people make meaning of new information using their schemas, which influence their emotional, cognitive, and behavioural responses to such information. Horowitz (1983, 1986, 2011) explains PTSD symptoms using two general "response modes" to stress. First, intrusion symptoms are the result of a failure to integrate traumatic experiences into one's pre-existing schematic network. Horowitz (1983) proposes that people have a *completion tendency*, which involves a propensity to assimilate new information (e.g., trauma), as well as the meaning of such information, into pre-existing schemas, and that people possess a bias toward preserving existing schematic structures. Should the trauma or the meanings that individuals assign to the trauma conflict with existing schemas, the person may experience *completion failure*, which results in a normative stress response. Furthermore, the individual will continue to experience intrusion symptoms until they successfully integrate the trauma information into their schematic network.

The individual may engage in a second response mode to defend against distressing intrusions. This response mode involves *defence mechanisms*, such as numbing, denial, repression, and avoidance that reduce the stress response by keeping the traumatic information out of conscious awareness. Horowitz (1983) describes PTSD symptoms as an oscillation between these two response modes whilst the individual processes the trauma information. Processing of trauma involves slow schematic change and PTSD symptoms resolve once traumatic experience is integrated within the schematic network.

3.2.2 | Shattered assumptions theory

The shattered assumptions theory (Janoff-Bulman, 1989; Janoff-Bulman & Frantz, 1997; Janoff-Bulman & Frieze, 1983) conceptualizes PTSD symptoms as the result of schematic change. This theory outlines three positive and rigid schematic assumptions: the world is meaningful (e.g., people get what they deserve), the world is benevolent (e.g., people are more good than not), and the self is worthy (e.g., I am good, so bad things could never happen to me). These three assumptions are proposed to afford the individual a feeling of

invulnerability and that the world is predictable, which produces a sense of safety and security. However, should an individual be unable to integrate new negative experiences into these pre-existing schemas, their assumptions are "shattered". Therefore, trauma can lead to rapid and overwhelming schematic change that causes feelings of extreme vulnerability, defencelessness, and distress. The more strongly a person holds these three basic assumptions, or if these assumptions have never been challenged before, the more sudden and shattering their schematic change will be. However, this theory has been challenged due to evidence that demonstrates people with multiple traumas, whose positive schemas should have already undergone schematic change, are more likely to experience PTSD symptoms (see Brewin & Holmes, 2003). In response, Janoff-Bulman suggested that people with more positive assumptions may recover faster than those with a trauma history, or that people with past trauma may not have integrated trauma information into their schematic structures and, therefore, new trauma information would continue to be "shattering" (Janoff-Bulmann, 1992, as cited in Brewin & Holmes, 2003). According to the shattered assumptions theory, individuals may engage coping strategies, such as denial, self-blame, and intrusions symptoms, which aid the re-construction of their schematic structure.

3.2.3 | Social cognitive theory

Benight and Bandura's (2004) social cognitive theory states that unhelpful self-schemas, specifically in relation to perceived self-efficacy, underlie PTSD symptoms. Self-efficacy describes one's perceived ability to manage their own functioning, but when considered in the context of traumatic experiences, describes an individual's ability to cope with the trauma and its sequelae, which shapes their cognitive, affective, and behavioural responses to trauma. Benight and Bandura (2004) propose several ways in which self-efficacy shapes trauma responses. First, self-efficacy can impact attentional and evaluative processes; those who have lower self-efficacy are likely to be vigilant toward potential threats and amplify the severity of risk associated with those threats. Second, self-efficacy can affect how people respond to perceived threats; people with low self-efficacy are less likely to try to control their environment to reduce their distress and are more likely to experience heightened emotional reactivity or attempt to avoid and/or escape threatening stimuli. Third, individuals with low self-efficacy may struggle to control their thoughts, emotions, and behaviours in response to threatening stimuli. As such, people with low self-efficacy are more likely to have intrusion symptoms and re-experience the emotional and behavioural aspects of trauma.

3.3 | Information processing models of PTSD

3.3.1 | Dual representation theory

According to the dual representation theory of PTSD (Brewin et al., 1996; Brewin & Holmes, 2003), trauma is processed emotionally within two memory systems. The first system involves conscious processing, whereby a traumatic event is integrated into long-term autobiographical memory. These memories were originally called "verbally accessible memories" because they can be both voluntarily and involuntarily retrieved, verbalized, and updated. However, Brewin et al.'s (2010) revised model, which integrates the original model with neurobiological models of memory and imagery, refers to these memories as "contextual-based representations" (C-Reps). C-Reps contain information about the context and events that occurred prior to, during, and following trauma, as well as the individual's appraisal of the meaning of a trauma (Brewin et al., 2010; Brewin & Holmes, 2003). C-Reps may include primary emotions that occurred during the event (e.g., fear), as well as secondary emotions about the perceived meaning of a trauma that are retrospectively generated (e.g., guilt or shame; Brewin & Holmes, 2003). Heightened arousal during trauma limits an individual's capacity to process large amounts of information (Brewin & Holmes, 2003), which, combined with attentional biases toward highly threatening aspects of the trauma, can result in fragmented and poorly contextualized C-Reps (Brewin et al., 1996; Brewin & Holmes, 2003). The second system involves unconscious processing of the physiological, motor, and sensory information associated with the trauma (Brewin et al., 1996). These memories are inflexible and cannot be retrieved intentionally. Instead, these memories are involuntarily accessed when the individual is exposed to internal (thoughts or bodily sensations) or external stimuli that match elements of the trauma (Brewin & Holmes, 2003). As they are comprised of mental representations of sensory information, they are difficult to verbalize (Brewin & Holmes, 2003) and, therefore, were labelled "situationally accessible memories" and later, in the revised model, "sensation-based representations" (S-Reps).

According to Brewin et al. (1996, 2010), PTSD is the result of a lack of integration between C-Reps and S-Reps (see Figure 2). When an individual is exposed to situational reminders of a trauma, highly detailed sensory, motor, physiological, and emotional features (S-Reps) are automatically activated in the absence of temporal and contextual information (C-Reps). Consequently, rather than recollecting a trauma memory, the individual re-experiences the memory as if it were occurring in real time along with the distressing affective, motor, physiological, and sensory experiences associated with the original memory (i.e., flashbacks or nightmares).

3.3.2 | Fear network account of emotional processing

The fear network account of emotional processing (Foa et al., 1989; Foa & Kozak, 1986) suggests that feared stimuli are embedded in long-term memory within a "fear network" (Foa & Kozak, 1986). Fear networks contains information about (a) feared and associated stimuli; (b) cognitive, behavioural, and physiological reactions to feared stimuli; and (c) the associations between feared stimuli and responses (i.e., meanings about trauma and trauma responses). Foa and Kozak (1986) suggest that PTSD symptoms result from a pathological,

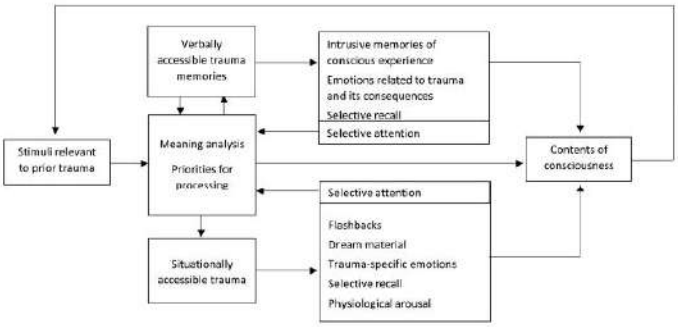

FIGURE 2 *The dual representation theory of post-traumatic stress disorder. Note.* From "A dual representation theory of posttraumatic stress disorder," by Brewin et al. (1996), *Psychological Review, 103*, p. 676 (https://doi.org/10.1037/0033-295X.103.4.670). Copyright 1996 by American Psychological Association. First developed by Brewin (1989). Reprinted with permission

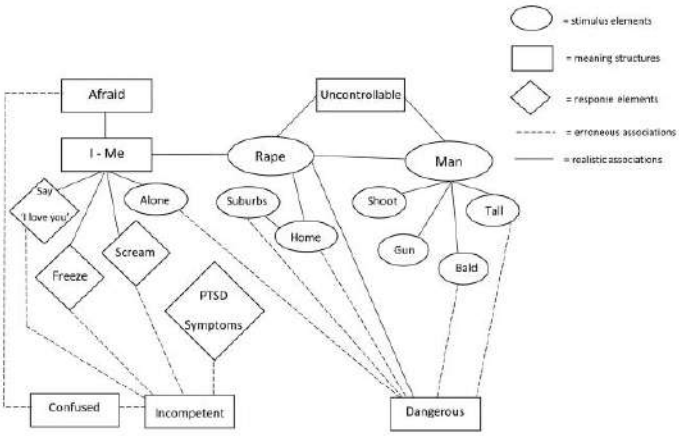

FIGURE 3 *A fear network account of emotional processing: A pathological fear network following rape. Note.* From "Cognitive approaches to posttraumatic stress disorder: The evolution of multirepresentational theorising," by T. Dalgleish (2004), *Psychological Bulletin, 130*, p. 237 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Foa and Rothbaum (1998). Reprinted with permission

change-resistant fear network comprised of excessive stimuli and response information, and heightened associations between elements that do not accurately reflect reality. When a person encounters an element of their fear network (e.g., dark outside) within their environment, the entire fear network becomes activated and triggers the survival response prescribed by that network (see Figure 3). Consequently, pathological fear networks produce strong emotional and behavioural responses to non-threatening stimuli (i.e., re-experiencing). Furthermore, avoidance and numbing symptoms are conceptualized as coping strategies that reduce the likelihood the fear network will be activated and, therefore, prevent re-experiencing symptoms (Foa et al., 1989). Additionally, hyperarousal symptoms may reflect lower-level activation of the fear network (Foa et al., 1989).

3.4 | Integrated models of PTSD

3.4.1 | Emotional processing theory

Emotional processing theory extends on the fear network account of emotional processing in several ways (Brewin & Holmes, 2003; Dalgleish, 2004). The revised theory incorporates additional information about pre-trauma beliefs and information available prior to, during, and after the trauma, as well as negative appraisals of one's responses during and after trauma (see Figure 4; Brewin & Holmes, 2003). There are three key components to emotional processing theory that interact to produce PTSD symptoms. Two of these components involve mental representations, and one involves post-traumatic reactions.

The first component involves memory records, which include pre-trauma memories, the trauma memory itself, and post-trauma memories (Dalgleish, 2004). Memory records are akin to "fear networks"; however, they have several extensions. First, biased information processing during encoding is acknowledged as producing disorganized memory records (Foa & Riggs, 1993, as cited in Dalgleish, 2004). Second, it is acknowledged that numerous, erroneous, and vague associations between trauma and non-trauma stimuli are recorded within memory records, which accounts for the widespread perception of danger amongst traumatized individuals (Foa & Rothbaum, 1998). Finally, memory records include physiological and behavioural survival response elements (e.g., dissociation) that may have been unsuccessful in preventing the trauma, which have led the individual to develop a sense of incompetence (Foa & Rothbaum, 1998).

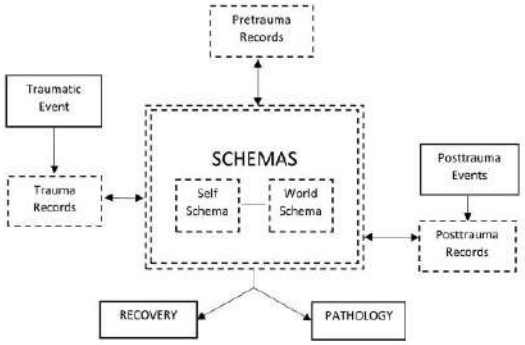

FIGURE 4 *Model of emotional processing theory: Emotional processing of trauma. Note.* From "Cognitive approaches to posttraumatic stress disorder: The evolution of multirepresentational theorising," by T. Dalgleish (2004), *Psychological Bulletin, 130*, p. 245 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Foa and Rothbaum (1998). Reprinted with permission

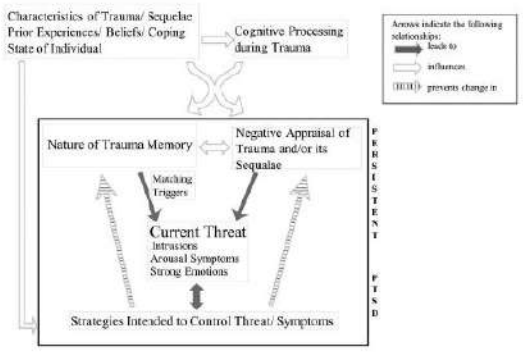

FIGURE 5 *A cognitive model of PTSD. Note.* From "a cognitive model of posttraumatic stress disorder," by A. Ehlers and Clark (2000), *Behaviour Research and Therapy, 38*, p. 321 (https://doi.org/10.1016/S0005-7967(99)00123-0). Copyright 2000 by Elsevier. Reprinted with permission

Like earlier schema-based models of PTSD (Horowitz, 1986; Janoff-Bulman, 1989), the second component of emotion processing theory suggests that traumatic events violate pre-existing positive schemas, which results in intrusion and avoidance symptoms (Dalgleish, 2004). However, whilst the shattered assumptions theory did not explain why people with a trauma history have increased vulnerability to PTSD (Dalgleish, 2004), emotional processing theory suggests that when people with a trauma history experience a new trauma, their negative schemas, which were shaped by past trauma, become activated, leading to distress and survival responses (Foa & Rothbaum, 1998).

The third component of emotional processing theory involves a variety of post-traumatic reactions to the self and others, and subsequent negative appraisals of such reactions (Dalgleish, 2004). Heightened emotional responses may lead to maladaptive appraisals such as "I am weak", particularly if the person's pre-existing self-schemas reflect incompetence. In turn, appraisals of post-traumatic responses may develop new, or strengthen existing, negative schemas about the world and the self (Rauch & Foa, 2006).

3.5 | A cognitive model of PTSD

Integrated models of PTSD amalgamate tenets from learning, schema-based, and information processing theories. In doing so, they address some of the limitations of earlier models (for a review, see Dalgleish, 2004) and provide a more comprehensive account of PTSD. Ehlers and Clark's (2000) cognitive model of PTSD suggests that impaired cognitive processing during trauma, which may be attributed to dissociative reactions at the time of trauma (peri-traumatic dissociation), combined with pre-existing beliefs about trauma, its sequelae, and oneself, influences the development of PTSD symptoms. The authors suggest that the central characteristic of PTSD is a sense of current threat, which is maintained by two key cognitive processes. First, idiosyncratic negative appraisals about the meaning of a trauma and its sequelae perpetuate a sense of current threat. Individuals may overgeneralize the probability of the event reoccurring (e.g., nowhere/nobody is safe) and negatively appraise their behaviour in relation to the trauma (e.g., I deserved this), and these appraisals keep the threat "alive". Second, impaired memory encoding during trauma leads to the trauma memory being fragmented and poorly integrated into long-term memory, which makes it difficult for the individual to accurately position the memory in time and place, link the memory to preceding and proceeding information, and to other autobiographic memories. However, strong associative learning occurs, and exposure to trauma-associated stimuli causes strong emotional reactions (see Figure 5).

3.5.1 | SPAARS model

The schematic, propositional, analogical, and associative representational systems (SPAARS) model outlines four types of mental representations that operate concurrently to produce PTSD symptoms (Dalgleish, 2004; Power & Dalgleish, 2008, 1999). First, schematic representations (i.e., schemas) contain abstract and general knowledge about the self, the world, and others. Second, propositional representations comprise language-based representations of events and their associated meanings, and are similar to C-Reps in the dual-representation theory (Brewin et al., 1996). Third, like S-Reps (Brewin et al., 1996), analogue representations comprise non-verbal mental images, which can occur across all sensory modalities. Finally, associative representations, which are similar to Foa and Kozak's (1986) fear network, link information between the other three levels of mental representation (see Figure 6).

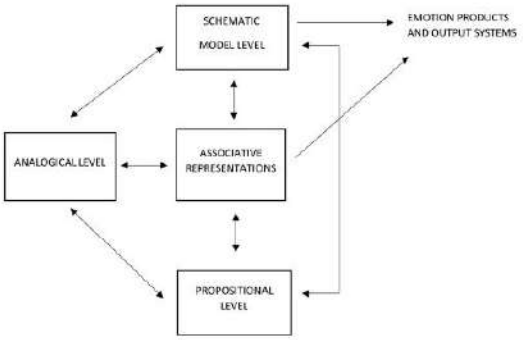

FIGURE 6 *The SPAARS model. Note.* From "Cognitive approaches to posttraumatic stress disorder: The evolution of multirepresentational theorising," by T. Dalgleish (2004), *Psychological Bulletin, 130*, p. 248 (https://doi.org/10.1037/0033-2909.130.2.228). Copyright 2004 by American Psychological Association. First developed by Power and Dalgleish (1997). Reprinted with permission

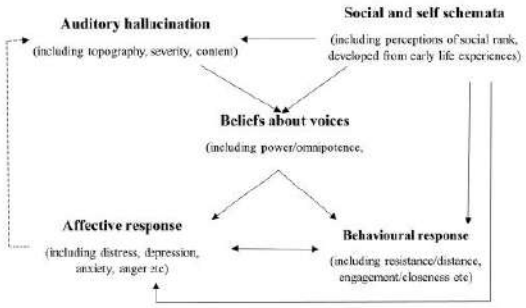

FIGURE 7 *A cognitive model of auditory hallucinations. Note.* From "The role of social schema in the experience of auditory hallucinations: A systematic review and a proposal for the inclusion of social schema in a cognitive behavioural model of voice hearing," by G. Paulik (2012), *Clinical Psychology and Psychotherapy, 19*, p. 469 (https://doi.org/10.1002/cpp.768). Copyright 2011 by John Wiley & Sons. Reprinted with permission

Information from events are stored in each representational format, and information processing is hierarchical in nature; schematic processing is a higher level of processing and integrates information from lower levels (analogue and propositional) to construct a whole and coherent meaning of autobiographical events (Dalgleish, 2004). Dominant schematic representations are proposed to orchestrate the storage of new information, as well as the activation and/or inhibition of information within lower-level representations. Information that is congruent with schematic representations is easily assimilated into the representational system, whilst incongruent information is more difficult to assimilate and more likely to be inhibited.

There are two routes of emotion generation within the SPAARS model (Dalgleish, 2004; Power & Dalgleish, 1999). The first involves appraisals of an event and/or reactions to that event at a schematic representational level. The second is automatic and involves associative representations. Here, information within various representational formats become activated as a result of past activations and associations between representational formats. Propositional representations generate emotion via associative representations, which link propositional representations to schematic representations. Once generated, emotions (e.g., fear) trigger a "response mode" for that specific emotion, whereby various corresponding elements within the larger representational system that is associated with that emotion (e.g., fear) become activated.

According to the SPAARS model, trauma causes intense appraisal-driven emotion activation (Dalgleish, 2004). Trauma-related information that is incongruent with schematic representations is repeatedly appraised whilst the individual attempts to assimilate the trauma information into their schematic representations. Continued appraisal leads to chronic low-level activation of the fear mode (hyperarousal) and to trauma-related information remaining active in one's mind (intrusion symptoms). Continued fear mode activation and the associated re-configuration of the representational system lead to cognitive processing biases, whereby re-experiencing symptoms are triggered by selective attention and cognitive processing biases. Until the traumatic event is successfully assimilated, the distinct representational components of that event remain highly cohesive. As such, stimuli that resemble part of the trauma experience can quickly activate the entire trauma memory, leading to flashbacks.

4 | OVERVIEW OF KEY THEORETICAL MODELS OF VOICES AND OTHER POSITIVE SYMPTOMS

Historically, neurobiological theories of positive symptoms have dominated voice hearing literature (Tarrier & Taylor, 2014). However, alternative models have emerged due to accumulating evidence that social and cognitive factors can precipitate and maintain psychotic episodes (Bucci & Tarrier, 2010; Tarrier & Taylor, 2014).

4.1 | A cognitive approach to voices

A key assumption of the cognitive approach to voices model is that voices themselves are not pathological (Birchwood & Chadwick, 1997; Chadwick & Birchwood, 1994). Instead, negative evaluative beliefs about one's voices can produce distress, and one's affective and behavioural response to voices (e.g., unhealthy engagement with voices, compliance, and unhealthy avoidance) can shape future appraisals and, therefore, future voices. Paulik (2012) extended this model to include the role of social schema in governing one's relationship with their voices (see Figure 7). A person's early interpersonal experiences (e.g., childhood trauma) shapes their social and self-

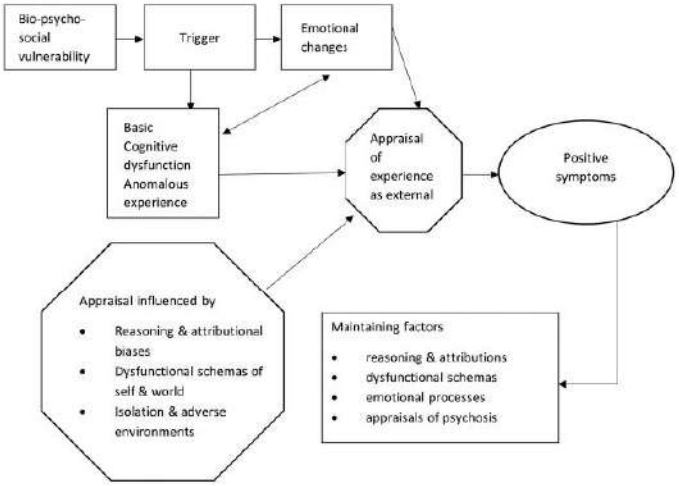

FIGURE 8 *A cognitive model of positive symptoms of psychosis. Note.* From "Cognitive, emotional, and social processes in psychosis: Refining cognitive behavioural therapy for persistent positive symptoms." by E. Kuipers et al. (2006), *Schizophrenia Bulletin, 32*, p. 525 (https://doi.org/10.1093/schbul/sbl014). Copyright 2006 by Oxford University Press. Reprinted with permission

schemas and, therefore, their typical pattern of interpersonal responding more generally. If we conceptualize voices as a form of interpersonal exchange, these schemas may shape one's beliefs about their voices, as well as their behavioural responses to voices.

4.2 | A cognitive model of the positive symptoms of psychosis

Garety et al. (2001) developed a cognitive model of psychosis (Figure 8) and proposed that unusual perceptual experiences themselves are not necessarily pathological; however, it is the misattribution of such symptoms as being externally generated that causes distressing positive symptoms (Bucci & Tarrier, 2010; Kuipers et al., 2006). Garety et al. (2001) outline four key cognitive factors that increase the likelihood that misattributions will maintain positive symptoms. First, reasoning and attribution processes may maintain external attributions. These include an external attribution style (the tendency to attribute the cause of experiences to external factors), as well as information gathering biases such as "jumping to conclusions" (makes judgements without all the facts), poor theory of mind (lack of ability to attribute mental states to oneself), belief inflexibility (a lack of willingness to consider alterative explanations), and belief confirmation bias (the tendency to interpret new information as evidence for existing erroneous beliefs). Second, dysfunctional schemas about the world (e.g., the world is dangerous), others (e.g., others are hostile), and self (e.g., I am weak) can increase the likelihood of negative content in positive symptoms, which in turn strengthen dysfunctional schemas. Third, negative emotions increase the likelihood that people will attribute their positive symptoms to external, threatening sources. Finally, people with low insight into their positive symptoms may be less likely to challenge unhelpful appraisals of their positive symptoms.

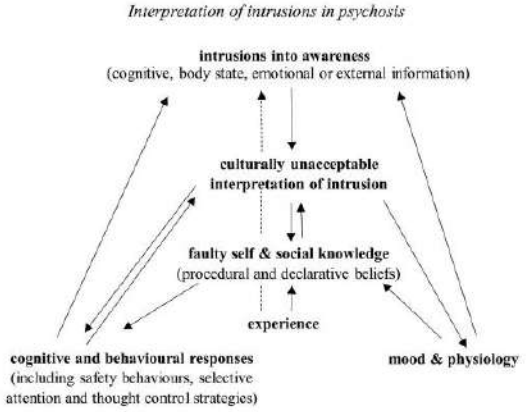

FIGURE 9 *A meta-cognitive model of psychosis. Note.* From "The interpretation of intrusions in psychosis: An integrative cognitive approach to hallucinations and delusions," by A. P. Morrison (2001), *Behavioural and Cognitive Psychotherapy, 29*, p. 261 (https://doi.org/10.1017/S1352465801003010). Copyright 2001 by British Association for Behavioural and Cognitive Psychotherapies. Reprinted with permission

4.3 | A meta-cognitive model of psychosis

According to Morrison's (2001) meta-cognitive model (Figure 9), positive symptoms start as relatively normal intrusions and fall into three categories: external stimulus information, cognitive state information, and body state information (Wells & Matthews, 1994). Morrison (2001) suggests that positive symptoms only become problematic if they are misinterpreted to be threatening and to have originated from an external source, which generates a cycle of negative affect, intrusive cognitions, and distressing positive symptoms.

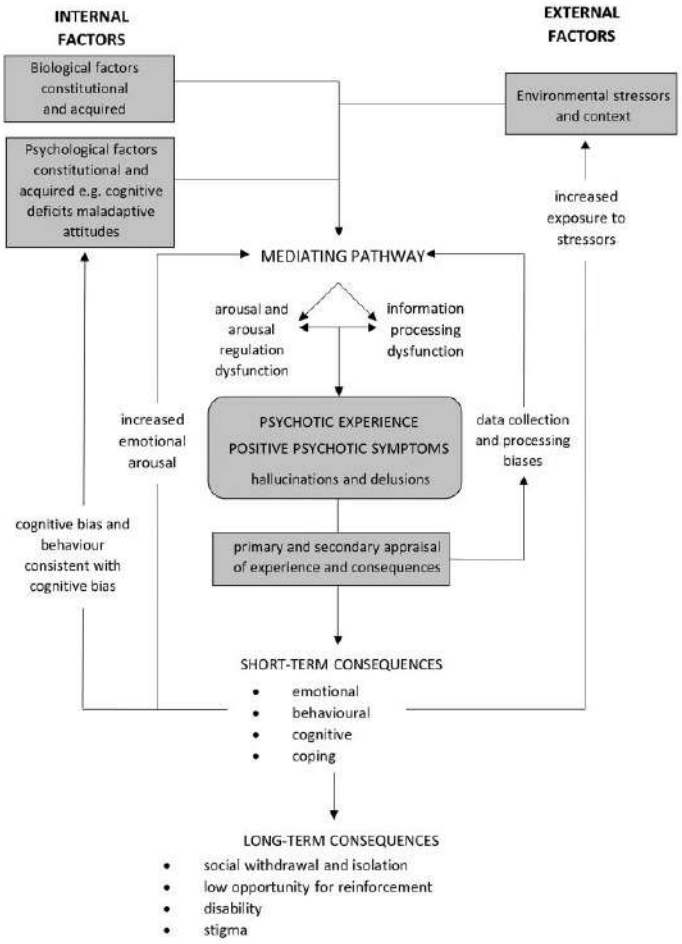

FIGURE 10 *A coping recovery model of psychotic symptoms. Note.* From A cognitive-behavioural case formulation approach to the treatment of schizophrenia, in *Case Formulation in Cognitive Behaviour Therapy* (p. 176), by N. Tarrier (2006), Routledge. Copyright 2006 by Taylor & Francis. Reprinted with permission

Morrison (2001) outlines three broad factors that maintain this cycle of positive symptoms: faulty social and self-knowledge, maladaptive cognitive and behavioural responses to voices, and mood and physiology. Theory of mind deficits may limit one's ability to recognize that others' mental states are distinct from their own. External attribution bias may contribute to external attributions about negative thoughts, whilst impaired ability to recognize one's own mental states and intention to act may contribute to the perception that intrusive cognitions are alien. Selective attention to threatening information (i.e., hypervigilance) and unhelpful reasoning processes, such as "jumping to conclusions" and confirmation bias, prevent consideration of information that disconfirms maladaptive beliefs. Unhelpful meta-cognitive beliefs about positive symptoms (e.g., the voice is warning me of unseen threats) and negative meta-cognitive beliefs (e.g., the voice is dangerous) may increase distress and the likelihood that the individual may engage in unhelpful cognitive and behavioural coping strategies.

To reduce the distress associated with voices, individuals may develop coping behaviours that perpetuate positive symptoms by preventing the individual from disconfirming their (mis)interpretations about intrusions (Morrison, 2001). Hypervigilance maintains a sense that intrusions are dangerous, whilst thought control attempts can increase intrusions. Additionally, safety behaviours (e.g., yelling at the voice to prevent oneself from doing what the voice says) can prevent disconfirmation of negative beliefs (e.g., my voice is dangerous). Finally, these cognitions and maladaptive coping strategies can perpetuate negative affect, which, in turn, impairs one's ability to engage in healthy reasoning processes and increases the likelihood of faulty information processing. Furthermore, negative affect may be interpreted as evidence of threat,

which increases the likelihood of perceived threats manifesting in the form of intrusive cognitions.

4.4 | A coping-recovery model of psychotic symptoms

Tarrier (2006) and Tarrier and Taylor (2014) developed the coping-recovery model (see Figure 10) and suggest that positive symptoms are the product of dynamic interactions between various internal and external factors. Internal factors can be biological or psychological and be inherited or acquired. Internal factors include cognitive deficits (e.g., cognitive inflexibility), maladaptive attitudes, information processing biases (e.g., source monitoring and reasoning biases), and heightened arousal and emotion regulation deficits. Once the activation of psychotic symptoms has occurred, the individual makes meaning of such symptoms. These appraisals can be primary, which involve immediate feelings of threat, or secondary, which involve mood disturbance, post-traumatic stress, or anxiety. Primary and secondary appraisals maintain symptoms in two ways. First, should the hallucinations be appraised as true, the individual may develop maladaptive beliefs about their symptoms (e.g., my voices are dangerous) and act upon those beliefs in a manner that causes them to confirm (or fail to disconfirm) this belief. This experience-belief-action-confirmation cycle perpetuates symptoms. Second, appraisals produce short-term cognitive, emotional, and behavioural responses that perpetuate symptoms via several pathways. These responses further increase arousal and are fed back through the same faulty cognitive and affective processes that triggered the onset of initial symptoms and exacerbate external stressors. For example, a person may believe voices are warning them that others want to harm them, which creates a sense of threat and psychological distress. The individual may experience heightened arousal, which they cannot regulate effectively. Pre-existing maladaptive attitudes and cognitive deficits may lead to continued faulty information processing and emotion regulation dysfunction. The individual may cope with distress by behaving aggressively toward others, which may cause social conflict that is interpreted as confirmation of persecution. Furthermore, these responses can lead to longer-term negative outcomes, such as social withdrawal, social isolation, disability, and stigma, which further exacerbate internal and external stressors.

5 | OVERVIEW OF TRAUMA-INFORMED MODELS OF VOICES

5.1 | Cognitive attachment model of voices

The cognitive attachment model (Figure 11) is one of only two known theoretical models of voices that provide a detailed explanation of the role that trauma plays in the development of voices and the relationship between trauma and the content of voices (Berry et al., 2017; Berry & Bucci, 2016). The model comprises both a vulnerability model and a

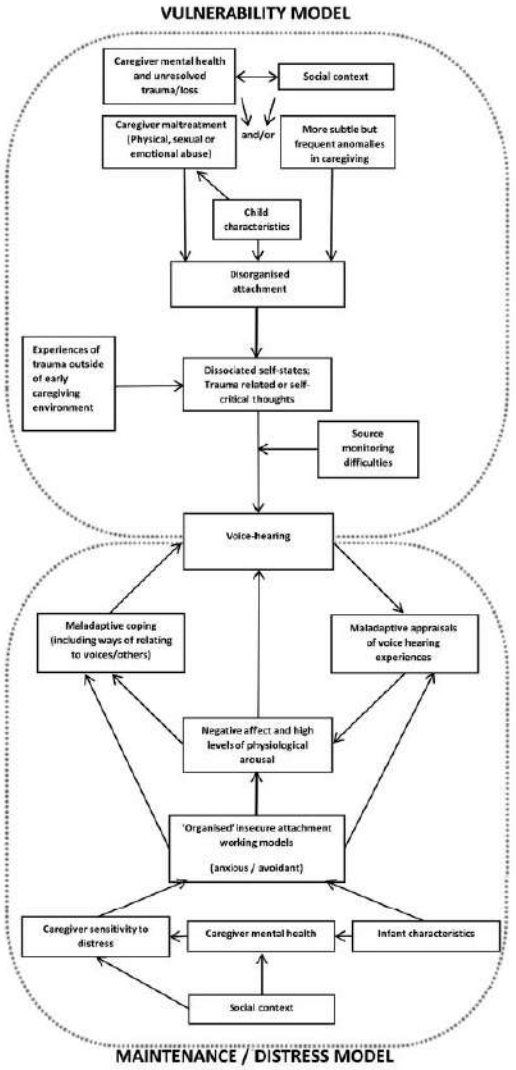

FIGURE 11 *The cognitive attachment voice-hearing model. Note.* From "Cognitive attachment model of voices: Evidence base and future implications," by Berry et al. (2017), *Frontiers in Psychiatry*, *8*, p. 4 (https://doi.org/10.3389/fpsyt.2017.00111). Copyright 2017 by the authors. Reprinted with permission

distress/maintenance model (Berry et al., 2017). This model identifies appraisals as a key maintaining factor but incorporates concepts from early attachment theory and dissociation (Berry et al., 2017; Berry & Bucci, 2016).

Insecure attachment style is a key process in both the vulnerability and maintenance components of the model (Berry et al., 2017; Berry & Bucci, 2016). Attachment refers to the emotional bond an individual has with significant others, and an individual's attachment

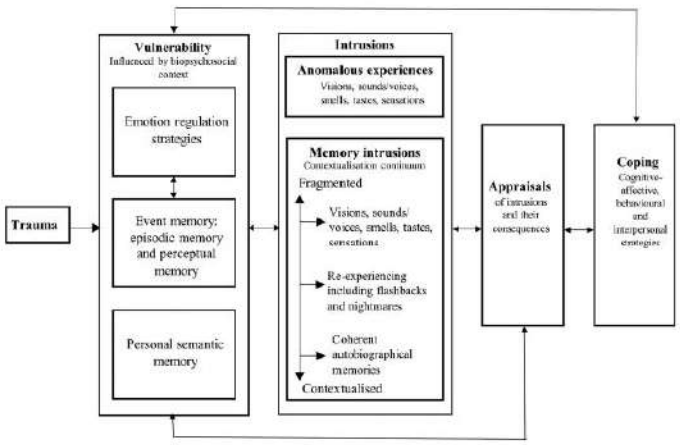

FIGURE 12 *A model of post-traumatic stress in psychosis. Note.* From "Pathways from trauma to psychotic experiences: A theoretically informed model of posttraumatic stress in psychosis" by A. Hardy (2017), *Frontiers in Psychology*, *8*, p. 5 (https://doi.org/10.3389/fpsyg.2017.00697). Copyright 2017 by the author. Reprinted with permission

style is heavily influenced by their early relationships with caregivers as these interactions shape one's internal working models (mental representations) of the self, others, and relationships (Bowlby, 1982). Internal working models guide attention, affect memory and interpretations of events, shape expectations about future interactions, and influence how a person regulates negative affect (Mikulincer & Shaver, 2005). Insecure attachment is associated with unhealthy early relationships (e.g., abuse or neglect), characterized by negative beliefs about the self and/or others, and is associated with poor social functioning and emotion regulation (Shaver & Mukulincer, 2012).

Other key concepts identified in this model are source monitoring and dissociation (Berry et al., 2017; Berry & Bucci, 2016). Source monitoring is a cognitive process that allows people to discriminate between internally and externally generated perceptions, and identify the source of such perceptions (Berry et al., 2017). The model suggests that an individual with disorganized attachment may dissociate in response to trauma-related memories or trauma-related and/or self-critical cognitions. That is, voices may be dissociated trauma-related intrusive memories or dissociated components of the self. Source monitoring deficits increase the risk that dissociated cognitions will be interpreted as originating from an external source and, therefore, trauma-related and self-critical thoughts will be perceived as externally generated voices.

Insecure attachment styles may drive maladaptive ways of coping with voices and interpersonal stress, which perpetuate voices. People with anxious attachment (desire for closeness) may be more inclined to seek out and engage with their voices, whilst people with avoidant attachment (desire for emotional distance and mistrust in others) may believe their voices are malevolent and attempt, but ultimately fail, to suppress them (Goldstone et al., 2012; Hayward et al., 2014). People with disorganized attachment (exhibiting both anxious and avoidant attachment) may oscillate between engaging and suppressing their voices. Furthermore, maladaptive appraisals of voices, driven by insecure attachment beliefs, may exacerbate negative affect and physiological arousal, which increases the likelihood of future voices.

5.2 | A model of post-traumatic stress in psychosis

Hardy (2017) developed a model of post-traumatic stress in psychosis (Figure 12) and suggests that childhood trauma produces neurodevelopmental changes that affect stress sensitivity and increase the risk that an individual will adopt unhelpful patterns of emotion regulation. Traumatized individuals may fluctuate between sympathetic (e.g., hypervigilance and avoidance) and parasympathetic (e.g., dissociation) nervous system activation to regulate distressing emotions. As these patterns of emotion regulation shape an individual's typical manner of relating to others, they have been likened to attachment styles (Hesse, 2008).

Additionally, Hardy (2017) refers to three aspects of autobiographical memory that contribute psychotic experiences, episodic memory (i.e., contextual information), perceptual memory (i.e., egocentric and sensory-perceptual information), and personal semantic memory (i.e., beliefs that are informed by a memory). Hardy (2017) outlines two forms of cognitive intrusions in psychosis, anomalous intrusions and trauma memory intrusions, that produce three different voice hearing experiences (seeMcCarthy-Jones, Thomas, et al., 2014; McCarthy-Jones, Trauer, et al., 2014): hypervigilance (i.e., no trauma-voice association), inner speech (i.e., indirect), and dissociative autobiographical (i.e., direct) voices. An important and unique advantage of Hardy's (2017) model is the capacity to explain voices that (a) have no obvious association to past traumas, (b) are indirectly related to past traumas, and (c) are directly related to past traumas.

5.2.1 | Voices with no obvious association with past trauma voice associations

Hypervigilance may be experienced by trauma-affected individuals and involves a heightened expectation of and sensitivity to threat, which can cause an individual to falsely perceive threats

(e.g., distressing voices) from non-threatening stimuli (McCarthy-Jones, Thomas, et al., 2014). Hardy (2017) suggests that hypervigilant voices may be the result of sympathetic nervous system sensitization and habitual dissociation. Sensitization reduces the threshold for threat detection, which causes heightened perception of danger from non-threatening external (e.g., distant sounds) or internal (e.g., somatic pain) stimuli and leads to anomalous intrusions (e.g., voices). Habitual dissociative detachment as an emotion regulation strategy may result in contextually disintegrated sensory-perceptual information intruding into consciousness. These types of intrusions may explain voice content that has no clear link to past trauma.

5.2.2 | Voices with indirect associations with past trauma

Another driver of anomalous intrusions involves mental imagery (across all sensory modalities) related to current and future goals, whereby mental imagery is perceptually and affectively consistent with one's personal semantic and perceptual memory representations (Hardy, 2017). That is, mental imagery generated by a traumatized individual may comprise trauma-related perceptual information (e.g., racing heart) and appraisals (e.g., others are cruel; I am weak), although the individual may not be aware of the link between their mental imagery and past trauma. Thus, distressing trauma-informed mental images, coupled with dissociative attachment, may lead to *inner speech voices* (McCarthy-Jones, Thomas, et al., 2014; McCarthy-Jones, Trauer, et al., 2014), whereby voices are thematically related to past trauma.

5.2.3 | Voices with direct associations with past trauma

Hardy (2017) suggests that in the context of trauma, perceptual memories are encoded with greater detail, whilst episodic memories are encoded with limited contextual information, and the nature of trauma memory intrusions varies depending on the degree in which memories are contextually integrated. At the less severe end of the continuum, *re-experiencing memory intrusions* (i.e., PTSD flashbacks) occur in the context of highly detailed perceptual memory and inhibited episodic memory, as the individual has some awareness of the link between intrusions and past trauma memories. At the more severe end of the continuum are fragmented memory intrusions, which involve retrieval of perceptual memories in the absence of any episodic information. People who experience these intrusions have less awareness of the link to past trauma and report hearing voices that recount past experiences rather than intrusive memories.

Hardy's (2017) model outlines other maintaining factors. Appraisals of intrusions are likely to be consistent with personal semantic memory and can maintain voice frequency and distress. For example, appraisals of the intrusion itself (e.g., voice is evil) or the consequences of intrusion (I am too weak to cope) can generate distress. Coupled with emotion regulation deficits, this distress can trigger maladaptive coping strategies, such as stress sensitivity (hyperarousal), negative reactivity, threat-focussed processing, sleep disruption, rumination, avoidance, numbing, and dissociation, which perpetuate problematic autobiographical memory representations that increase intrusions.

6 | COMPARISON OF MODELS

This review identified six maintaining factors that are unique to models of PTSD, nine that are unique to models of voices (and other positive symptoms), and six that are common across both sets of symptoms. These factors are summarized below in Table 1. Only one model explained different types of trauma-related voices (Hardy, 2017), which suggested that mental imagery and dissociative processes are specific to indirect trauma-related voices, whilst memory intrusions are specific to direct trauma-related voices.

6.1 | Contributions and limitations of theoretical models

Past reviews have detailed the various theoretical strengths and limitations of the PTSD theories reviewed in this paper (Brewin & Holmes, 2003; Dalgleish, 2004), but this is the first review of theories of voices (and other positive symptoms) and trauma-related voices. Integrative models of PTSD include factors outlined in earlier standalone models of PTSD and, therefore, provide more comprehensive accounts with augmented explanatory power (Brewin & Holmes, 2003; Dalgleish, 2004; Ehlers & Clark, 2000). Except for the meta-cognitive model of psychosis (Morrison, 2001), there is less mechanistic overlap between theories of voices compared to models of PTSD. Nevertheless, key theoretical commonalities exist between models, and overall, unusual perceptual experiences are theorized to be normal and only become pathological when maladaptive appraisals of such experiences generate distress (Garety et al., 2001; Morrison, 2001; Paulik, 2012; Tarrier, 2006; Tarrier & Taylor, 2014).

As distressing voices are commonly experienced outside the psychotic spectrum, researchers have acknowledged the need to conceptualize psychotic-like symptoms, such as voices, as distinct from psychotic disorders and other psychotic-like symptoms (Carpenter, 2016; Murray, 2017). However, of the six models of positive symptoms that were reviewed, only three are specific to voices (Berry et al., 2017; Berry & Bucci, 2016; Hardy, 2017; Paulik, 2012), which suggests that a lack of symptom specificity is a key limitation of models of positive symptoms. This theoretical limitation may explain, in part, the inconsistent evidence for the efficacy of psychological interventions that are based on models of broader positive symptoms, such as CBT for psychosis (CBTp), in treating psychotic-like symptoms (Johns et al., 2019). Studies typically use a composite CBTp approach that targets multiple theorized factors within diagnostically heterogeneous samples, which may obscure the relative role of each mechanism in producing change in distinct symptoms (Johns et al., 2019).

TABLE 1 A summary shared and unique mechanisms

	Models of PTSD								
	Associative learning theory	Non-associative learning theory	Model of stress response	Shattered assumptions theory	Social cognitive theory	A dual representation theory of PTSD	Fear network account of emotional processing	A cognitive model of PTSD	Emotional processing theory
Mechanisms unique to models of PTSD									
Conditioning	✓								
Extinction failure	✓	✓							
Habituation failure		✓							✓
Fear inhibition failure	✓								
Overgeneralization/excessive associative learning	✓						✓	✓	✓
Failure to assimilate/accommodate trauma into schematic network			✓	✓					
Mechanisms unique to models of positive symptoms									
Faulty reasoning, information processing, source monitoring, and intention to act identification									
Negative affect									
Meta-cognitive beliefs									
Social knowledge deficits/theory of mind									
Thought control									
Maladaptive coping (e.g., responding to voices)									
Emotion dysregulation									
Insecure attachment									
Hypervigilance/attention biases									
Mechanisms common to models of PTSD and positive symptoms									
Dissociation									✓
Stress sensitization		✓							
Appraisals of trauma/voices			✓	✓	✓	✓		✓	✓
Negative schemas (self, others, and world)								✓	✓
					✓				✓

TABLE 1 (Continued)

	Models of PTSD								
	Associative learning theory	Non-associative learning theory	Model of stress response	Shattered assumptions theory	Social cognitive theory	A dual representation theory of PTSD	Fear network account of emotional processing	A cognitive model of PTSD	Emotional processing theory
Low self-efficacy /mastery/ coping beliefs/sense of competence									
Memory storage, consolidation, and retrieval deficits						✓		✓	✓

TABLE 1 (Continued)

	Models of PTSD	Models of positive symptoms				Trauma-informed models of voice hearing	
	The SPAARS model	A cognitive approach to voices	A cognitive model of the positive symptoms of psychosis	A meta-cognitive model of psychosis	A coping-recovery model of psychosis	The cognitive attachment model of psychosis	A model of post-traumatic stress in psychosis
Mechanisms unique to models of PTSD							
Conditioning							
Extinction failure							
Habituation failure							
Fear inhibition failure							
Overgeneralization/excessive associative learning	✓						
Failure to assimilate/ accommodate trauma into schematic network	✓						
Mechanisms unique to models of positive symptoms							
Faulty reasoning, information processing, source monitoring, and intention to act identification			✓	✓	✓	✓	
Negative affect		✓	✓	✓	✓	✓	✓
Meta-cognitive beliefs			✓	✓	✓	✓	
Social knowledge deficits/ theory of mind				✓			✓
Thought control				✓			
		✓		✓			✓

TABLE 1 (Continued)

	Models of PTSD	Models of positive symptoms				Trauma-informed models of voice hearing	
	The SPAARS model	A cognitive approach to voices	A cognitive model of the positive symptoms of psychosis	A meta-cognitive model of psychosis	A coping-recovery model of psychosis	The cognitive attachment model of psychosis	A model of post-traumatic stress in psychosis
Maladaptive coping (e.g., responding to voices)					✓	✓	✓
Emotion dysregulation						✓	✓
Insecure attachment				✓			✓
Hypervigilance/attention biases							✓
Mechanisms common to models of PTSD and positive symptoms							
Dissociation						✓	✓
Stress sensitization							✓
Appraisals of trauma/voices	✓	✓	✓	✓	✓	✓	✓
Negative schemas (self, others, and world)		✓			✓	✓	✓
Low self-efficacy /mastery/ coping beliefs/sense of competence			✓				
Memory storage, consolidation, and retrieval deficits			✓				✓

Furthermore, individually tailored CBTp that targets the factors theorized to maintain specific symptoms (e.g., challenges power beliefs to treat command voices) are associated with larger effects ($d = 0.44$ to $d = 0.49$; e.g., Lincoln & Peters, 2019; van der van der Gaag et al., 2014) than composite CBTp interventions for positive symptoms ($d = 0.33$ to $d = 0.40$; e.g., Jauhar et al., 2014; Pfammatter et al., 2006). Furthermore, preliminary evidence shows that individually tailored CBTp administered to transdiagnostic samples of voices hearers in naturalistic settings show even larger effects in both voice frequency ($d = 1.13$) and voice-related distress ($d = 1.35$; Paulik, Hayward, et al., 2019).

Stand-alone models of PTSD and positive symptoms are insufficient in explaining the comorbidity and symptomatic overlap between PTSD and voices (de de Bont et al., 2015; Morrison et al., 2003; Hardy et al., 2016). Of the three models that are specific to voices, only two models explain voices with a trauma-informed approach. A key contribution of Berry and Bucci's (2016) model is that it explains how "subtle" traumatic and/or inconsistent childhood experiences, which may not meet diagnostic criteria for PTSD (Criterion A, APA, 2013), may lead to trauma-related voices via insecure attachment and dissociative coping. However, this model does not explain pathways to different types of trauma-related voices.

Hardy's (2017) model is the only model that outlines specific mechanistic processes associated with each type of voices. Another key strength of this model is its comprehensive incorporation of factors from models of both sets of symptoms. However, the model suggests that memory interventions should be prioritized in the treatment of trauma-related voices with an additional focus on addressing maladaptive coping and beliefs but does not clearly account for why existing PTSD treatments that aim to target these factors have shown limited effectiveness in reducing distressing voices compared to PTSD symptoms (Brand et al., 2018; Steel et al., 2017; Swan et al., 2017). It may be that other mechanistic processes (e.g., information processing errors) interact with those emphasized by Hardy (2017) to explain how voices differ from other trauma intrusions. As such, Hardy's (2017) model is a valuable clinical tool for complex case formulation, but integration of additional processes is required to generate novel research hypotheses beyond those that could made from stand-alone models of PTSD and/or positive symptoms.

There are several strengths and limitations of this review. The primary contribution is that this is the first review to comprehensively review models of PTSD and positive symptoms to categorize factors that are common and unique across both sets of symptoms. Consequently, this review provides a solid foundation for the development of an integrative model of trauma-related voices that may offer multiple potential explanations of trauma-related voices. A model such as this may be essential to guide future research in this area, given that existing models are unable to explain the similarities and differences between trauma-related voices, PTSD symptoms, and other types of voices. Additionally, this review provides a detailed summary of the key theories of PTSD and positive symptoms, which may be a valuable resource for researchers and students working in these fields. The theories summarized in this paper were identified via searches of academic databases and reference to a recently published book with a clinical and neuropsychological overview of psychosis (Badcock & Paulik, 2019). However, as a systematic review of voice hearing and PTSD literature was not undertaken, it is possible that there are published theories of trauma-related voices that have not been summarized in this paper.

7 | CONCLUSION AND FUTURE DIRECTIONS

This review revealed that there is considerable symptomatic and mechanistic overlap between PTSD and positive symptoms. These findings suggest that careful assessment of voices in clients with post-traumatic stress, and of post-traumatic stress in voice hearers, may reveal clinically relevant information that can aid accurate case conceptualization and treatment planning. Furthermore, individualized psychological treatments that target the common factors identified in this review, such as appraisals, negative schemas, and disrupted memory processes, may be most broadly effective for symptoms experienced by trauma-affected voice hearers.

This review identified two trauma-informed models of voices that extend on stand-alone models of PTSD and positive symptoms, which offer unique perspectives on trauma-related factors (Berry & Bucci, 2016), explanations for variations in symptom expression (direct versus indirect voices), and a comprehensive consideration of psychological factors gleaned from theories of both PTSD and positive symptoms (Hardy, 2017). However, trauma-informed models offer limited scope for novel hypotheses beyond those that can be made from stand-alone models. Future research is needed to test the relationship between theorized factors identified in these models within samples of trauma-affected voice hearers with direct and indirect (or both) trauma-related voices. Such research should use transdiagnostic samples and psychometric measures of voices (rather than positive symptoms more generally) to investigate voices as a distinct symptom, separate to psychotic-spectrum disorders and other psychotic-like symptoms.

Perhaps most importantly, future research should first extend on trauma-informed models of voices to further refine and integrate the common and unique factors identified in this review by elaborating the theorized *interactions* and *pathways* between such factors, for both direct and indirect voices. Whilst such efforts may increase theoretical complexity of this phenomenon, added specificity about the directionality of relationships will support the generation of unique hypotheses about mechanistic relationships across different types of voices, thereby aiding development of a robust, theoretically informed research agenda from which enhanced interventions could be developed.

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CONFLICT OF INTEREST

There are no conflicts of interest to declare.

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Appendix D

Publication Under Review Confirmation: The Trauma-Related Voice Model

Peer review status

The Trauma-Related Voices Model: An Integration of Auditory Verbal Hallucinations and Posttraumatic Stress

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Appendix E

Publication Under Review Confirmation: Pathways from Trauma to Unusual Perceptual Experiences

View Submission Similarity Check Results (24%) Correspondence Send E-mail	PPTRP-22-0263	Pathways from Trauma to Unusual Perceptual Experiences: Modelling the Roles of Insecure Attachment, Negative Affect, Emotion Regulation, and Dissociation	21 Nov 2022	Under review

Appendix F

Publication Under Review Confirmation: Voice Hearers' Explanations of Trauma-Related Voices

View Submission Similarity Check Results (6%) Correspondence Send E-mail	PPTRP.22.0240	Voice Hearers' Explanations of Trauma-Related Voices and Processes of Change Throughout Imagery Rescripting: A Qualitative Exploration	31 Oct 2022	Under review

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Expected presentation date	Feb 2023
Portions	Figure 1 (pg. 237) Figure 4 (pg. 245) Figure 5 (pg. 248)
Requestor Location	Miss. Laura Strachan Curtin University Psychology Department Building 401, Kent Street Bentley, 6102 Australia Attn: Miss. Laura Strachan
Total	**0.00 AUD**

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v1.2

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Date	11/07/1997		
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		Expected presentation date	2023-02-28
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Editor of portion(s)	N/A	Author of portion(s)	FOA, EDNA B.; ROTHBAUM, BARBARA OLASOV
Volume of serial or monograph	N/A		
Page or page range of portion	76 & 78	Issue, if republishing an article from a serial	N/A
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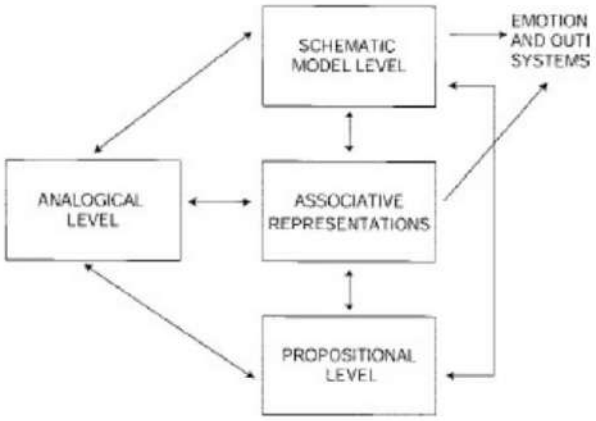

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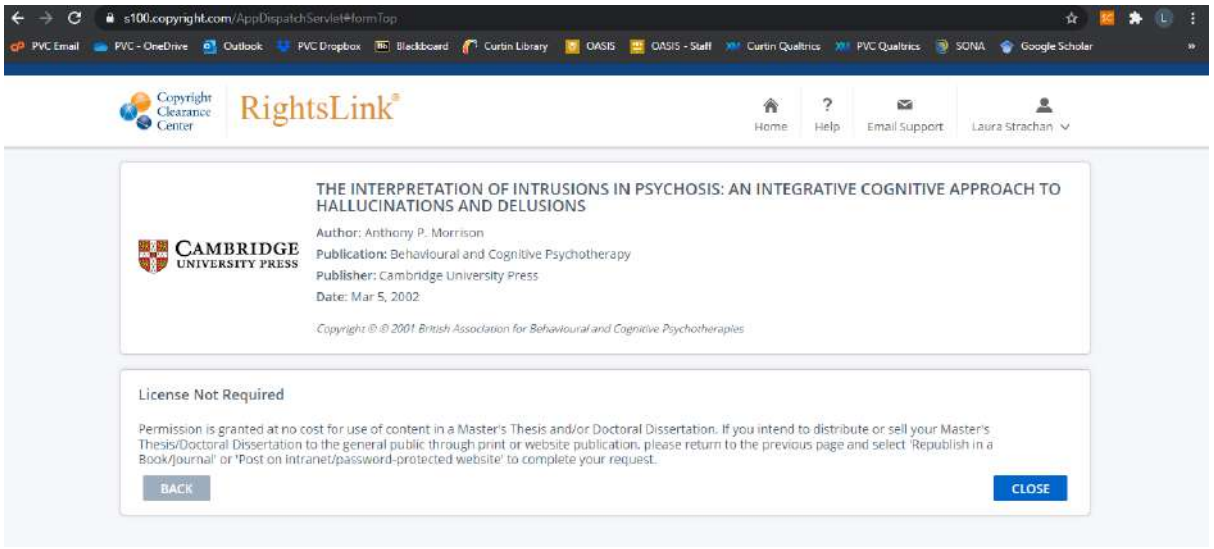
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1. Personality and individual differences

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Article Title	Development and preliminary validation of an emotional self-efficacy scale	**Publication Type**	Journal
		Start Page	432
		End Page	436
Author/Editor	INTERNATIONAL SOCIETY FOR THE STUDY OF INDIVIDUAL	**Issue**	5
		Volume	45
Date	01/01/1980		
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NEW WORK DETAILS

Title	Trauma-Related Voice Hearing: Understanding Mechanisms of Maintenance and Change	Institution Name	Curtin University
		Expected Presentation Date	2023-01-31
Instructor Name	Laura Strachan, School of Population Health		

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Title, Description or Numeric Reference of the Portion(s)	Items from Table 1	Title of the Article/Chapter the Portion Is From	Development and preliminary validation of an emotional self-efficacy scale
Editor of Portion(s)	N/A	Author of Portion(s)	Kirk, Beverley A.; Schutte, Nicola S.; Hine, Donald W.
Volume of Serial or Monograph	45	Issue, if Republishing an Article From a Serial	5
Page or Page Range of Portion	432-436	Publication Date of Portion	2008-10-01

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ii) No License granted shall in any way: (i) include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied) (ii) permit "publishing ventures" where any particular anthology would be systematically marketed at multiple institutions.

iii) Subject to any Publisher Terms (and notwithstanding any apparent contradiction in the Order Confirmation arising from data provided by User), any use authorized under the academic pay-per-use service is limited as follows:

A) any License granted shall apply to only one class (bearing a unique identifier as assigned by the institution, and thereby including all sections or other subparts of the class) at one institution;

B) use is limited to not more than 25% of the text of a book or of the items in a published collection of essays, poems or articles;

C) use is limited to no more than the greater of (a) 25% of the text of an issue of a journal or other periodical or (b) two articles from such an issue;

D) no User may sell or distribute any particular anthology, whether photocopied or electronic, at more than one institution of learning;

E) in the case of a photocopy permission, no materials may be entered into electronic memory by User except in order to produce an identical copy of a Work before or during the academic term (or analogous period) as to which any particular permission is granted. In the event that User shall choose to retain materials that are the subject of a photocopy permission in electronic memory for purposes of producing identical copies more than one day after such retention (but still within the scope of any permission granted), User must notify CCC of such fact in the applicable permission request and such retention shall constitute one copy actually sold for purposes of calculating permission fees due; and

F) any permission granted shall expire at the end of the class. No permission granted shall in any way include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied).

iv) Books and Records; Right to Audit. As to each permission granted under the academic pay-per-use Service, User shall maintain for at least four full calendar years books and records sufficient for CCC to determine the numbers of copies made by User under such permission. CCC and any representatives it may designate shall have the right to audit such books and records at any time during User's ordinary business hours, upon two days' prior notice. If any such audit shall determine that User shall have underpaid for, or underreported, any photocopies sold or by three percent (3%) or more, then User shall bear all the costs of any such audit; otherwise, CCC shall bear the costs of any such audit. Any amount determined by such audit to have been underpaid by User shall immediately be paid to CCC by User, together with interest thereon at the rate of 10% per annum from the date such amount was originally due. The provisions of this paragraph shall survive the termination of this License for any reason.

b) ***Digital Pay-Per-Uses of Academic Course Content and Materials (e-coursepacks, electronic reserves, learning management systems, academic institution intranets).*** For uses in e-coursepacks, posts in electronic reserves, posts in learning management systems, or posts on academic institution intranets, the following additional terms apply:

i) The pay-per-uses subject to this Section 14(b) include:

A) **Posting e-reserves, course management systems, e-coursepacks for text-based content**, which grants authorizations to import requested material in electronic format, and allows electronic access to this material to members of a designated college or university class, under the direction of an instructor designated by the college or university, accessible only under appropriate electronic controls (e.g., password);

B) **Posting e-reserves, course management systems, e-coursepacks for material consisting of photographs or other still images not embedded in text**, which grants not only the authorizations described in Section 14(b)(i)(A) above, but also the following authorization: to include the requested material in course materials for use consistent with Section 14(b)(i)(A) above, including any necessary resizing, reformatting or modification of the resolution of such requested material (provided that such modification does not alter the underlying editorial content or meaning of the requested material, and provided that the resulting modified content is used solely within the scope of, and in a manner consistent with, the particular authorization described in the Order Confirmation and the Terms), but not including any other form of manipulation, alteration or editing of the requested material;

C) **Posting e-reserves, course management systems, e-coursepacks or other academic distribution for audiovisual content,** which grants not only the authorizations described in Section 14(b)(i)(A) above, but also the following authorizations: (i) to include the requested material in course materials for use consistent with Section 14(b)(i)(A) above; (ii) to display and perform the requested material to such members of such class in the physical classroom or remotely by means of streaming media or other video formats; and (iii) to "clip" or reformat the requested material for purposes of time or content management or ease of delivery, provided that such "clipping" or reformatting does not alter the underlying editorial content or meaning of the requested material and that the resulting material is used solely within the scope of, and in a manner consistent with, the particular authorization described in the Order Confirmation and the Terms. Unless expressly set forth in the relevant Order Conformation, the License does not authorize any other form of manipulation, alteration or editing of the requested material.

ii) Unless expressly set forth in the relevant Order Confirmation, no License granted shall in any way: (i) include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied or, in the case of Works subject to Sections 14(b)(1)(B) or (C) above, as described in such Sections) (ii) permit "publishing ventures" where any particular course materials would be systematically marketed at multiple institutions.

iii) Subject to any further limitations determined in the Rightsholder Terms (and notwithstanding any apparent contradiction in the Order Confirmation arising from data provided by User), any use authorized under the electronic course content pay-per-use service is limited as follows:

A) any License granted shall apply to only one class (bearing a unique identifier as assigned by the institution, and thereby including all sections or other subparts of the class) at one institution;

B) use is limited to not more than 25% of the text of a book or of the items in a published collection of essays, poems or articles;

C) use is limited to not more than the greater of (a) 25% of the text of an issue of a journal or other periodical or (b) two articles from such an issue;

D) no User may sell or distribute any particular materials, whether photocopied or electronic, at more than one institution of learning;

E) electronic access to material which is the subject of an electronic-use permission must be limited by means of electronic password, student identification or other control permitting access solely to students and instructors in the class;

F) User must ensure (through use of an electronic cover page or other appropriate means) that any person, upon gaining electronic access to the material, which is the subject of a permission, shall see:

- a proper copyright notice, identifying the Rightsholder in whose name CCC has granted permission,

- a statement to the effect that such copy was made pursuant to permission,
- a statement identifying the class to which the material applies and notifying the reader that the material has been made available electronically solely for use in the class, and
- a statement to the effect that the material may not be further distributed to any person outside the class, whether by copying or by transmission and whether electronically or in paper form, and User must also ensure that such cover page or other means will print out in the event that the person accessing the material chooses to print out the material or any part thereof.

G) any permission granted shall expire at the end of the class and, absent some other form of authorization, User is thereupon required to delete the applicable material from any electronic storage or to block electronic access to the applicable material.

iv) Uses of separate portions of a Work, even if they are to be included in the same course material or the same university or college class, require separate permissions under the electronic course content pay-per-use Service. Unless otherwise provided in the Order Confirmation, any grant of rights to User is limited to use completed no later than the end of the academic term (or analogous period) as to which any particular permission is granted.

v) Books and Records; Right to Audit. As to each permission granted under the electronic course content Service, User shall maintain for at least four full calendar years books and records sufficient for CCC to determine the numbers of copies made by User under such permission. CCC and any representatives it may designate shall have the right to audit such books and records at any time during User's ordinary business hours, upon two days' prior notice. If any such audit shall determine that User shall have underpaid for, or underreported, any electronic copies used by three percent (3%) or more, then User shall bear all the costs of any such audit; otherwise, CCC shall bear the costs of any such audit. Any amount determined by such audit to have been underpaid by User shall immediately be paid to CCC by User, together with interest thereon at the rate of 10% per annum from the date such amount was originally due. The provisions of this paragraph shall survive the termination of this license for any reason.

c) ***Pay-Per-Use Permissions for Certain Reproductions (Academic photocopies for library reserves and interlibrary loan reporting) (Non-academic internal/external business uses and commercial document delivery).*** The License expressly excludes the uses listed in Section (c)(i)-(v) below (which must be subject to separate license from the applicable Rightsholder) for: academic photocopies for library reserves and interlibrary loan reporting; and non-academic internal/external business uses and commercial document delivery.

i) electronic storage of any reproduction (whether in plain-text, PDF, or any other format) other than on a transitory basis;

ii) the input of Works or reproductions thereof into any computerized database;

iii) reproduction of an entire Work (cover-to-cover copying) except where the Work is a single article;

iv) reproduction for resale to anyone other than a specific customer of User;

v) republication in any different form. Please obtain authorizations for these uses through other CCC services or directly from the rightsholder.

Any license granted is further limited as set forth in any restrictions included in the Order Confirmation and/or in these Terms.

d) ***Electronic Reproductions in Online Environments (Non-Academic-email, intranet, internet and extranet).*** For "electronic reproductions", which generally includes e-mail use (including instant messaging or other electronic transmission to a defined group of recipients) or posting on an intranet, extranet or Intranet site (including any display or performance incidental thereto), the following additional terms apply:

i) Unless otherwise set forth in the Order Confirmation, the License is limited to use completed within 30 days for any use on the Internet, 60 days for any use on an intranet or extranet and one year for any

other use, all as measured from the "republication date" as identified in the Order Confirmation, if any, and otherwise from the date of the Order Confirmation.

ii) User may not make or permit any alterations to the Work, unless expressly set forth in the Order Confirmation (after request by User and approval by Rightsholder); provided, however, that a Work consisting of photographs or other still images not embedded in text may, if necessary, be resized, reformatted or have its resolution modified without additional express permission, and a Work consisting of audiovisual content may, if necessary, be "clipped" or reformatted for purposes of time or content management or ease of delivery (provided that any such resizing, reformatting, resolution modification or "clipping" does not alter the underlying editorial content or meaning of the Work used, and that the resulting material is used solely within the scope of, and in a manner consistent with, the particular License described in the Order Confirmation and the Terms.

15) Miscellaneous.

a) User acknowledges that CCC may, from time to time, make changes or additions to the Service or to the Terms, and that Rightsholder may make changes or additions to the Rightsholder Terms. Such updated Terms will replace the prior terms and conditions in the order workflow and shall be effective as to any subsequent Licenses but shall not apply to Licenses already granted and paid for under a prior set of terms.

b) Use of User-related information collected through the Service is governed by CCC's privacy policy, available online at www.copyright.com/about/privacy-policy/.

c) The License is personal to User. Therefore, User may not assign or transfer to any other person (whether a natural person or an organization of any kind) the License or any rights granted thereunder; provided, however, that, where applicable, User may assign such License in its entirety on written notice to CCC in the event of a transfer of all or substantially all of User's rights in any new material which includes the Work(s) licensed under this Service.

d) No amendment or waiver of any Terms is binding unless set forth in writing and signed by the appropriate parties, including, where applicable, the Rightsholder. The Rightsholder and CCC hereby object to any terms contained in any writing prepared by or on behalf of the User or its principals, employees, agents or affiliates and purporting to govern or otherwise relate to the License described in the Order Confirmation, which terms are in any way inconsistent with any Terms set forth in the Order Confirmation, and/or in CCC's standard operating procedures, whether such writing is prepared prior to, simultaneously with or subsequent to the Order Confirmation, and whether such writing appears on a copy of the Order Confirmation or in a separate instrument.

e) The License described in the Order Confirmation shall be governed by and construed under the law of the State of New York, USA, without regard to the principles thereof of conflicts of law. Any case, controversy, suit, action, or proceeding arising out of, in connection with, or related to such License shall be brought, at CCC's sole discretion, in any federal or state court located in the County of New York, State of New York, USA, or in any federal or state court whose geographical jurisdiction covers the location of the Rightsholder set forth in the Order Confirmation. The parties expressly submit to the personal jurisdiction and venue of each such federal or state court.

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Publication Title	Clinical psychology & psychotherapy	Country	United Kingdom of Great Britain and Northern Ireland
Article Title	A Narrative Review of Psychological Theories of Post-traumatic Stress Disorder, Voice Hearing, and other Psychotic Symptoms	Rightsholder	John Wiley & Sons - Books
		Publication Type	e-Journal
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Language	English		

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NEW WORK DETAILS

Title	Trauma-related Voice Hearing: Understanding Mechanisms of Maintenance and Change	Institution Name	Curtin University
		Expected Presentation Date	2023-01-31
Instructor Name	Laura Strachan		

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Editor of Portion(s)	N/A		
Volume of Serial or Monograph	N/A	Author of Portion(s)	Strachan, Laura P.; Paulik, Georgie; McEvoy, Peter M.
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The following terms and conditions ("General Terms"), together with any applicable Publisher Terms and Conditions, govern User's use of Works pursuant to the Licenses granted by Copyright Clearance Center, Inc. ("CCC") on behalf of the applicable Rightsholders of such Works through CCC's applicable Marketplace transactional licensing services (each, a "Service").

1) **Definitions.** For purposes of these General Terms, the following definitions apply:

"License" is the licensed use the User obtains via the Marketplace platform in a particular licensing transaction, as set forth in the Order Confirmation.

"Order Confirmation" is the confirmation CCC provides to the User at the conclusion of each Marketplace transaction. "Order Confirmation Terms" are additional terms set forth on specific Order Confirmations not set forth in the General Terms that can include terms applicable to a particular CCC transactional licensing service and/or any Rightsholder-specific terms.

"Rightsholder(s)" are the holders of copyright rights in the Works for which a User obtains licenses via the Marketplace platform, which are displayed on specific Order Confirmations.

"Terms" means the terms and conditions set forth in these General Terms and any additional Order Confirmation Terms collectively.

"User" or "you" is the person or entity making the use granted under the relevant License. Where the person accepting the Terms on behalf of a User is a freelancer or other third party who the User authorized to accept the General Terms on the User's behalf, such person shall be deemed jointly a User for purposes of such Terms.

"Work(s)" are the copyright protected works described in relevant Order Confirmations.

2) **Description of Service.** CCC's Marketplace enables Users to obtain Licenses to use one or more Works in accordance with all relevant Terms. CCC grants Licenses as an agent on behalf of the copyright rightsholder identified in the relevant Order Confirmation.

3) **Applicability of Terms.** The Terms govern User's use of Works in connection with the relevant License. In the event of any conflict between General Terms and Order Confirmation Terms, the latter shall govern. User acknowledges that Rightsholders have complete discretion whether to grant any permission, and whether to place any limitations on any grant, and that CCC has no right to supersede or to modify any such discretionary act by a Rightsholder.

4) **Representations; Acceptance.** By using the Service, User represents and warrants that User has been duly authorized by the User to accept, and hereby does accept, all Terms.

5) **Scope of License; Limitations and Obligations.** All Works and all rights therein, including copyright rights, remain the sole and exclusive property of the Rightsholder. The License provides only those rights expressly set forth in the terms and conveys no other rights in any Works

6) **General Payment Terms.** User may pay at time of checkout by credit card or choose to be invoiced. If the User chooses to be invoiced, the User shall: (i) remit payments in the manner identified on specific invoices, (ii) unless otherwise specifically stated in an Order Confirmation or separate written agreement, Users shall remit payments upon receipt of the relevant invoice from CCC, either by delivery or notification of availability of the invoice via the Marketplace platform, and (iii) if the User does not pay the invoice within 30 days of receipt, the User may incur a service charge of 1.5% per month or the maximum rate allowed by applicable law, whichever is less. While User may exercise the rights in the License immediately upon receiving the Order Confirmation, the License is automatically revoked and is null and void, as if it had never been issued, if CCC does not receive complete payment on a timely basis.

7) **General Limits on Use.** Unless otherwise provided in the Order Confirmation, any grant of rights to User (i) involves only the rights set forth in the Terms and does not include subsequent or additional uses, (ii) is non-exclusive and non-transferable, and (iii) is subject to any and all limitations and restrictions (such as, but not limited to, limitations on duration of use or circulation) included in the Terms. Upon completion of the licensed use as set forth in the Order Confirmation, User shall either secure a new permission for further use of the Work(s) or immediately cease any new use of the Work(s) and shall render inaccessible (such as by deleting or by removing or severing links or other locators) any further copies of the Work. User may only make alterations to the Work if and as expressly set forth in the Order Confirmation. No Work may be used in any way that is defamatory, violates the rights of third parties (including such third parties' rights of copyright, privacy, publicity, or other tangible or intangible property), or is otherwise illegal, sexually explicit, or obscene. In addition, User may not conjoin a Work with any other material that may result in damage to the reputation of the Rightsholder. User agrees to inform CCC if it becomes aware of any infringement of any rights in a Work and to cooperate with any reasonable request of CCC or the Rightsholder in connection therewith.

8) **Third Party Materials.** In the event that the material for which a License is sought includes third party materials (such as photographs, illustrations, graphs, inserts and similar materials) that are identified in such material as having been used by permission (or a similar indicator), User is responsible for identifying, and seeking separate licenses (under this Service, if available, or otherwise) for any of such third party materials; without a separate license, User may not use such third party materials via the License.

9) **Copyright Notice.** Use of proper copyright notice for a Work is required as a condition of any License granted under the Service. Unless otherwise provided in the Order Confirmation, a proper copyright notice will read substantially as follows: "Used with permission of [Rightsholder's name], from [Work's title, author, volume, edition number and year of copyright]; permission conveyed through Copyright Clearance Center, Inc." Such notice must be provided in a reasonably legible font size and must be placed either on a cover page or in another location that any person, upon gaining access to the material which is the subject of a permission, shall see, or in the case of republication Licenses, immediately adjacent to the Work as used (for example, as part of a by-line or footnote) or in the place where substantially all other credits or notices for the new work containing the republished Work are located. Failure to include the required notice results in loss to the Rightsholder and CCC, and the User shall be liable to pay liquidated damages for each such failure equal to twice the use fee specified in the Order Confirmation, in addition to the use fee itself and any other fees and charges specified.

10) **Indemnity.** User hereby indemnifies and agrees to defend the Rightsholder and CCC, and their respective employees and directors, against all claims, liability, damages, costs, and expenses, including legal fees and expenses, arising out of any use of a Work beyond the scope of the rights granted herein and in the Order Confirmation, or any use of a Work which has been altered in any unauthorized way by User, including claims of defamation or infringement of rights of copyright, publicity, privacy, or other tangible or intangible property.

11) **Limitation of Liability.** UNDER NO CIRCUMSTANCES WILL CCC OR THE RIGHTSHOLDER BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL DAMAGES (INCLUDING WITHOUT LIMITATION DAMAGES FOR LOSS OF BUSINESS PROFITS OR INFORMATION, OR FOR BUSINESS INTERRUPTION) ARISING OUT OF THE USE OR INABILITY TO USE A WORK, EVEN IF ONE OR BOTH OF THEM HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. In any event, the total liability of the Rightsholder and CCC (including their respective employees and directors) shall not exceed the total amount actually paid by User for the relevant License. User assumes full liability for the actions and omissions of its principals, employees, agents, affiliates, successors, and assigns.

12) **Limited Warranties.** THE WORK(S) AND RIGHT(S) ARE PROVIDED "AS IS." CCC HAS THE RIGHT TO GRANT TO USER THE RIGHTS GRANTED IN THE ORDER CONFIRMATION DOCUMENT. CCC AND THE RIGHTSHOLDER DISCLAIM ALL OTHER WARRANTIES RELATING TO THE WORK(S) AND RIGHT(S), EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ADDITIONAL RIGHTS MAY BE REQUIRED TO USE ILLUSTRATIONS, GRAPHS, PHOTOGRAPHS, ABSTRACTS, INSERTS, OR OTHER PORTIONS OF THE WORK (AS OPPOSED TO THE ENTIRE WORK) IN A MANNER CONTEMPLATED BY USER; USER UNDERSTANDS AND AGREES THAT NEITHER CCC NOR THE RIGHTSHOLDER MAY HAVE SUCH ADDITIONAL RIGHTS TO GRANT.

13) **Effect of Breach.** Any failure by User to pay any amount when due, or any use by User of a Work beyond the scope of the License set forth in the Order Confirmation and/or the Terms, shall be a material breach of such License. Any breach not cured within 10 days of written notice thereof shall result in immediate termination of such License without further notice. Any unauthorized (but licensable) use of a Work that is terminated immediately upon notice thereof may be liquidated by payment of the Rightsholder's ordinary license price therefor; any unauthorized (and unlicensable) use that is not terminated immediately for any reason (including, for example, because materials containing the Work cannot reasonably be recalled) will be subject to all remedies available at law or in equity, but in no event to a payment of less than three times the Rightsholder's ordinary license price for the most closely analogous licensable use plus Rightsholder's and/or CCC's costs and expenses incurred in collecting such payment.

14) **Additional Terms for Specific Products and Services.** If a User is making one of the uses described in this Section 14, the additional terms and conditions apply:

a) ***Print Uses of Academic Course Content and Materials (photocopies for academic coursepacks or classroom handouts).*** For photocopies for academic coursepacks or classroom handouts the following additional terms apply:

i) The copies and anthologies created under this License may be made and assembled by faculty members individually or at their request by on-campus bookstores or copy centers, or by off-campus copy shops and other similar entities.

ii) No License granted shall in any way: (i) include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied) (ii) permit "publishing ventures" where any particular anthology would be systematically marketed at multiple institutions.

iii) Subject to any Publisher Terms (and notwithstanding any apparent contradiction in the Order Confirmation arising from data provided by User), any use authorized under the academic pay-per-use service is limited as follows:

A) any License granted shall apply to only one class (bearing a unique identifier as assigned by the institution, and thereby including all sections or other subparts of the class) at one institution;

B) use is limited to not more than 25% of the text of a book or of the items in a published collection of essays, poems or articles;

C) use is limited to no more than the greater of (a) 25% of the text of an issue of a journal or other periodical or (b) two articles from such an issue;

D) no User may sell or distribute any particular anthology, whether photocopied or electronic, at more than one institution of learning;

E) in the case of a photocopy permission, no materials may be entered into electronic memory by User except in order to produce an identical copy of a Work before or during the academic term (or analogous period) as to which any particular permission is granted. In the event that User shall choose to retain materials that are the subject of a photocopy permission in electronic memory for purposes of producing identical copies more than one day after such retention (but still within the scope of any permission granted), User must notify CCC of such fact in the applicable permission request and such retention shall constitute one copy actually sold for purposes of calculating permission fees due; and

F) any permission granted shall expire at the end of the class. No permission granted shall in any way include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied).

iv) Books and Records; Right to Audit. As to each permission granted under the academic pay-per-use Service, User shall maintain for at least four full calendar years books and records sufficient for CCC to determine the numbers of copies made by User under such permission. CCC and any representatives it may designate shall have the right to audit such books and records at any time during User's ordinary business hours, upon two days' prior notice. If any such audit shall determine that User shall have underpaid for, or underreported, any photocopies sold or by three percent (3%) or more, then User shall bear all the costs of any such audit; otherwise, CCC shall bear the costs of any such audit. Any amount determined by such audit to have been underpaid by User shall immediately be paid to CCC by User, together with interest thereon at the rate of 10% per annum from the date such amount was originally due. The provisions of this paragraph shall survive the termination of this License for any reason.

b) ***Digital Pay-Per-Uses of Academic Course Content and Materials (e-coursepacks, electronic reserves, learning management systems, academic institution intranets).*** For uses in e-coursepacks, posts in electronic reserves, posts in learning management systems, or posts on academic institution intranets, the following additional terms apply:

i) The pay-per-uses subject to this Section 14(b) include:

A) **Posting e-reserves, course management systems, e-coursepacks for text-based content**, which grants authorizations to import requested material in electronic format, and allows electronic access to this material to members of a designated college or university class, under the direction of an instructor designated by the college or university, accessible only under appropriate electronic controls (e.g., password);

B) **Posting e-reserves, course management systems, e-coursepacks for material consisting of photographs or other still images not embedded in text**, which grants not only the authorizations described in Section 14(b)(i)(A) above, but also the following authorization: to include the requested material in course materials for use consistent with Section 14(b)(i)(A) above, including any necessary resizing, reformatting or modification of the resolution of such requested material (provided that such modification does not alter the underlying editorial content or meaning of the requested material, and provided that the resulting modified content is used solely within the scope of, and in a manner consistent with, the particular authorization described in the Order Confirmation and the Terms), but not including any other form of manipulation, alteration or editing of the requested material;

C) **Posting e-reserves, course management systems, e-coursepacks or other academic distribution for audiovisual content**, which grants not only the authorizations described in Section 14(b)(i)(A) above, but also the following authorizations: (i) to include the requested material in course materials for use consistent with Section 14(b)(i)(A) above; (ii) to display and perform the requested material to such members of such class in the physical classroom or remotely by means of streaming media or other video formats; and (iii) to "clip" or reformat the requested material for purposes of time or content management or ease of delivery, provided that such "clipping" or reformatting does not alter the underlying editorial content or meaning of the requested material and that the resulting material is used solely within the scope of, and in a manner consistent with, the particular authorization described in the Order Confirmation and the Terms. Unless expressly set forth in the relevant Order Conformation, the License does not authorize any other form of manipulation, alteration or editing of the requested material.

ii) Unless expressly set forth in the relevant Order Confirmation, no License granted shall in any way: (i) include any right by User to create a substantively non-identical copy of the Work or to edit or in any other way modify the Work (except by means of deleting material immediately preceding or following the entire portion of the Work copied or, in the case of Works subject to Sections 14(b)(1)(B) or (C) above, as described in such Sections) (ii) permit "publishing ventures" where any particular course materials would be systematically marketed at multiple institutions.

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Appendix H

Authorship Statements for Studies in Thesis

Chapter 2 (Study 1): A Narrative Review of Psychological Theories of Post-traumatic Stress Disorder, Voices, and Other Psychotic Symptoms

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). A narrative review of psychological theories of post-traumatic stress disorder, voice hearing, and other psychotic symptoms. *Clinical Psychology & Psychotherapy, 29*(6), 1791-1811. https://doi.org/10.1002/cpp.2754

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data collection and integration, manuscript preparation.	
Georgie Paulik	Assisted with conceptualisation of research aims and design, reviewing and editing drafts.	
Peter McEvoy	Assisted with conceptualisation of research aims and design, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Chapter 3 (Study 2): An Integrative Model of Trauma-Related Voices

Strachan, L. P., Paulik, G., & McEvoy, P. M. (2022). *The trauma-related voices model: An integration of auditory verbal hallucinations and posttraumatic stress* [Manuscript submitted for publication]. School of Population Health, Curtin University.

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data collection and integration, manuscript preparation.	
Georgie Paulik	Assisted with conceptualisation of research aims and design, reviewing and editing drafts.	
Peter McEvoy	Assisted with conceptualisation of research aims and design, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Chapter 4 (Study 3): A Systematic Review of Relationships Between Voices, Posttraumatic Stress Symptoms, and Potential Mechanisms of Maintenance and Change

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data collection, data synthesis, interpretation of results, manuscript preparation.	
Georgie Paulik	Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	
Peter McEvoy	Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Chapter 5 (Study 4): Pathways From Trauma to Unusual Perceptual Experiences: Modelling the Roles of Insecure Attachment, Negative Affect, Emotion Regulation, and Dissociation.

Strachan, L. P., Paulik, G., Preece, D., & McEvoy, P. M. (2022). *Pathways from trauma to unusual perceptual experiences: Modelling the roles of insecure attachment, negative affect, emotion regulation, and dissociation* [Manuscript submitted for publication]. School of Population Health, Curtin University.

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data collection, data analysis, interpretation of results, manuscript preparation.	
Georgie Paulik	Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	
David Preece	Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	
Peter McEvoy	Assisted with conceptualisation of research aims and design, data analysis, interpretation of results, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Chapter 6 (Study 5): Effectiveness and Change Mechanisms of Imagery Rescripting for Trauma-Affected Voice Hearers: An Open Trial

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data analysis, interpretation of results, manuscript preparation.	
Georgie Paulik	Delivering intervention. Data collection. Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	
Jun Chih	Assisted with data analysis and interpretation of results	
Peter McEvoy	Assisted with conceptualisation of research aims and design, interpretation of results, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Chapter 7 (Study 6): Voice Hearers Explanations of Trauma-Related Voice Hearing, Post-Traumatic Stress Symptoms, and Imagery Rescripting: A Qualitative Study

Strachan, L. P., Paulik, G., Roberts, L., & McEvoy, P. M. (2022). *Voice hearers' explanations of trauma-related voices and processes of change throughout imagery rescripting: A qualitative exploration* [Manuscript submitted for publication]. School of Population Health, Curtin University.

Author	Contribution	Acknowledgement
Laura Strachan	Conceptualisation of research aims and design, data collection, data analysis, interpretation of results, manuscript preparation.	
Georgie Paulik	Assisted with conceptualisation of research aims and design, reviewing and editing drafts.	
Lynne Roberts	Assisted with conceptualisation of research aims and design, data analysis, interpretation of results, reviewing and editing drafts.	
Peter McEvoy	Assisted with conceptualisation of research aims and design, data analysis, interpretation of results, reviewing and editing drafts.	

Note. All signed authors acknowledge that this statement accurately represents their contribution to the above research output.

Appendix I

Chapter 4: Systematic Search String

unusual perceptual experience* or voice hearing or voice hearer* or auditory hallucination* or psychotic-like experience* or psychosis AND post traumatic stress or ptsd or trauma NOT anxiety disorder* or personality disorder* or depression or depressive disorder* or obsessive-compulsive or panic or agoraphobia or eating disorder* or substance use or alcohol use or autism or autistic or bipolar or ADHD or attention deficit hyperactivity disorder AND mechanism* or explanatory or mediator* or temporal association* or conditioning or associative learning or extinction or habituation or fear inhibition or over generalisation* or associative connection* or stress sensiti?ation or stress desensiti?ation or appraisal* or reapprais* or attribution* or evaluation* or post traumatic cognition* or belief* about voices or interpretation* or schema* or schematic or core belief* or completion failure or failure to complete or failure to integrate or integration failure or accommodation failure or failure to accommodate or self efficacy or competence or incompetence or coping or mastery or reasoning or source monitoring or intention to act or negative affect or negative emotion* or meta-cognition or meta-cognitive belief* or hopelessness or belief* about worry or social belief* or theory of mind or cognitive control or responding to voices or attachment or dissociation OR control adj4 thought* or control adj4 voice* or assimilate* adj4 fail* or trauma adj4 belief* or voice* adj4 belief* or memor* adj4 disintegration or memor* adj4 integration or memor* adj4 fragment* or memor* adj4 reorgani?ation or memor* adj4 storage or memor* adj4 consolidation or memor* adj4 quality or memor* adj4 vividness or memor* adj4 retrieval or trauma adj4 cognition* or emotion adj4 regulation or emotion adj4 regulate or affect adj4 regulate or affect adj4 regulation or information adj4 process*

Appendix J

Total Number of Active Rescripting Sessions Completed

Total rescripting sessions	No. participants
	n = 49
0	2 (4.1%)
1	1 (2.0%)
2	1 (2.0%)
3	2 (4.1%)
4	1 (2.0%)
5	1 (2.0%)
6	2 (4.1%)
7	18 (36.7%)
8	4 (8.2%)
9	3 (6.1%)
10	3 (6.1%)
11	1 (2.0%)
12	1 (2.0%)
13	3 (6.1%)
14	4 (8.2%)
15	1 (2.0%)
16	0 (0.0)
17	1 (2.0%)

Appendix K

Overview of Session and Assessment Content, and Missing Cases at each Timepoint

Timepoint	Session No.	Session Content	Proportion of missing cases[a]	Assessment Content
1 (BL1)	1	Assessment		Primary outcomes, secondary outcomes, mechanism, single-items
2 (BL2)	-	-		Primary outcomes, single-items
3 (BL3)	2	Preparation		Primary outcomes, single-items
4 (IR1)	3	Rescripting	0 (0%)	Single-items
5 (IR2)	4	Rescripting	0 (0%)	Single-items
6 (IR3)	5	Rescripting	0 (0%)	Single-items
7 (MT)	6	Rescripting	0 (0%)	Primary outcomes, secondary outcomes, mechanism, single-items
8 (IR5)	7	Rescripting	0 (0%)	Single-items
9 (IR6)	8	Rescripting	0 (0%)	Single-items
10 (IR7)	9	Rescripting	2 (4.1%)	Single-items
11 (IR8)	10	Rescripting	19 (38.8%)	Single-items
12 (IR9)	11	Rescripting	23 (46.9%)	Single-items
13 (IR10)	12	Rescripting	27 (55.1%)	Single-items
14 (IR11)	13	Rescripting	29 (59.2%)	Single-items
15 (IR12)	14	Rescripting	30 (61.2%)	Single-items
16 (IR13)	15	Rescripting	31 (63.3%)	Single-items
17 (IR14)	16	Rescripting	34 (69.4%)	Single-items
18 (IR15)	17	Rescripting	38 (77.6%)	Single-items
19 (IR16)	18	Rescripting	39 (79.6%)	Single-items
20 (IR17)	19	Rescripting	39 (79.6%)	Single-items
21 (PT)	20	Wrap up		Primary outcomes, secondary outcomes, mechanism, single-items
22 (FU)	-			Primary outcomes, secondary outcomes, mechanism, single-items

Note. BL = baseline; IR = active rescripting session; MT = mid-treatment; PT = post-treatment; FU = three-month follow-up.
[a]Cases missing due to dropout or discharge from ImRs treatment.

Appendix L

Raw Means and Standard Deviations for all Variables, and Cronbach's Alphas for Full Scale Variables at Each Assessment Point

	BL1	BL2	BL3	IR1	IR2	IR3	IR4/MT	IR5	IR6	IR7	PT	FU
Means (SDs)												
PDS	46.46 (12.10)	43.26 (15.68)	44.10 (14.53)	-	-	-	39.24 (16.71)	-	-	-	2878 (17.18)	31.89 (18.03)
PDS-RE	11.21 (4.14)	10.02 (4.73)	11.02 (4.55)	-	-	-	11.36 (4.31)	-	-	-	6.40 (4.59)	5.83 (5.08)
HPSVQ	23.48 (5.85)	22.07 (7.77)	21.77 (7.69)	-	-	-	19.83 (8.23)	-	-	-	18.05 (8.07)	13.33 (10.27)
HPSVQ-E	10.52 (3.52)	9.93 (4.41)	9.94 (4.26)	-	-	-	8.50 (4.34)	-	-	-	7.33 (4.41)	7.03 (5.04)
HPSVQ-P	12.96 (3.11)	12.14 (4.04)	11.83 (3.98)	-	-	-	11.33 (4.52)	-	-	-	10.73 (4.39)	9.83 (5.69)
DASS	31.81 (12.94)	-	-	-	-	-	28.97 (13.83)	-	-	-	16.84 (11.11)	25.29 (14.46)
ERQ-R	23.10 (6.65)	-	-	-	-	-	24.18 (1.10)				24.84 (5.84)	26.21 (6.15)
ERQ-S	17.36 (5.13)	-	-	-	-	-	17.59 (5.67)	-	-	-	15.78 (0.86)	17.18 (4.44)
ESES-UM	23.93 (6.54)	-	-	-	-	-	25.69 (9.01)	-	-	-	28.30 (8.33)	28.96 (8.84)
SCS	2.29 (0.64)	-	-	-	-	-	2.52 (0.72)	-	-	-	2.80 (0.67)	2.86 (0.63)
Dissociation	2.31 (1.24)	2.39 (1.18)	2.51 (1.18)	2.28 (1.12)	2.17 (1.16)	2.13 (1.24)	2.02 (1.34)	1.86 (1.22)	1.85 (1.32)	1.74 (1.25)	1.45 (1.11)	1.85 (1.18)
Intrusions	15.64 (22.59)	17.80 (18.61)	20.21 (19.35)	19.34 (22.02)	13.91 (19.39)	12.36 (14.62)	13.84 (18.77)	11.40 (14.01)	11.61 (13.46)	10.47 (12.64)	5.53 (8.67)	12.18 (12.34)
Voice distress	56.69 (24.05)	54.76 (27.35)	57.74 (23.00)	54.81 (22.52)	52.50 (25.89)	50.27 (27.81)	47.21 (27.26)	45.45 (25.87)	46.49 (26.76)	42.63 (23.43)	37.13 (26.81)	42.09 (32.65)
Voice frequency	3.28 (1.80)	3.44 (1.91)	3.81 (1.61)	3.70 (1.57)	3.63 (1.74)	3.49 (1.83)	3.12 (1.72)	3.14 (1.79)	3.05 (1.77)	2.87 (1.79)	2.58 (2.00)	2.53 (2.19)
Positive valence	1.00 (1.17)	0.93 (1.10)	0.87 (1.06)	0.85 (1.08)	0.78 (0.92)	0.98 (1.14)	0.91 (1.19)	1.02 (1.22)	0.76 (1.07)	0.87 (1.07)	1.15 (1.27)	1.12 (1.04)
Negative valence	2.90 (1.06)	2.83 (1.26)	3.15 (0.91)	3.04 (1.00)	2.98 (1.18)	2.69 (1.36)	2.74 (1.38)	2.74 (1.29)	2.73 (1.36)	2.45 (1.29)	2.23 (1.44)	2.15 (1.40)
Cronbach's alpha												
PDS	0.88	0.93	0.91	-	-	-	0.94	-	-	-	0.95	0.96

PDS-RE	0.78	0.84	0.83	-	-	-	0.88	-	-	-	0.87	0.90
HPSVQ	0.83	0.92	0.91	-	-	-	0.92	-	-	-	0.90	0.95
HPSVQ-E	0.81	0.91	0.89	-	-	-	0.88	-	-	-	0.87	0.93
HPSVQ-P	0.71	0.86	0.82	-	-	-	0.87	-	-	-	0.86	0.92
DASS	0.93	-	-	-	-	-	0.95	-	-	-	0.96	0.96
ERQ-R	0.85	-	-	-	-	-	0.88	-	-	-	0.81	0.88
ERQ-S	0.75	-	-	-	-	-	0.82	-	-	-	0.75	0.50
ESES-UM	0.87	-	-	-	-	-	0.93	-	-	-	0.93	0.95
SCS	0.82	-	-	-	-	-	0.88	-	-	-	0.85	0.84

Note. SD = standard deviation; BL = baseline assessment; IR = weekly imagery rescripting assessment; MT = mid-treatment assessment; PT = post-treatment assessment; FU = three month follow up assessment; PDS = Posttraumatic Diagnostic Scale for DSM-5, PDS-RE = Posttraumatic Diagnostic Scale for DSM-5, HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire, HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale, HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics subscale, DASS = Depression Anxiety and Stress Scales-21; ERQ-R = Emotion Regulation Questionnaire – Cognitive Reappraisal subscale; ERQ-S = Emotion Regulation Questionnaire – Expressive Suppression subscale; ESES-UM = Emotional Self-Efficacy Scale – Understanding and Managing subscale; SCS = Self-Compassion Scale Short Form; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voices distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.

Appendix M

Model-Estimated Means and Standard Errors for all Variables at Each Assessment Point

	Estimated Means (*SE*)											
	BL1	BL2	BL3	IR1	IR2	IR3	IR4/MT	IR5	IR6	IR7	PT	FU
PDS	47.16	43.65	44.79	-	-	-	39.39	-	-	-	29.01	32.43
	(2.20)	(2.26)	(2.23)				(2.30)				(2.32)	(2.40)
PDS-RE	11.39	10.4	11.21	-	-	-	11.21	-	-	-	6.32	7.61
	(0.65)	(0.66)	(0.65)				(0.65)				(0.68)	(0.70)
HPSVQ	23.48	22.11	21.83	-	-	-	20.16	-	-	-	18.47	17.36
	(1.13)	(1.15)	(1.13)				(1.15)				(1.17)	(1.20)
HPSVQ-E	10.56	10.04	9.96	-	-	-	8.66	-	-	-	7.52	7.20
	(0.61)	(0.63)	(0.62)				(0.63)				(0.64)	(0.65)
HPSVQ-P	12.95	12.02	11.87	-	-	-	11.53	-	-	-	10.98	10.17
	(0.79)	(0.76)	(0.73)				(0.71)				(0.70)	(0.70)
DASS	32.99	-	-	-	-	-	29.29	-	-	-	17.47	26.29
	(1.90)						(1.93)				(1.96)	(2.10)
ERQ-R	23.54	-	-	-	-	-	23.85	-	-	-	24.57	25.57
	(1.05)						(1.05)				(1.03)	(1.09)
ERQ-S	17.35	-	-	-	-	-	17.63	-	-	-	15.72	16.99
	(0.80)						(0.82)				(0.80)	(0.85)
ESES-UM	24.35	-	-	-	-	-	25.76	-	-	-	28.71	28.21
	(1.24)						(1.27)				(1.30)	(1.37)
SCS	2.29	-	-	-	-	-	2.55	-	-	-	2.79	2.73
	(0.11)						(0.11)				(0.10)	(0.11)
Dissociation	2.51	2.42	2.59	2.31	2.21	2.15	2.03	1.88	1.85	1.74	1.47	1.90
	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.19)	(0.18)	(0.19)
Intrusions	16.04	20.52	21.23	20.01	14.83	12.98	13.85	11.38	11.24	9.62	5.03	11.57
	(2.93)	(2.81)	(2.65)	(2.58)	(2.53)	(2.50)	(2.50)	(2.49)	(2.49)	(2.52)	(2.50)	(2.61)
Voice distress	60.14	56.46	58.68	55.27	52.72	50.40	47.77	46.43	47.29	44.08	38.03	42.96
	(3.70)	(3.82)	(3.72)	(3.74)	(3.76)	(3.78)	(3.82)	(3.84)	(3.86)	(3.94)	(3.89)	(4.06)
Voice	3.37	3.40	3.84	3.66	3.59	3.42	3.12	3.21	3.13	3.01	2.68	2.65
frequency	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
Positive	1.03	0.94	0.88	0.86	0.78	0.96	0.92	1.03	0.80	0.88	1.17	1.14
valence	(0.16)	(0.17)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.18)
Negative	3.03	2.89	3.16	3.02	2.96	2.69	2.76	2.78	2.76	2.51	2.27	2.20
valence	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.20)

Note. M = mean; *SE* = *standard error*; BL = baseline assessment; IR = weekly imagery rescripting assessment; MT = mid-treatment assessment; PT = post-treatment assessment; FU = three month follow up; PDS = Posttraumatic Diagnostic Scale for DSM-5, PDS-RE = Posttraumatic Diagnostic Scale for DSM-5,

HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire, HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale, HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics subscale, DASS = Depression Anxiety and Stress Scales-21; ERQ-R = Emotion Regulation Questionnaire – Cognitive Reappraisal subscale; ERQ-S = Emotion Regulation Questionnaire – Expressive Suppression subscale; ESES-UM = Emotional Self-Efficacy Scale – Understanding and Managing subscale; SCS = Self-Compassion Scale Short Form; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voices distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.

Appendix N

Pearson's Bivariate Correlations Between Primary, Secondary, Mechanism, and Weekly Outcomes at Baseline One Assessment

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. PDS-5															
2. PDS-5-RE															
3. HPSVQ	0.013	0.010													
4. HPSVQ-E	0.012	0.070	.896**												
5. HPSVQ-P	0.028	-0.051	.865**	.553**											
6. DASS-21	.674**	.537**	.302*	0.288	0.266										
7. ESES-UM	-.336*	-0.004	-0.018	-0.064	0.039	-.307*									
8. SCS	-.439**	-0.104	0.030	-0.029	0.056	-.406**	.687**								
9. ERQ-CR	-0.018	0.113	0.035	-0.013	0.052	-0.192	.483**	.582**							
10. ERQ-ES	0.123	-0.073	0.024	-0.002	0.069	0.289	-.344*	-0.159	-0.067						
11. Dissociation	0.099	0.186	.312*	0.135	.453**	.322*	0.072	-0.033	0.081	0.171					
12. Intrusions	0.180	.348*	0.066	0.117	-0.015	0.110	0.090	0.225	0.287	-0.015	0.001				
13. Voice distress	0.251	0.254	.655**	.588**	.572**	.481**	-0.019	0.091	0.068	-0.004	0.238	0.250			
14. Voice frequency	-0.052	-0.043	.680**	.411**	.814**	0.226	0.052	0.074	-0.064	0.145	.487**	0.055	.494**		
15. Positive valence	-0.047	0.035	-0.148	-.293*	0.043	-0.181	.438**	.428**	.338*	0.036	0.078	.354*	0.007	-0.019	
16. Negative valence	0.092	0.144	.711**	.789**	.446**	.294*	-0.033	0.027	-0.008	0.002	0.000	0.180	.547**	.444**	-.303*

Note. N = 49; PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; PDS-5-RE = Posttraumatic Diagnostic Scale for DSM-5; HPSVQ = Hamilton Program for Schizophrenia Voices Questionnaire; HPSVQ-E = Hamilton Program for Schizophrenia Voices Questionnaire – Emotional Characteristics subscale; HPSVQ-P = Hamilton Program for Schizophrenia Voices Questionnaire – Physical Characteristics subscale; DASS = Depression Anxiety and Stress Scales-21; ERQ-CR = Emotion Regulation Questionnaire – Cognitive Reappraisal subscale; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression subscale; ESES-UM = Emotional Self-Efficacy Scale – Understanding and Managing subscale; SCS = Self-Compassion Scale Short Form; Dissociation = weekly dissociation frequency; Intrusions = weekly intrusion frequency; Voice distress = weekly voice distress; Voice frequency = weekly frequency of voices; Positive valence = weekly frequency of positively valenced voices; Negative valence = weekly frequency of negatively valenced voices.
*p <.05, **p <.01