

Emotional and non-emotional mental imagery and auditory verbal hallucinations (hearing voices): A systematic review of imagery assessment tools

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Abstract

It is unknown to what extent mental imagery and auditory verbal hallucinations (AVHs) are related. Trials evaluating this issue used both emotional and non-emotional mental imagery tools, thereby complicating outcomes comparisons. Therefore, the present study aimed to systematically review the literature on mental imagery in individuals with AVHs to (1) inventory imagery assessment tools used in this population, (2) to collect information on the relation between emotional and non-emotional mental imagery in all sensory domains and AVHs and (3) to integrate the outcomes of this systematic review in a model of different mental imagery domains and related assessment tools. We conducted a systematic literature search in the PubMed Database. After full-text screening, 17 papers were included. Findings showed that a variety of assessment methods have been used to assess various aspects of mental imagery in people with AVHs, suggesting that there is a lack of agreed theoretical conceptualization of mental imagery and AVHs. In addition, the studies confirmed as was expected that non-emotional mental imagery seemed unrelated to AVHs whereas emotional mental imagery was related to AVHs. Lastly, we proposed a model of mental imagery domains and corresponding assessment methods distinguishing between emotional and non-emotional mental imagery.

KEYWORDS

auditory verbal hallucinations, imagery assessment tools, mental imagery, voice hearing

1 | INTRODUCTION

Auditory verbal hallucinations (AVHs; e.g., hearing voices that others cannot hear) are one of the most prevalent and disabling features of

psychosis (American Psychiatric Association, 2013; Sommer et al., 2012). AVHs are viewed as a key feature of psychosis, often accompanied by delusions, negative symptoms (e.g., anhedonia and blunted affect) and cognitive disturbances (American Psychiatric

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Association, 2013; Perrotta, 2020). However, accumulating evidence reveals that AVHs are prevalent in a wide range of mental health problems, such as post-traumatic stress disorder, anxiety disorders, mood disorders, eating disorders and personality disorders, and in the general population (Aleman & Larøi, 2008; Hackmann et al., 2011; van Os & Reininghaus, 2016; Waters et al., 2018). This highlights the need for a broader transdiagnostic approach to understanding AVHs and a new approach to conceptualizing mental health problems characteristic for AVHs (Borsboom, 2017; Fried et al., 2020). This new approach might facilitate improvements of current psychological interventions (van Os & Reininghaus, 2016).

Recently, clinicians and researchers have started to move from a traditional categorical approach to a more dimensional and transdiagnostic understanding of symptoms, assuming that mental health problems arise from interactions between symptoms that maintain each other (Borsboom, 2017; Fried et al., 2020; Wigman et al., 2017). This is also the case for emotional mental imagery as a transdiagnostic feature of mental disorders, where more symptoms are associated with more emotional mental imagery (di Simplicio et al., 2016; Moritz et al., 2013), contributing to difficulties in emotional, motivational and behavioural domains (Ji et al., 2019). Both mental imagery and AVHs are often accompanied by anxiety and increased negative affect (Ji et al., 2019; Lysaker & Salyers, 2007; Morrison, 2001; van Oosterhout et al., 2013) and are both described in individuals with psychosis (i.e., co-occur), suggesting a relationship between them. To date, there are two hypotheses on the relationship between mental imagery and symptoms of psychosis, such as AVHs. One suggests that mental images and symptoms of psychosis are two different concepts interacting with each other (i.e., cognitive concepts hypothesis; Schulze et al., 2013). The other suggests that mental imagery and symptoms of psychosis are two similar concepts on a continuum (i.e., the continuum model; Morrison, 2001). The first hypothesis originates from the field of anxiety disorders. Schulze et al. (2013) suggest that there is an overlap in cognitive processes that lead to maintenance of symptoms of anxiety and psychosis. Intrusive mental images are found to be highly prevalent in anxiety disorders. Typical examples are observer perspective image of self-doing something that will cause rejection in social phobia, obsessional images that are unpleasant and ego-dystonic in OCD or vivid images of phobic objects in phobia (Hackmann et al., 2011). Following, Schulze et al. (2013) argue that intrusive mental images may be common in individuals with psychosis also and contribute to the distress of symptoms of psychosis. Morrison (2001) provides a model for the continuum hypothesis and argues that symptoms of psychosis can be seen as intrusions into awareness (e.g., hallucinations) or a culturally unaccepted misinterpretation of such intrusions (e.g., delusions). According to Morrison's continuum hypothesis, the misinterpretation of the intrusions causes associated distress and disability and is thereby indirectly responsible for the emergence or maintenance of psychotic symptoms. The misinterpretations themselves can be maintained by associated emotional, physical, behavioural and cognitive responses, such as selective attention, safety behaviour and counter-productive control strategies. Moreover, the intrusions are often

Key Practitioner Message

- Suitable measures of mental imagery for auditory verbal hallucinations (AVHs) or psychosis are limited.
- There is an urgent need for a measure of emotional mental imagery associated with AVHs.
- Emotional and non-emotional mental imagery measures are poorly distinguished, resulting in inaccurate research conclusions.
- AVHs are associated with emotional mental imagery.

associated with beliefs about self and others (e.g., encapsulated beliefs).

To further explore these hypotheses, there is a need for reliable and valid mental imagery measures. If consensus about preferred specific mental imagery measures in psychosis is lacking, clinicians and researchers will use various kinds of mental imagery assessments methods, which likely complicates study outcomes comparisons and proper evaluation of the relationship between and mental imagery and symptoms of psychosis. Insights into the relationship between mental imagery and mental health problems have resulted in the development of several different assessment tools. Traditionally, mental imagery is explored using neuropsychological tests and self-report instruments (Pearson et al., 2013), while more recently, questionnaires have emerged that measure mental imagery in individuals with mood instability or anxiety (di Simplicio et al., 2016; Ji et al., 2019). However, in order to explore the relationship between mental imagery and AVHs and contribute to a more in-depth understanding of AVHs, more research is needed. This review adds to the current literature by presenting a model of different mental imagery domains and related assessment tools and to address the relationship between mental imagery and AVHs.

1.1 | What is mental imagery?

Kosslyn et al. (2001) defined mental imagery as 'perceptual information accessed from memory, giving rise to the experience of "seeing with the mind's eye" or "hearing with the mind's ear," without the presence of external stimuli'. Mental imagery is a broad concept, which can be multi-sensory and occur in a variety of forms, from spontaneous thinking in mental pictures to intrusive recurrent disabling images (Hackmann et al., 2011). Mental imagery is a common feature in daily live and facilitates mental functioning by helping us to vividly remember past events and plan future ones, and to envision future goals (Berntsen & Jacobsen, 2008; D'Argembeau et al., 2011). These same mental imagery processes also play a core role in various mental disorders (Blackwell, 2019). Several disorders are associated with vivid intrusive mental imagery, for example, intrusive flashbacks in trauma, or images with distorted sense of the self in eating disorders, or images of future orientated self-harm of suicidal ideation in

depression (Blackwell, 2019). Importantly, mental imagery has a more powerful impact on emotion and behaviour than verbal linguistic thinking (Holmes & Mathews, 2010; Saulsman et al., 2020).

Recent research in mental imagery led to a helpful distinction between non-emotional or neutral mental imagery (e.g., mentally rotating a neutral object) and emotional mental imagery (e.g., imagining a happy face) (di Simplicio et al., 2016; O'Donnell et al., 2020). While non-emotional mental imagery appeared unaffected in patients with mood and anxiety disorders (di Simplicio et al., 2016), emotional mental imagery was clearly related to negative mood, anxiety and other mental health problems across mental disorders (di Simplicio et al., 2016; Ji et al., 2019). To date, it is unknown whether non-emotional or emotional mental imagery are associated with AVHs.

1.2 | Assessment of mental imagery in psychology

Pearson et al. (2013) provided the first framework of different imagery assessment tools and proposed three main domains of mental imagery: general imagery use and experience (i.e., the use of non-emotional mental imagery), clinical aspects of mental imagery (such as intrusions or flashbacks, prospective images and bias in mental imagery) and cognitive stages of mental imagery based on the computational theory of Kosslyn and colleagues (Kosslyn, 1980, 1994; Kosslyn et al., 2006).

In Kosslyn's computational theory, mental images are thought to be initially created either directly from perceptual information or indirectly from previously stored information held in long-term memory (i.e., image generation), once held in mind temporarily avoiding immediate decay by active re-activation of visual memory representations from images generated in either short-term or long-term memory (i.e., image maintenance); such images' characteristics can be interpreted/scanned (i.e., image inspection) and further transformed (i.e., image manipulation).

TABLE 1 Examples of imagery assessment tools

Aspect of mental imagery	Task	Author
<i>Cognitive aspects of non-emotional mental imagery</i>	Image generation tasks	Podgorny and Shepard (1978)
Image generation	Image maintenance task	Kosslyn et al. (1990)
Image maintenance	Map scanning tasks	Kosslyn et al. (1978)
Image inspection	Image rotation task	Shepard and Metzler (1971)
Image manipulation		
<i>Subjective domains of non-emotional mental imagery</i>	Betts' Questionnaire upon Mental Imagery Short form (QMI)	Sheehan (1967)
	Vividness of Visual Imagery Questionnaire (VVIQ) (non-emotional)	Marks (1973)
	Spontaneous Use of Imagery Scale (SUIS) (non-emotional)	Reisberg et al. (2003)
<i>Emotional mental imagery</i>	Cognitive bias modification task	Holmes et al. (2006)
Image interpretation bias	Impact of Event Scale—Revised	Hackmann et al. (1998)
Intrusions/flashbacks	Imagery Interview	Van den Berg et al. (2020)
Characteristics of emotional mental imagery (such as compellingness, vividness or associated appraisals)	Dutch Imagery Survey	O'Donnell et al. (2020)
	Emotional–Spontaneous Use of Imagery Scale (e-SUIS)	

Note: This overview is adapted from Pearson et al. (2013) and extended by including elaborations based on recent insights into emotional mental imagery, such as newly developed mental imagery assessment tools (O'Donnell et al., 2020; Slofstra et al., 2018; van den Berg et al., 2020).

A paucity of studies showed that emotional mental imagery can also be divided into different imagery characteristics (Hackmann et al., 2011; Holmes et al., 2008). These imagery characteristics consist of quality aspects (e.g., vividness and compellingness of mental images), the associated appraisals (e.g., metacognitive beliefs or likelihood of imagery and encapsulated beliefs associated to the images, i.e., meaning of the image about the self, such as 'this image reflects I am worthless') (Dodd et al., 2013) and associated emotion and behaviour (van den Berg et al., 2020).

Imagery assessments vary between neuropsychological assessments (such as measures of different cognitive stages of mental imagery), subjective domain measures (such as measures of vividness or imagery interpretation biases) and clinical questionnaires and interviews to assess emotional mental imagery and related characteristics (such as vividness, compellingness and the associated appraisals). Table 1 presents an overview of different imagery assessment tools used in psychology adapted from Pearson et al. (2013) and extended by including elaborations based on recent insights into emotional mental imagery, such as newly developed mental imagery assessment tools (O'Donnell et al., 2020; Slofstra et al., 2018; van den Berg et al., 2020).

1.3 | Mental imagery and AVHs

To the best of our knowledge, no study to date has investigated mental imagery in a transdiagnostic sample with AVHs. However, in the current scientific literature, there are studies that assessed mental imagery in individuals with psychosis. In these studies, mental imagery was assessed with either neurocognitive tests (Seal et al., 2004), self-report measures (Sack et al., 2005) or a clinical interview adapted from Hackmann et al. (1998) (Morrison et al., 2002; Schulze et al., 2013). These studies suggest an association between mental imagery (especially emotional imagery) and symptoms of psychosis, such as AVHs

(Morrison et al., 2002; Schulze et al., 2013). Also, a small number of experimental studies investigating the effects of mental imagery interventions on delusions in individuals with psychosis showed that these interventions reduced maladaptive mental imagery and symptoms of psychosis (Morrison, 2004; Pitfield et al., 2020; Serruya & Grant, 2009; Taylor et al., 2020). Interventions using mental imagery to target other symptoms associated with psychosis, such as nightmares and trauma intrusions, have showed promising results as well (Ison et al., 2014; Paulik et al., 2019; Sheaves et al., 2019). All these findings highlight the need to further explore the specific role of mental imagery in the experience of psychotic symptoms but especially AVHs, as AVHs are viewed as a key feature of psychosis and limited research is done on this topic. To facilitate our understanding of the relationship between mental imagery and AVHs, appropriate assessment tools that take account of the recent advances in understanding the particular relationship between mental imagery and mental disorders are needed. One such recent insight is the differentiation between non-emotional and emotional mental imagery in individuals with mental disorders, often overlooked in studies on mental imagery and symptoms of psychosis. Another one is the distinction between qualitative aspects of mental imagery and associated appraisals of imagery (van den Berg et al., 2020). Overall, a detailed overview of emotional and non-emotional mental imagery assessments used in individuals with AVHs would contribute to expanding our understanding of the specific relationship between mental imagery and AVHs that in turn can lead to enhanced psychological interventions for individuals with AVHs.

The aim of the current study was to conduct a systematic review of the literature on mental imagery in individuals with AVHs to (1) inventory imagery assessment tools used in this population and (2) to collect information on the relation between two different aspects of mental imagery in all sensory modalities (i.e., emotional and non-emotional mental imagery) and AVHs. Finally, we aimed to integrate the outcomes of this systematic review in a model of different mental imagery domains and their related imagery assessment tools for clinicians and researchers.

2 | METHODS

2.1 | Protocol and registration

This review was conducted according to the PRISMA guidelines (Moher et al., 2010). The protocol was pre-registered on the international prospective register of systematic reviews PROSPERO (CRD42021270975).

2.2 | Inclusion and exclusion criteria

Clinical trials, experimental studies and case reports published up to October 2022, which described the relationship between mental imagery and AVHs (i.e., hearing voices) in individuals who are seeking

help for mental health problems, were included. As research findings suggest that a higher level of psychopathology is strongly associated with higher levels of mental imagery, this study had focussed on help-seeking individuals with AVHs (Ji et al., 2019). Excluded were studies including individuals with psychosis or schizophrenia without hearing voices or omitting any information on the modality of the experienced hallucinations. Also, studies including healthy individuals with hallucination proneness were excluded. Since literature on mental imagery and voice hearing was limited, some studies with a voice hearing subsample were included. Reviews, non-English articles and animal studies were excluded.

2.3 | Literature search

The following literature search was conducted in the PubMed database: (('schizophrenia spectrum and other psychotic disorders' [MeSH Major Topic]) OR (psychosis [Text Word]) OR (auditory hallucinations [Text Word]) OR (auditory vocal hallucinations [Text Word]) OR (auditory verbal hallucinations [Text Word]) OR (voices [Text Word]) OR (hearing voices [Text Word]) OR (voice hearing [Text Word])) AND (((('imagery psychotherapy' [All Fields]) OR ('imagery' [All Fields])) OR ('mental imagery' [All Fields])).

3 | RESULTS

3.1 | Study selection

The search resulted in 158 articles. Four additional articles were identified through references in other papers (Figure 1). The articles were screened by two authors independently, according to the PRISMA guidelines (Moher et al., 2010). After full-text screening, 17 papers were included from the search.

3.2 | Findings of the reviewed studies

3.2.1 | Assessment studies

Non emotional mental imagery

Four studies assessed non-emotional mental imagery associated with AVHs (Table 2). Evans et al. (2000) studied auditory image generation ability in 19 individuals diagnosed with schizophrenia with auditory-verbal neuropsychological tasks. Evans et al. (2000) found no differences in auditory imagery performance between individuals with ($n = 12$) and without ($n = 7$) AVHs. Böcker et al. (2000) showed no significant differences between individuals with hallucinations ($n = 13$) and without hallucinations ($n = 19$) in image maintenance and inspection. However, the hallucinating group performed worse on the measure of image generation than the non-hallucinating group. Aynsworth et al. (2017) performed an experimental study with individuals with both visual hallucinations and AVHs ($n = 16$) and

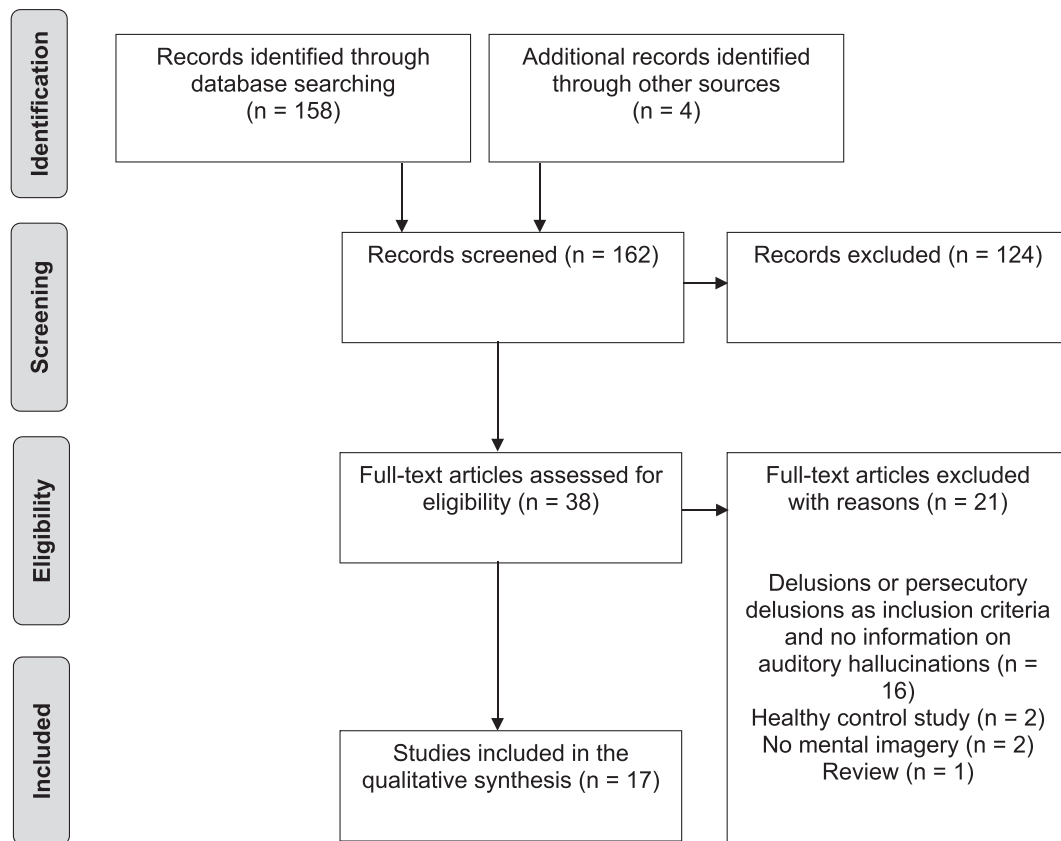


FIGURE 1 Study inclusion process.

individuals with AVHs only ($n = 15$). In this study, the object reality monitoring, word-picture task by Brébion et al. (2008) was used, which is compatible with the assessment of image inspection and image maintenance. The study showed no impairments in image inspection and maintenance in the group with AVHs. Auvinen-Lintunen et al. (2021) investigated the vividness and controllability of non-emotional mental imagery in 42 individuals with recent onset psychosis with the following self-report questionnaires; Betts' Questionnaire upon Mental Imagery Short form (QMI) and the Vividness of Visual Imagery Questionnaire (VVIQ). Vividness of non-emotional mental imagery was low, and controllability of mental imagery was unaffected in this study sample. Negative and affective symptoms (e.g., mood and anxiety) were associated with low vividness of non-emotional mental imagery. Anxiety and self-neglect were the best predictors of low vividness. Only an elevated mood associated with higher vividness of non-emotional mental imagery.

3.2.2 | Summary of findings

Aspects of mental imagery

In summary, results need to be interpreted with caution as all reviewed studies were conducted in small samples. Image maintenance and image inspection abilities appeared unimpaired in individuals with AVHs (Aynsworth et al., 2017; Böcker et al., 2000). One study suggested that image generation is impaired in individuals with

hallucinations (Böcker et al., 2000), while another study failed to replicate this finding (Evans et al., 2000). Vividness of non-emotional mental imagery was not enhanced in individuals with (recent onset) psychosis and AVHs. More negative and affective symptoms might be associated with less non-emotional mental imagery (Auvinen-Lintunen et al., 2021).

Assessment tools

Studies into non-emotional mental imagery and AVHs used imagery assessment tools that measure a cognitive stage of non-emotional mental imagery (e.g., object imagery tasks or image generation tasks), non-emotional mental imagery proneness (QMI) or specific aspects of non-emotional mental imagery, such as vividness of non-emotional mental imagery (VVIQ).

Emotional mental imagery

To date, only two studies assessed emotional mental imagery in individuals with psychosis who have AVHs (Table 2). Morrison et al. (2002) used the Imagery Interview by Hackmann et al. (1998) and suggested that emotional imagery is related to psychosis. Morrison et al. (2002) found that of 35 individuals with psychosis, 74% experienced negative intrusive images associated with delusions and hallucinations. Of these, 69% experienced the intrusive image in conjunction with a psychotic symptom. Most individuals reported that their emotional mental imagery associated with hallucinations and delusions is recurrent. Laing et al. (2016) also used an adaptation of

TABLE 2 Clinical and experiment studies on the assessment of non-emotional and emotional mental imagery in relation to auditory verbal hallucinations.

Aspect of mental imagery	Task/imagery assessment tool	Findings	Author
Non-emotional mental imagery			
Domains specific aspects of non-emotional mental imagery	QMI, VVIQ	No enhanced vividness negative association between affective symptoms and non-emotional mental imagery	Auvinen-Lintunen et al. (2021)
Cognitive stages of non-emotional mental imagery			
Image generation	Objective experimental tasks Tasks involving auditory imagery.	Impaired image generation No impairments in image generation.	Böcker et al. (2000) Evans et al. (2000)
Image maintenance	Objective experimental tasks Object reality monitoring task, word-picture task (Brébion et al., 2008)	Not impaired Not impaired	Böcker et al. (2000) Aynsworth et al. (2017)
Image inspection	Objective experimental tasks Object reality monitoring task, word-picture task (Brébion et al., 2008)	Not impaired Not impaired	Böcker et al. (2000) Aynsworth et al. (2017)
Image manipulation	<i>No findings</i>	<i>No findings</i>	<i>No findings</i>
Emotional mental imagery			
	Adapted version of the imagery interview of Hackmann et al. (1998)	Negative intrusive imagery is found in people with psychosis and also associated with auditory verbal hallucinations.	Morrison et al. (2002)
	Adapted version of the imagery interview of Hackmann et al. (1998) combined with items from an intrusive imagery interview (Patel et al., 2007)	Positive images in people with psychosis and auditory verbal hallucinations are associated with lower levels of depression and anxiety	Laing et al. (2016)

Abbreviations: QMI, Betts' Questionnaire upon Mental Imagery Short form; VVIQ, Vividness of Visual Imagery Questionnaire.

Hackmann's et al. (1998) Imagery Interview and found that 48% of the 31 included patients with first episode psychosis, of which six heard voices, also experience positive images. These positive images were associated with lower levels of depression and social anxiety.

3.2.3 | Summary of findings

Aspects of mental imagery

Negative intrusive imagery was found in people with psychosis and probably associated with AVHs (Morrison et al., 2002). Positive images in people with psychosis and AVHs were associated with lower levels of depression and anxiety (Laing et al., 2016).

Assessment tools

Hackmann's et al. (1998) imagery interview was used to measure emotional mental imagery in people with AVHs; in Laing's study (2016), additional items of the Intrusive Imagery Interview were added.

3.2.4 | Intervention studies

So far, nine intervention studies have investigated mental imagery interventions in individuals with AVHs (Table 3). Ison et al. (2014)

used the imagery interview adapted from Hackmann et al. (1998) to assess emotional mental imagery in four individuals with psychosis and AVHs. They adapted the imagery rescripting manual of Arntz and Weertman (1999), offering two treatment sessions in which the ending was altered of distressing memories relating to their hallucinations with an aim to reduce distress by updating negative associated beliefs. All participants experienced more control over the mental image after the treatment. The control over their mental images had increased at 1 month follow-up for three participants. There were no changes on severity of AVHs. Paulik et al. (2019) studied the effects of imagery rescripting following the manual of Arntz and Weertman (1999) in 12 trauma-affected voice hearers (transdiagnostic sample) over eight therapy sessions. In this study, although no specific mental imagery assessment tool was used, the number of trauma intrusions was reported. Imagery rescripting was an acceptable treatment, and trauma intrusions, voice distress and frequency were significantly reduced after treatment. Trauma intrusions further decreased at 3 months of follow-up measurement. Similar improvements in trauma-related memory intrusions were replicated in their 2021 paper on imagery rescripting delivered via telehealth (Paulik et al., 2021). Clarke et al. (2022) also investigated imagery rescripting following the manual of Arntz and Weertman (1999) in 12 individuals with psychosis and PTSD but expanded on the aforementioned two studies by controlling for time effects, repeated measures and trauma memory

TABLE 3 Clinical and experimental imagery intervention studies in individuals with auditory verbal hallucinations.

Aspect of mental imagery	Imagery intervention	Task/imagery assessment tool	Findings	Author(s)
Emotional mental imagery	Imagery rescripting (ImRs) according protocol of Arntz and Weertman (1999).	Adaptation of the imagery interview from Hackmann et al. (1998).	ImRs improved sense of control over negative affect, associated beliefs and distress associated with the image.	Ison et al. (2014)
Frequency of emotional mental imagery	Imagery rescripting (ImRs) according protocol of Arntz and Weertman (1999).	Number of trauma intrusions was reported	ImRs reduced trauma intrusions, voice distress and frequency.	Paulik et al. (2021); Paulik et al. (2019).
No specific aspect of mental imagery	1. A brief attachment imagery task 2. A positive and neutral guided imagery task	Not applicable Not applicable	The therapy reduced paranoia and improved mood The positive imagery intervention improved positive future thinking.	Pitfield et al. (2020) Smith et al. (2022)
Domain specific aspects of emotional mental imagery	1. EMDR 2. Imaginal exposure 3. Imagery rescripting (ImRs) according protocol of Arntz and Weertman (1999).	VAS-scales to assess the level of vividness and associated emotions of traumatic intrusions. Trauma Memory Questionnaire (Halligan et al., 2003) and Posttraumatic Cognitions Inventory (Foa et al., 1999) to assess the intrusiveness of mental imagery, disorganization and the negative post-traumatic cognitions related to the traumatic image VAS-scales to assess conviction in the distressing appraisal, frequency, distress, and sense of control associated with the traumatic memory	EMDR was effective in reducing symptoms of trauma and symptoms of auditory verbal hallucinations Severity of auditory verbal hallucinations and the intrusiveness of the trauma memory reduced after therapy. ImRs reduced frequency of trauma intrusions, distress, and appraisal conviction of trauma intrusions and improved controllability.	Croes et al. (2014); de Bont et al. (2016); van den Berg and van der Gaag (2012); Van den Berg et al. (2013) Brand et al. (2021) Clarke et al. (2022)

Abbreviations: EMDR, eye movement desensitization and reprocessing; ImRs, imagery rescripting; VAS, visual analogue scales.

exposure during assessment. Indeed, imagery rescripting was an acceptable treatment and frequency of trauma intrusions, distress and appraisal conviction of trauma intrusions reduced significantly. Van den Berg and colleagues investigated in several trials the effects of Eye Movement Desensitization and Reprocessing (EMDR) for individuals with a psychotic disorder and with AVHs. EMDR is a psychological therapy for intrusive and distressing memories where the client recalls their distressing memories/images while doing bilateral stimulation with the aim to reduce distress. Van den Berg and colleagues showed that EMDR was effective in reducing symptoms of trauma (de Bont et al., 2016; van den Berg et al., 2013; van den Berg & van der Gaag, 2012) and symptoms of AVHs (van den Berg et al., 2013; van den Berg & van der Gaag, 2012) in individuals diagnosed with a psychotic disorder and with AVHs. In all these studies, no specific

imagery assessment tools were used. Instead, the participants were interviewed about imagery related aspects, such as distress associated with the traumatic memory or the vividness of traumatic memories. Croes et al. (2014) investigated EMDR treatment for three individuals with psychosis and AVHs, again not using any emotional mental imagery assessment tool, but visual analogue scales (VASs) measuring vividness and associated emotions of traumatic intrusions. Croes and colleagues found that EMDR reduced vividness and that reduced emotions was associated with the traumatic intrusions in all three individuals. According to participants, especially treating flash-forward imagery of worst scenarios was experienced as helpful. In addition, EMDR reduced levels of anxiety, depression and the severity of psychotic symptoms. In an experimental case study by Pitfield et al. (2020), also lacking specific assessment tools for emotional mental

imagery, two participants were treated with a brief attachment imagery task (recalling an image of a place where they felt safe and relaxed) for 1 week. This imagery task was effective in reducing paranoia and improving mood during the intervention phase, but these improvements were not maintained at follow-up. Brand et al. (2021) investigated six sessions of prolonged imaginal exposure for trauma-related AVHs in a transdiagnostic sample of 15 people with AVHs and trauma. In this study, the Trauma Memory Questionnaire was used to assess the intrusiveness and disorganization of the trauma memory (Halligan et al., 2003). Negative post-traumatic cognitions were assessed using the Posttraumatic Cognitions Inventory (Foa et al., 1999). Brand et al. (2021) found that imaginal exposure reduced the severity of AVHs and symptoms of the intrusiveness of the trauma memory. Finally, the study of Smith et al. (2022) investigated the short-term effects of neutral (i.e., imagining a table, chair or rug) and positive (i.e., imagining a successful interview for a job/course, catching up with a friend or receiving positive feedback at work) guided imagery intervention in individuals with first episode psychosis. A subsample of the total sample was positive for AVHs. The study used a future thinking task prompting participants during 1 min to generate events that may happen in the future. Unfortunately, no mental imagery measures were applied after the intervention. The positive imagery intervention was associated with an increased positive future thinking as compared to the neutral imagery intervention, suggesting that this may be a good tool to target amotivation and engagement in therapy.

3.2.5 | Summary of findings

Aspects of mental imagery

The reviewed intervention studies in the above section investigated an adaption of cognitive behavioural therapy with an imagery intervention focus (i.e., imagery rescripting, EMDR, imaginal exposure and imagery attachment task) all targeting emotional mental imagery but primarily focussed on traumatic memories. Interventions targeting emotional mental imagery show promising results in the treatment of AVHs. Reductions were found in emotional mental imagery (such as frequency of trauma intrusions, vividness of these images, associated distress and beliefs) (Brand et al., 2021; de Bont et al., 2016; Ison et al., 2014; van den Berg et al., 2013; van den Berg & van der Gaag, 2012), affective symptoms and the severity of AVHs and other psychotic symptoms (Brand et al., 2021; Croes et al., 2014; de Bont et al., 2016; Paulik et al., 2019; Pitfield et al., 2020; van den Berg & van der Gaag, 2012). In addition, using a positive guided imagery intervention in individuals with first episode psychosis and AVHs could target amotivation and increase engagement in therapy (Smith et al., 2022).

Assessment tools

Overall, no standardized imagery assessment tools were used in these intervention studies. Instead, trauma intrusion frequencies, the distress associated to the image and vividness of mental imagery using

VAS-scales were reported. A few studies applied the imagery interview of Hackmann et al. (1998) was used. One study used the Trauma Memory Questionnaire was used to assess the intrusiveness and disorganization of the trauma memories (Halligan et al., 2003) and the Posttraumatic Cognitions Inventory (Foa et al., 1999) to assess the negative post-traumatic cognitions related to the traumatic image. In summary, standardized emotional mental imagery measures were limited, which might be related to the fact that there is still no consensus about the theoretical conceptualisation of emotional mental imagery and AVHs.

3.3 | Imagery assessment tools: Introducing a new model

The included studies in the current review used various assessment methods to evaluate different aspects of mental imagery associated with AVHs. Having carefully examined these studies, we believe that the variety of imagery assessment tools currently used in the field of AVHs gives rise to confusion, inconsistencies and sometimes incorrect and misleading interpretation of data. For example, trials using non-emotional imagery measures incorrectly conclude that mental imagery and AVHs are unrelated. In addition, limited studies assessed the various aspects of emotional mental imagery relevant to mental health problems as defined by Hackmann et al. (2011) and Holmes et al. (2008) (i.e., imagery appraisals and imagery quality aspects), except for studies that used the imagery interview of Hackmann et al. (1998) or its adaptations. Hackmann's interview provides rich qualitative data, which are clinically very useful, but as an assessment tool, it is relatively time-consuming and resource heavy for research purposes with large sample sizes. It seems reasonable to assume that the multitude of imagery assessment tools stem from a lack of agreed upon theoretical conceptualisation of mental imagery and AVHs. A more comprehensive, less time consuming, quantitative tool of mental imagery that assesses all aspects of mental imagery might contribute to a more in-depth and transdiagnostic theoretical understanding of the specific relationship between mental imagery and AVHs. Extrapolating on the results of this review and models about different domains of mental imagery described in the introduction (di Simplicio et al., 2016; Pearson et al., 2013), we propose an elaborated model of mental imagery domains and corresponding assessment tools in psychology (Figure 2). Only examples of assessment tools used in studies included in this review are incorporated in this model, as we aimed to expand the understanding of the specific relationship between mental imagery and AVHs by developing an elaborated overview of emotional and non-emotional mental imagery assessments used in individuals with AVHs. As different imagery interventions are suggested to target different aspects of mental imagery (Hackmann et al., 2011) and cognitive models suggest that different aspects of imagery influence affect, behaviour and attention across mental disorders (Ji et al., 2019), it seems pertinent to find more specific measures of mental imagery. While reviewing the literature, we noticed that it is difficult to classify all the existing measurements of mental imagery in one specific

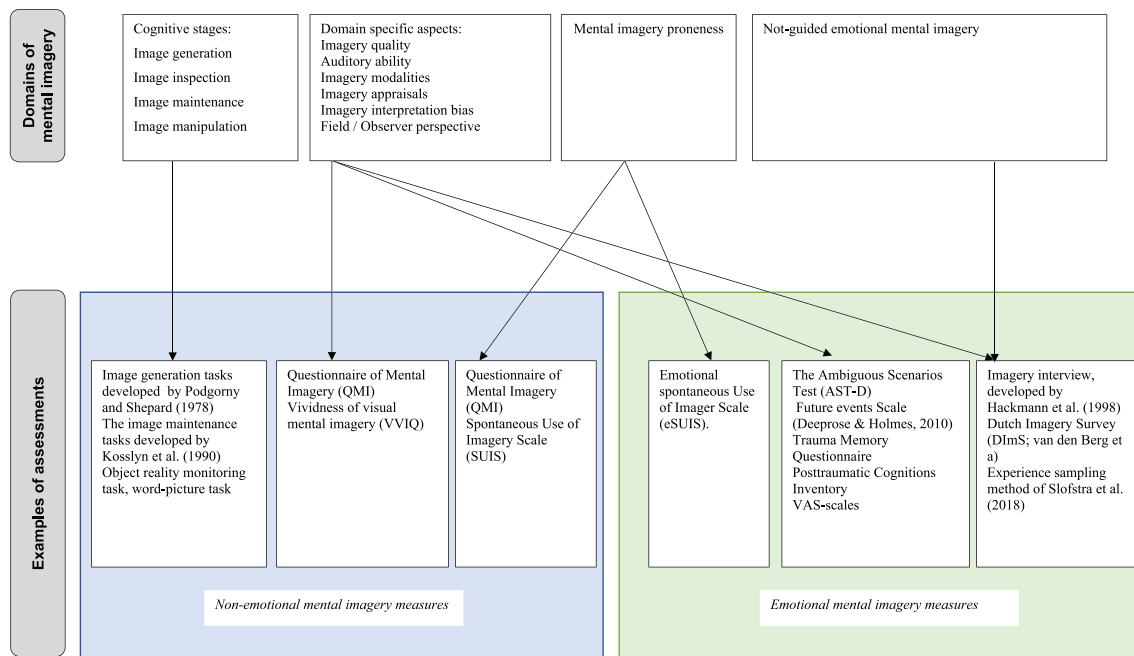


FIGURE 2 Model of emotional and non-emotional imagery domains and related assessment tools. *Note:* Image generation: creation of mental images either directly from perceptual information or indirectly from preciously stored information held in long-term memory. Image maintenance: active re-activation of visual memory representations from images generated in either short- or long-term memory. Image inspection: interpretation or scanning of mental images. Image manipulation: transformation of images. Imagery quality: vividness and compellingness of mental images. Imagery appraisals: metacognitive beliefs and conviction associated to the images. Field/observer perspective: looking out your own eyes in a mental image or seeing yourself in the image as an external observer.

domain, because the domains are overlapping. Therefore, several measurements are mentioned in more than one domain (Figure 2). To the best of our knowledge, this is the first model of mental imagery domains and corresponding assessments tools distinguishing between non-emotional and emotional mental imagery. This could contribute to a more in-depth understanding of the relationship between specific aspects of mental imagery and mental health problems.

4 | DISCUSSION

The current review aimed to provide an up-to-date detailed overview of studies investigating emotional and non-emotional mental imagery in individuals with AVHs. Given the inconsistent findings reported about the relationship between mental imagery and AVHs in the scientific literature, the current review examined on (1) imagery assessment tools used in this population and (2) the relation between different mental imagery aspects in all sensory domains (i.e., emotional and non-emotional mental imagery) and AVHs. The third aim was to integrate the outcomes of this systematic review in a model of different mental imagery domains and their related imagery assessment tools used in AVHs, to help future researcher and clinicians by evaluating different aspects of mental imagery in AVHs or other populations with psychiatric problems. The included studies used a range of assessments methods to assess different aspects of mental imagery, suggesting that there is a lack of agreed theoretical conceptualisation of mental imagery and AVHs. Suitable measures of

mental imagery in psychosis are limited. Overall, the reviewed studies showed that non-emotional mental imagery does not seem related to AVHs, whereas emotional mental imagery is. This conclusion is in line with earlier findings in other populations with mood and anxiety disorders (di Simplicio et al., 2016; Ji et al., 2019).

4.1 | Non-emotional mental imagery and AVHs: Findings

According to our newly proposed imagery assessment model, assessments used in the scientific literature studying non-emotional mental imagery and AVHs measure (1) cognitive stages of non-emotional mental imagery, (2) non-emotional mental imagery proneness (QMI and SUI) or (3) domain specific aspects of non-emotional mental imagery, such as vividness of non-emotional mental imagery (VVIQ). These latter two aspects of non-emotional mental imagery appear unrelated to AVHs (e.g., Auvinen-Lintunen et al., 2021). Affective symptoms might be negatively associated with non-emotional mental imagery (Auvinen-Lintunen et al., 2021). The results are in line with results of Bell and Halligan (2010) using the VVIQ in a non-clinical population with high and low schizotypy levels, showing that the vividness of non-emotional mental imagery was not related to schizotypy levels. These results are not surprising considering earlier findings that non-emotional mental imagery appeared largely intact in individuals with psychiatric disorders and is not associated with mood and anxiety symptoms per se (di Simplicio et al., 2016; Ji et al., 2019).

Although the VVIQ and QMI both measure non-emotional mental imagery, the VVIQ specifically measures vividness of non-emotional mental imagery and the QMI addresses non-emotional imagery proneness across seven sensory domains. Studies assessing cognitive stages of non-emotional mental imagery are limited, used small sample sizes, different assessment methods (e.g., letter visualization task or object imagery task) and reporting contradictory findings and used small sample sizes. Two studies assumed that image inspection and image maintenance abilities are unaffected in individuals with AVHs hallucinations (Aynsworth et al., 2017; Böcker et al., 2000). Findings about image generation are contradicting (Böcker et al., 2000; Evans et al., 2000). Difficulties with image generation might have implications for imagery focused therapies. Findings described above highlight the need for further research into the relation between imagery generation and therapy engagement. None of the studies have investigated image manipulation in AVHs. Ba et al. (2022) investigated image manipulation with mental rotation tasks in a small study sample of individuals with different stages of the psychotic disorder. This study revealed that image manipulation was impaired in individuals with a first episode psychosis or chronic psychosis as compared to healthy individuals or individuals with a mood or anxiety disorder. Ba et al. (2022) suggests that this impaired image manipulation might reflect difficulties with mental spatial imagery, which could explain problems with theory of mind in individuals with psychosis. Furthermore, the results of the included studies that assessed cognitive stages of non-emotional mental imagery revealed that cognitive stages are more impaired when individuals have hallucinatory experiences in multiple domains (Aynsworth et al., 2017; Böcker et al., 2000). This is in line with findings of enhanced cognitive impairment in more severe psychotic symptoms (Fett et al., 2020; Sheffield et al., 2018). The stages of cognitive non-emotional mental imagery are somehow related to cognitive functioning in general (Pearson et al., 2013). Surprisingly, none of the included studies corrected their findings for general cognitive functioning or for the severity of psychotic symptoms. This is a severe limitation of these studies given that cognitive deficits are observed in individuals with AVHs and are associated with the severity of symptoms (Fett et al., 2020; Kanchanatawan et al., 2018). Indeed, this would be an important issue for future research to address. Another limitation of the reviewed studies that assessed non-emotional mental imagery is that some of the studies (Auvinen-Lintunen et al., 2021; Böcker et al., 2000; Evans et al., 2000) claim that mental imagery is not related to AVHs. This is particularly relevant to mention as these studies base this conclusion on tests assessing non-emotional imagery proneness and tasks measuring image generation, inspection and maintenance, while this does not say anything about the relationship between emotional mental imagery and AVHs.

4.2 | Emotional mental imagery and AVHs: Findings

Studies into the assessment of emotional mental imagery and AVHs are rare. To date, there is one study showing that individuals with

both hallucinations and delusions experience disabling intrusive images (Morrison et al., 2002). Indeed, lower levels of affective symptomatology were associated with enhanced likelihood of generated prospective positive mental imagery in individuals with psychosis and AVHs (Laing et al., 2016). These findings are in line with studies assessing emotional mental imagery in delusions (Lockett et al., 2012; Malcolm et al., 2015; Schulze et al., 2013). Indeed, these results also support findings of di Simplicio et al. (2016) and Ji et al. (2019), suggesting that the presence of emotional imagery appears especially important for the understanding of psychopathology across mental disorders.

4.3 | Treatment of emotional mental imagery and AVHs: Findings

Research into mental imagery treatment for individuals with AVHs mainly focussed on traumatic memories using imagery rescripting techniques. Interventions targeting trauma related emotional mental imagery in participants with AVHs show promising results. Targeting trauma related emotional mental imagery appeared to reduce distress associated with the image (Clarke et al., 2022; Ison et al., 2014), affective symptoms, aspects of emotional mental imagery (such as frequency of trauma intrusions, vividness of these images) and the severity (Clarke et al., 2022) of psychotic symptoms (Croes et al., 2014; de Bont et al., 2016; Paulik et al., 2019; van den Berg et al., 2013; van den Berg & van der Gaag, 2012). This is in line with findings in delusions (Morrison, 2004; Newman-Taylor et al., 2020; Serruya & Grant, 2009; Taylor et al., 2020). The studies focusing on delusions exclusively work with traumatic memories but targeted also emotional mental images associated with the delusions in their treatment approaches. Moreover, different imagery treatment techniques were used, such as metacognitive imagery techniques in addition to imagery rescripting techniques. Future research is required to investigate the feasibility and effectiveness of different imagery interventions for mental imagery associated with AVHs.

4.4 | Introducing a new model: Linking to hypotheses about mental imagery and psychosis

The findings of this study suggest that especially questionnaires measuring emotional mental imagery could provide meaningful information about a possible link between mental imagery and AVHs and contribute to elaborating on theoretical hypothesis mentioned in the introduction, e.g., the cognitive concepts hypothesis of Schulze et al. (2013), the continuum hypothesis of Morrison (2001) or both. To explore these hypotheses, we feel that exploring temporal relationships between both quality of imagery and associated appraisals as well as effect on emotion and behaviour might provide more insight. This might lead to the development of a new hypothesis, possibly incorporating both two existing theoretical hypotheses, that better explains this relationship between mental imagery and AVHs.

4.5 | Limitations

The findings of the current study need to be interpreted with caution due to the following limitations. Overall, there is limited research into non-emotional and emotional mental imagery in individuals with AVHs. Most of the studies are underpowered, which complicates the conclusion about a possible relationship between different aspects of mental imagery and AVHs. Another complicating factor is the lack of clear distinction between emotional and non-emotional mental imagery measures and possible overlap between them, leading researchers to draw inaccurate conclusions. This lack of clear distinction between emotional and non-emotional mental imagery measures also complicated our ability to compare outcomes of the included studies and to evaluate the relationship between mental imagery and AVHs. We proposed a model clarifying the distinction between non-emotional and emotional mental imagery summarizing appropriate measures for the different domains of mental imagery (Figure 2). Future studies could take these limitations into account and should focus on different aspects of mental imagery, using appropriate assessment tools according to our model (Figure 2), in individuals with AVHs.

5 | CONCLUSION

Taken collectively, emotional mental imagery appears associated to AVHs. Due to the lack of suitable emotional imagery measures, the precise nature of a possible relationship with different aspects of problematic emotional mental imagery and AVHs, as yet, is difficult to explore. Future studies should focus on measuring different aspects of emotional mental imagery related to AVHs. This in turn will allow us to further explore both theoretical hypotheses about the relationship between mental imagery and AVHs, the cognitive concepts hypothesis and the continuum hypothesis, which ultimately might allow for an update of current cognitive models, cognitive behavioural therapy and related therapy protocols for individuals with AVHs using imagery techniques. Also, studies investigating the overlap and distinction between emotional and non-emotional mental imagery are warranted. Moreover, there is an urgent call for the development of an assessment tool of emotional mental imagery and its related aspects in AVHs.

AUTHOR CONTRIBUTIONS

Conceptualization: Hella Janssen, Karin C. van den Berg, Ger P. J. Keijsers and Machteld C. Marcelis. **Methodology:** Hella Janssen. **Investigation:** Hella Janssen. **Data extraction:** Hella Janssen and Karin C. van den Berg. **Writing—original draft preparation:** Hella Janssen. **Writing—review and editing:** Karin C. van den Berg, Georgie Paulik, Katherine Newman-Taylor, Christopher D. J. Taylor, Craig Steel, Ger P. J. Keijsers and Machteld C. Marcelis. **Visualization:** Hella Janssen. **Supervision:** Georgie Paulik, Katherine Newman-Taylor, Christopher D. J. Taylor, Craig Steel, Ger P. J. Keijsers and Machteld C. Marcelis.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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