Flinders University

The Effects of Drawing on Memory for Traumatic Events: Implications for Professional Practices

By

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Summary

Arts-based interventions are commonly used in many professional practices with people who have experienced traumatic events. For example, *drawing* is used to facilitate communication and event recall in forensic, clinical, and therapeutic settings. Although there is little empirical research examining the effects of visual image creation on post-trauma symptoms it is often claimed that artmaking helps alleviate such symptoms. One theory for how visual image creation may reduce unwanted post-trauma outcomes is based on the dual-representation theory of posttraumatic stress disorder (PTSD). By this theory visual-motor tasks (akin to drawing) can interfere with the cognitive resources required to consolidate unwanted trauma-specific memories (i.e., intrusions – a key diagnostic criterion of PTSD). Given that drawing is a known *voluntary* memory enhancer, it is surprising that studies that have examined its effects on memory have not considered its effects on *involuntary* memory. My thesis drew upon several related but distinct areas of research to fill this gap in the literature. My thesis evaluated the effects and possible underlying mechanisms of change for arts-based interventions in the treatment of trauma, by measuring the effects of post-event drawing on both voluntary event recall and involuntary intrusions.

Chapter 1 introduces the dual-representation theory of PTSD which is used throughout my thesis as a possible underlying mechanism of change for arts-based interventions in the treatment of trauma. Several potential moderators of the effects of visual-image creation (i.e., drawing) on event recall and intrusions are also considered, including task timing (*immediate* versus *delayed* drawing) and task focus (*event-focused* drawing versus *non-event focused* drawing). Each moderator addresses an important practical implication regarding the use of post-trauma drawing.

Chapter 2 provides a systematic review and meta-analysis of the efficacy of *visual* arts-based interventions in the treatment of trauma by focusing on research from the popular

field of arts therapy. Database searches identified 21 randomised controlled trials (RCTs; *N* = 868) that met strict inclusion criteria. Both *PTSD-specific* outcomes (e.g., intrusions, avoidance, hyperarousal) and *non-PTSD* specific outcomes (e.g., depression, quality of life) were examined, along with several potential moderators (age, diagnosis type, trauma type, intervention instruction, control type, therapy mode, and therapy duration). Regression analyses indicated that arts therapy was effective in reducing PTSD specific outcomes in children but not in adults. For those who had experienced acute traumas (e.g., combat related trauma, sexual abuse), non-PTSD specific outcomes such as depression reduced. Moreover, visual-image creation appeared to be effective for enhancing positive non-PTSD specific outcomes, such as quality of life, relaxation, and enjoyment in group-based arts therapy. Nonetheless, none of the studies in the meta-analysis measured the effects of visual-image creation on intrusions—the main focus of my thesis.

Chapter 3 reports a systematic review and meta-analysis of the effects of *drawing* on memory relative to *verbal-only* methods of communication (i.e., "talk only" interviews). Database searches unearthed 36 RCTs (*N* = 2013) examining the effects of drawing-based interventions on event memory. The memory outcome measures were *amount* and *accuracy* of information reported, as well as *inaccuracy* (i.e., number of errors, confabulations). Several potential moderators were also considered (age, event type, control type, task timing); two other moderators of interest were not assessed due to a paucity of studies (i.e., event focus, task focus). Drawing enhanced the amount and accuracy of information reported, but did not reduce errors, or confabulations, relative to verbal-only controls. These results were not affected by any of the moderating factors. Importantly, none of the studies identified in the database searches had measured the effects of drawing on intrusions—the main focus of my thesis.

Chapter 4 reports three experiments that were the first to specifically test the effects of drawing versus verbalising on both event recall and intrusions, using the trauma-film paradigm as an analogue trauma. The voluntary memory outcomes were *amount* and *accuracy* of information reported, as well as *inaccuracy* (i.e., number of *errors*, *confabulations*). To fill the gap identified in my two previous chapter reviews, involuntary memory outcomes were also measured (i.e., *intrusion frequency* and *distress*). Two potential moderators were also examined (i.e., task timing, task focus). In Experiment 1 (n = 60), *immediate event-focused* drawing failed to enhance event recall across 3 consecutive days and sponsored *more* intrusions 24-hrs after participants watched the trauma film. In Experiment 2 (n = 60) *delayed* event-focused drawing had no effect on any of the memory outcomes, relative to verbal control. Though Experiment 3 (n = 28) did not obtain full samples, trends in the data suggest that immediate *non-event focused* drawing may reduce the accuracy of voluntary event recall but appears to have little impact on intrusions.

Chapter 5 reports a mixed-method thematic analysis that explored the relationship between the qualitative details of participants' trauma-film drawings (i.e., those collected in my experiments; n = 51) and their quantified memory scores. Four drawing *themes* were coded and analysed (i.e., verbal-contextual, visual-perceptual, detailed-realistic, simple-naïve), together with the number of traumatic elements depicted in each drawing. The results showed that it was the inclusion of verbal-contextual details (i.e., numbers, arrows, words), and not visual-perceptual details (i.e., shattered glass, blood, crying) that was associated with *fewer* intrusions. There was no evidence that the representational quality of drawings (i.e., detailed-realistic vs. simple-naïve) related to memory for the event. However, the greater the number of traumatic elements drawn, the greater the subsequent voluntary memory score (i.e., amount of information reported, accuracy).

Chapter 6 assessed the feasibility of measuring both event recall and intrusions for a drawing intervention performed during an *autobiographical* memory interview. Participants shared a negative and/or stressful experience after being randomly allocated to either an event-focused draw+talk (n = 6), non-event focused draw+talk (n = 6) or talk-only interview condition (n = 5). Verbal transcripts were coded for *amount* of information reported during interview (i.e., word count), and participants then performed an *intrusion* task in which their involuntary memories of the shared event were measured via keyboard presses. Trends in the data suggested that non-event focused drawing might increase the amount of information reported in interview but might also increase the likelihood of experiencing unwanted intrusions post-interview, relative to the other conditions. Despite the non-significant findings (perhaps due to small sample size), a full-scale study examining the effects of drawing on autobiographical *voluntary* and *involuntary* memory using the chosen methodology appears feasible —and would inform best practice for the use of drawing during memory interviews.

In summary, my thesis provides an important step in examining the possible underlying mechanisms of change for arts-based interventions in the treatment of trauma. My studies indicate that there can be negative consequences to immediately drawing post-trauma. Adverse effects may occur whether participants draw the target event or something unrelated to it (i.e., comfort drawing), potentially even when drawing occurs long after the trauma. Importantly, my studies invite an important conversation in the research community on the need to build the evidence base for best practice for the use of drawing on memory following traumatic experience, both for event recall and intrusion development— a conversation with important implications for the use of arts-based interventions in professional practices.

Declaration

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed GAMaddox

Date 25.08.23

Acknowledgement of Country

Flinders University acknowledges the Traditional Owners and Custodians of the lands on which its campuses are located, these are the Traditional Lands of the Arrernte, Dagoman, First Nations of the South East, First Peoples of the River Murray & Mallee region, Jawoyn, Kaurna, Larrakia, Ngadjuri, Ngarrindjeri, Ramindjeri, Warumungu, Wardaman and Yolngu people.

We honour their Elders past, present, and emerging.

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find a prouder mum. We can start to steal back some of that time we lost to long days and late nights. I can now keep my promise and take you on a holiday!

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Author Note

Throughout my thesis I use the pronoun “we” and/or the determiner “our” when discussing the empirical studies to reflect the collaboration between myself and co-authors. Importantly however, this thesis reflects my original and novel contribution to knowledge, having taken the principal role in the conceptualisation, design, programming, data analyses, experimental write up, as well as manuscript preparations, submissions, and revisions. In addition, I acted as Chief Investigator on all studies included in this thesis. As such I was responsible for all project management including, but not limited to, recruitment, ethics applications, pre-registration, and final manuscript submissions.

List of Publications

Maddox, G. A., Bodner, G. E., Christian, M. W., & Williamson, P. (2023). A systematic and meta-analytic review of the effectiveness of visual art therapy for traumatic experiences. *Clinical Psychology & Psychotherapy* [Revise & Resubmit].

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Maddox, G. A., Bodner, G. E., & Balzan, R. P. (2023). The effects of drawing on memory and wellbeing in an interview context: A feasibility study. [Manuscript prepared]

List of Conference Proceedings

Maddox, G. A., Bodner, G. E., Christians, M. W., & Williamson, P. (2022, July 13) *Australasian Brain & Psychological Sciences Meeting.* Drawing on Memory: A systematic and meta-analytic review, The University of Queensland, Brisbane.

Maddox, G. A., Bodner, G. E., Christians, M. W., & Williamson, P. (2022, June 16). *College of Counselling Psychologists Conference: Working with Complex Mental Health & Diversity.* A meta-analytic review on the effectiveness of visual art therapy for trauma. Melbourne.

Maddox, G. A., Bodner, G. E., & Balzan, R. P. (2023, April 12-14). *Experimental Psychology Conference.* Gauging the Effects of Post-Event Drawing on Memory for a Traumatic Event. The Australian National University, Canberra.

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Chapter 1: General Introduction

Arts-based interventions are commonly used with vulnerable populations that have experienced traumatic events. We need look no further than the media to see examples of how arts-based activities, such as drawing, are employed to help people express, communicate and work through traumatic experiences. Examples include the 9/11 terrorist attacks in New York (Duerson, 2012), the war in Syria (BBC, 2018), the bushfire crisis in Australia (ABC, 2020), the COVID-19 pandemic (Gaulkin, 2020) and most recently the war in Ukraine (Morrow, 2022). Indeed, drawing is used to facilitate event recall in forensic, clinical, and therapeutic professional settings (see Mattison & Dando, 2020). Previous research has confirmed that drawing is a powerful facilitator of memory retrieval (for review see Driessnack, 2005; see also Maddox et al., 2023). Experimental studies have illustrated that given the opportunity to draw, participants report more accurate information about the event in question relative to only talking about their experience (e.g., Butler et al., 1995; Barlow et al., 2011; Otgaar et al., 2016; Patterson & Hayne, 2011; Strange et al., 2003), or writing it down (Krackow, 2011; Matsuo & Miura, 2017). The memory benefits of post-event drawing have been detected both with children (see Driessnack, 2005 for a meta-analytic review; see also Maddox et al., 2023) and with adults (Dando, 2013; Dando et al., 2009; Matsuo & Muira, 2017). Importantly, drawing has been found to enhance memory whether drawings are created *immediately* following an event or after a long *delay* (e.g., from 1 day to 1 year; see Butler et al. 1995; Bruck et al., 2000; Gardner et al. 2020; Gross & Hayne, 1999; Katz & Hershkowitz, 2010). It is therefore no wonder that drawing is used by many professions including police, psychologists, counsellors, and art therapists (see Mattison & Dando, 2020).

Take, for example, a forensic or clinical interview wherein a person is invited to draw their experience after witnessing a car accident. Based on current research, we can be

relatively confident that this person would have enhanced and accurate recall of the car accident after drawing it (i.e., rather than having just talked about the event). Enhanced and accurate recall of the event is a favourable outcome, especially if their testimony of the car accident were to be later relied on in court. Further, based on current theory, in a therapeutic setting drawing the event may help this person process their trauma of the car accident. That is, some research suggests that visually depicting traumatic events can safeguard against unwanted memories (e.g., Hass-Cohen-Findlay, 2019; Spiegal et al., 2006; Talwar, 2007). Importantly, however, research has yet to fully examine this possibility.

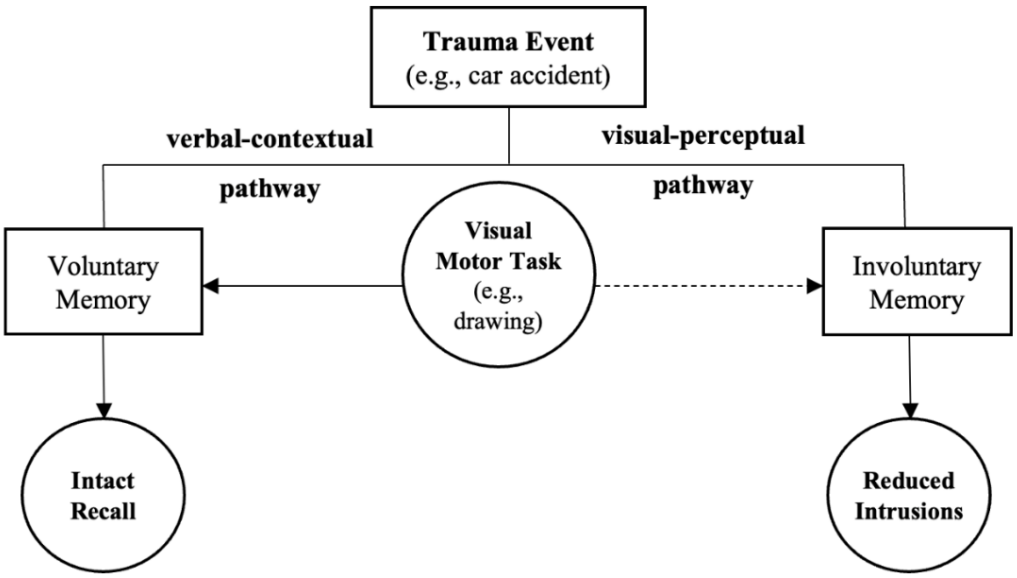
To date, studies examining the relative effects of drawing versus verbalising on event recall have focused solely on *voluntary* memory. Voluntary memories are wanted, intentional and purposefully brought into consciousness (Mace, 2008). But there is another type of memory that is prevalent following traumatic events, known as *involuntary* memory. Involuntary memories (unlike voluntary memories) are spontaneous, unintentional, automatic, and often unwanted (Mace, 2008). Also known as *intrusions,* and colloquially referred to as *flashbacks*, involuntary memories following traumatic events can be vivid, distressing, intrusive, image-based, and repetitive. In fact, intrusions are known to be a contributing factor in the development and maintenance of posttraumatic stress disorder (PTSD) and are recognised as a central characteristic of the disorder (APA, 2013).

The *dual-representation theory* of PTSD posits that memories following a trauma are encoded via two distinct memory systems. One system is theorised to encode, store, and retrieve memories via a predominately *visual*-perceptual pathway. Memories processed via this visual system are recalled involuntarily (i.e., intrusions). The other system is theorised to encode, store, and retrieve memories via a predominately *verbal*-contextual pathway. Memories processed via this verbal-contextual system are recalled voluntarily (i.e., consciously, deliberately; see Brewin et al., 1996). Research suggests such memories are

consolidated within a few hours following a traumatic experience (e.g., after approximately 6 hours; see Nader, 2003; see also McGaugh, 2000). During the initial consolidation phase our memories are considered malleable (e.g., able to be altered, disrupted, or modified), but after this consolidation phase, for a time, our memories are theorised to become stored, stable, and less likely to be easily modified (Mace, 2005; James et al, 2015; Brewin, 2014). That is, until such time as they are reactivated and again go through another consolidation phase, a process known as *reconsolidation* (James et al., 2015). Interestingly, studies have suggested that performing *visual*-motor tasks during the initial memory consolidation phase (e.g., immediately after a trauma) can interfere with the visual-perceptual processing pathway. The same pathway responsible for intrusion development. In turn, this interruption may lead to a reduction in trauma-related intrusions, thus safeguarding against the development of PSTD; dubbed a "cognitive vaccine" (see Holmes et al., 2010). Figure 1.1 illustrates the process of disrupting the visual cognitive pathway, during memory consolidation, using *drawing* as the visual-motor task.

Figure 1.1

Illustration of Proposed Memory Outcomes Following a Drawing Task



Note. Left: drawing task will not interfere with verbal-contextual pathway leaving voluntary event recall intact. Right: drawing task will interfere with visual-perceptual pathway thereby reducing involuntary memory intrusions.

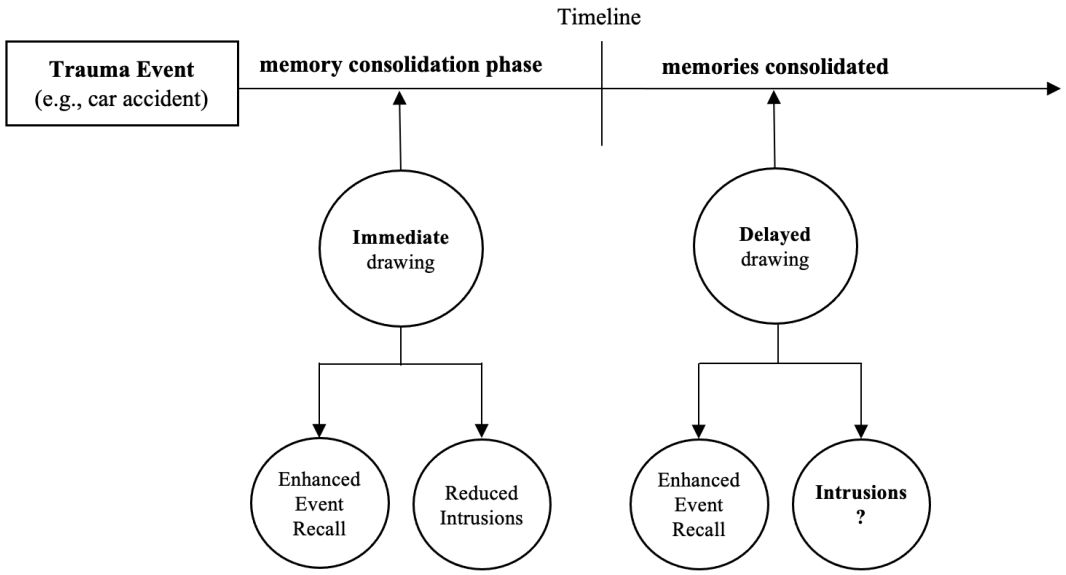
Post-event drawing has yet to be investigated as a visual-motor task for reducing intrusions. Drawing may reduce intrusions via the same underlying mechanisms of change as other well researched "cognitive vaccines". Based on the dual-representational theory of PTSD (see Brewin et al., 1996; see also Holmes & Bourne, 2008) intrusion reduction may occur due to the drawing task causing cognitive interference. That is, drawing as a visual-motor task might interfere with the *visual*-perceptual processing required to store involuntary memories, thereby safeguarding against the possible intrusion development (see Figure 1.1; see also Holmes, 2010). However, drawing is a known voluntary memory enhancer (see Wammes et al., 2019) and as such it may also facilitate conceptual processing, rather than interfering with it (as per dual coding theory; see Brewin et al., 1996). Importantly however, drawing is not theorised to interfere with the *verbal*-contextual processing pathway. The pathway required to consolidate voluntary memories (as per Figure 1.1), thus leaving

deliberate and conscious event recall intact (for review see Brewin, 2014; see also Krans et al., 2009).

Based on the timeline for memory consolidation, the effectiveness of a drawing task for reducing intrusions following a traumatic event may depend on when the task is performed. Previous studies have examined the effects of visual-motor tasks (akin to drawing) when they are performed during or immediately after witnessing a trauma. Specifically, drawing may need to be performed *during* the period of memory consolidation to interfere and/or compete with the cognitive resources required for involuntary memory processing (for review see Brewin, 2014; see also James et al., 2015). And yet, drawing is often applied as an intervention long after initial exposure to a traumatic event (e.g., 9/11, Syrian War, Ukrainian War). Figure 1.2. illustrates how *task timing* may influence the effect of drawing on voluntary and involuntary memory.

Figure 1.2

Drawing by Task Timing



Note. Based on theoretical models of PTSD (e.g., Brewin et al., 1996).

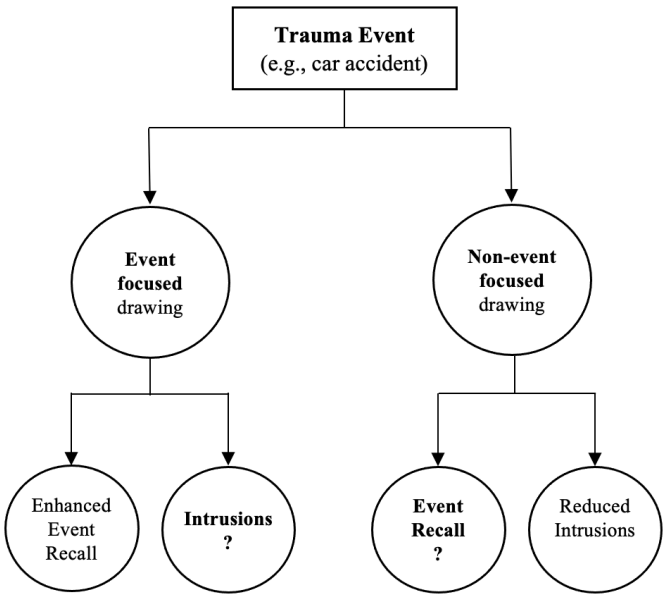
As illustrated in Figure 1.2 (left to right), after witnessing a trauma event (e.g., *car accident*) an immediate drawing task (i.e., performed *during* memory consolidation) may enhance event recall while reducing intrusions; after which, the memories would be consolidated. A delayed drawing task (i.e., performed *after* the memory consolidation period) might enhance event recall, but its effects on involuntary memory remains unknown.

Similarly, the effectiveness of drawing for reducing intrusions following traumatic events may be moderated by the focus of the drawing task. Previous studies have examined the effects of *non-event focused* visual-motor tasks on intrusion reduction. For example, playing Tetris after witnessing a traumatic event, relative to performing a verbal task has also been shown to reduce intrusions while leaving voluntary memory intact (for review see Brewin, 2014, Krans et al., 2009). However, *event-focused* tasks such as mentally reimaging the traumatic event have been shown to have no impact on intrusions (see Hagenaars & Arntz, 2012). In addition, although event-focused drawing has been found to enhance voluntary memory accuracy, non-event focused drawing might impair event recall. That is, drawing something unrelated to the target event, colloquially known as "comfort drawing" is also used in forensic, clinical, and therapeutic settings to divert attention away from the difficulty of reliving the to-be-remembered trauma (Bekhit et al., 2005; Malchiodi, 1998, as cited in, MacLeod et al., 2016). Very few studies have examined the effects of non-event focused drawing on subsequent event recall and have obtained mixed results (e.g., MacLeod et al., 2016; Poole & Dickson, 2014). Thus, more research is needed to understand how non-event focused (i.e., comfort drawing) may interfere with event recall and intrusions. In addition, more research is needed to examine whether drawing functions as a sensory/perceptual task, thereby inhibiting the encoding of traumatic memories, or acts more simply, as a visual task that helps facilitate recall of traumatic events. Figure 1.3 illustrates

how task focus (i.e., event-focused vs. non-event focused) may influence the effect of drawing on voluntary and involuntary memory.

Figure 1.3

Drawing by Task Focus



Note. Left: *event-focused* drawing task will enhance voluntary event recall, but its effect on involuntary memory intrusions is unknown. Right: *non-event focused* drawing task may reduce involuntary memory intrusions, but its effects on voluntary event recall is unknown.

In sum, drawing has been identified as a useful tool for eliciting voluntary event recall during police eyewitness interviewing (Dando et al., 2009; Mattison et al., 2016; Otgaar et al., 2016), psychological assessments (Veltman & Browne, 2002; Woodford et al., 2015) and therapeutic interventions (Clements, 1996; Cohen-Yatziv & Regev, 2019; Shouten et al., 2019). Drawing may be an effective, inexpensive, and already commonly used tool to enhance accurate event recall, while reducing unwanted intrusions following traumatic events. And yet the effects of post-event drawing on involuntary memory intrusions following trauma remains unverified. Given drawing is already widely used to facilitate recall following traumatic events (see Mattison & Dando, 2020), and considering its well-

established effects on voluntary memory (for review see Driessnack, 2005; Maddox et al., 2023), my thesis sought to fill a gap in the literature. By examining the effects of post-event drawing on both voluntary event recall and involuntary intrusions, my thesis explores how best to measure the possible underlying mechanisms of change for arts-based interventions in the treatment of trauma. Next, I introduce the rationale for each of the studies that make up the 5 main chapters of my thesis.

Thesis Overview

On the effectiveness of visual arts therapy for traumatic experiences: A systematic review and meta-analysis

Given the popularity of arts-based interventions for helping people connect to their traumatic memories (see Hass-Cohen-Findlay, 2019; Spiegal et al., 2006; Talwar, 2007), I first broadly examined the efficacy of *visual arts* therapies in the treatment of trauma, with a focus on the possible underlying mechanisms of change. That is, I sought to uncover whether visual arts-based interventions might alleviate PTSD symptoms by reducing intrusions. Specifically, the act of creating a visual image may interfere with the cognitive resources required to consolidate unwanted intrusive memories. This first systematic review was intended to be a broad overview of the outcomes of visual arts-based interventions, in the hope of uncovering some theoretical support for the notion that visual image creation (e.g., drawing) could alleviate PTSD symptoms by reducing intrusions. Consequently, I evaluated previous reviews and conducted a meta-analysis on 21 eligible studies to examine the effectiveness of visual arts therapy following trauma. Through conducting this review, I encountered two main issues. First, there was a paucity of high-quality randomised controlled trials (RCTs). Second, the lack of standardised protocols made it difficult to operationalise arts therapy. By way of example, arts therapies were often inclusive of many non-visual image creation activities, such as dance, drama, poetry, music, and the like.

Isolating the unique effects of visual-image creation following trauma, and the potential underlying mechanisms of change (i.e., intrusion reduction), proved difficult. Consequently, while this review provided an important benchmark for gauging the effectiveness of arts therapy in the treatment of trauma, it became clear that I needed to narrow the definition of an arts-based intervention to one that could be easily operationalised and examined. Accordingly, Chapter 3 provided a review of *drawing* and its effects on memory.

Drawing on Memory: A meta-analytic review

Drawing is just a picture created with simple tools, most traditionally pen, pencil, or crayon on paper. And yet, drawing is also commonly used to facilitate communication following traumatic events in settings such as forensic and clinical interviews (for review see Derkson & Connolly, 2022). In Chapter 3, I meta-analytically examined 36 eligible RCTs to determine how drawing affects memory relative to verbal-only methods of communication (e.g., "talk only" interviews). This review highlighted two main gaps in the literature.

First, there was a paucity of studies examining the effects of drawing on memory for *trauma-specific* events, even though most of the reviewed studies highlighted the usefulness of drawing for facilitating event recall following distinctly traumatic events (cf. Katz & Hamama, 2012; Katz & Hershkowitz, 2010). For example, Derksen and Connolly's (2022) review opened with a hypothetical scenario of a young child drawing alleged sexual abuse during a forensic interview. And yet, the research I uncovered examining the effects of drawing on memory following *trauma-specific* events was surprisingly scarce.

Second, I did not find any previous studies examining the effects of event drawing on *involuntary memory*. Consequently, although our review highlighted that drawing, relative to verbal-only methods of communication, can enhance *voluntary memory*, it became clear that research needed to examine the effects of drawing on intrusions—a contributing key criterion

of PTSD. Accordingly, Chapter 4 reported a set of experiments designed to specifically target this knowledge gap.

Gauging the effects of post-event drawing on memory for a traumatic event

Chapter 4 reports 3 experiments that examined whether drawing reduces intrusions while either improving or not impairing accurate event recall. Given the paucity of studies examining the effects of drawing on memory for trauma-specific stimuli, the involuntary memory literature was used to design these experiments (for review see Brewin, 2014). Despite trauma-specific stimuli being used to examine the effects of various visual-motor tasks on intrusion development (Brewin, 2014), drawing specific studies had yet to use the *trauma-film paradigm*.

The trauma-film paradigm provides an ethical analogue of a lived traumatic experience. In the trauma-film paradigm, participants watch a film that depicts distressing content (Holmes & Bourne, 2008). Various film themes had been used in the trauma-film paradigm, such as sexual assault, physical assault, and traffic accidents (Arnaudova & Hagenaars, 2017). Typically, these themes are selected based on the trauma criterion (e.g., actual or threatened death, serious injury or sexual violation) required for a diagnosis of PTSD (APA, 2013; Arnaudova & Hagenaars, 2017). Importantly, the use of trauma film events allowed me to measure the effects of drawing on memory in a controlled setting, and thus to make causal inferences (Arnaudova & Hagenaars, 2017).

Across 3 experiments, I tracked the effects of an *event-focused* and *non-event focused* draw versus *verbal* task on both voluntary and involuntary memory over 3 consecutive days, using the trauma-film paradigm. The experiments were designed to capture both the *accuracy* and the *amount* of information produced when remembering the target event (i.e., voluntary memory). Importantly, the experiments were also the first to gauge the effects of drawing on intrusion *frequency* and *distress* using trauma-specific stimuli (i.e., involuntary memory). In

Experiment 1, the drawing versus verbal task was *event-focused* and occurred *immediately* after viewing a trauma film (see Figure 1.1). In Experiment 2, the event-focused tasks were performed after a 24hr *delay* (see Figure 1.2). And in Experiment 3, the drawing task was changed to be *non-event focused* (see Figure 1.3).

Next, we broadened our research by conducting a mixed-method thematic analysis to examine the relationship between the qualitative elements of the drawings obtained in our experimental studies and subsequent memory outcomes.

What do drawings reveal about later recall and intrusions for a traumatic event? Insights from a mixed-method thematic analysis

Drawings can provide a richness of information regarding cognitive processes and memory outcomes, with recent advances in innovative research tools making the study of sketches simpler. Chapter 5 reports a mixed-method thematic analysis that explored the relationship between participants drawings of the trauma-film and their subsequent event recall and intrusion development. Informed by the dual-representation theory of PTSD (Brewin et al., 1996) and using indictive thematic analysis, drawings obtained in the experiments reported in Chapter 4 were coded for themes using NVivo 12 software. Themes were categorised as verbal-contextual, or visual-perceptual. Representational quality was categorised as detailed-realistic, or simple-naïve and examined, as previous studies had unearthed a relationship between the quality of participants drawings and their later memories performance (i.e., Butler et al., 1995; Gross & Hayne, 1999). The relationship between the number of traumatic elements drawn and subsequent memory was then examined. Thus, Chapter 5 analysed the association between qualitative aspects of participants drawings and their quantitative memory outcomes (i.e., event recall and intrusions). This mixed method study provided some unique insight into the potential underlying mechanisms of change driving the efficacy of arts-based interventions following trauma.

The experiments outlined in Chapter 4 and 5 filled an important gap in the literature, but they may have lacked ecological validity. Indeed, there has been criticism of lab-based studies that use video or live/staged events rather than personal experiences to measure the effects of drawing on memory (e.g., Deeb et al., 2021). However, since the *accuracy* of participants' memories for personally experienced events cannot be determined, an examination of *both* lab-based studies (where the to-be-remembered events are controlled) and autobiographical events was warranted. Still, the reviews reported in Chapters 2 and 3 highlighted that only 5 studies had examined the effects of drawing on memory for autobiographical events (see Deeb et al., 2021; Gross & Hayne, 1998; Katz & Hershkowitz, 2010; Salmon et al., 2003; Wesson & Salmon, 2001), and none of examined drawings effect on intrusions. Accordingly, in Chapter 6, I designed and conducted a feasibility study on the effects of drawing on autobiographical event recall and intrusions.

The effects of drawing on memory and wellbeing in an interview context

In Chapter 6, I report a feasibility study that examined the effects of drawing on autobiographical memory, including both event recall and intrusions. In keeping with the lab-based experiments in Chapter 4, I examined these effects under 3 distinct conditions: event-focused drawing, non-event focused drawing, and verbal debriefing. Importantly, our Chapter 6 study allowed us to examine these effects in a more ecologically valid way (c.f., trauma-film paradigm; see Chapter 4; Maddox et al., 2023). Indeed, only a few studies have examined the effects of drawing following personal traumatic experiences, focusing on *autobiographical* voluntary memories such as sexual abuse (Katz & Hamama, 2012; Katz & Hershkowitz, 2010) or other emotionally laden events (MacLeod et al., 2013; Wesson & Salmon, 2001; Salmon et al., 2003).

In our Chapter 2 review meaningful inferences could not be made regarding the effectiveness of visual arts-based interventions (e.g., arts therapy) on involuntary memory as

only 3 of these reported intrusion subscales from PTSD specific measures (e.g., from the PTCI, PCL, IES-R). Thus, the feasibility study reported in Chapter 6 was the first to examine how the effects of drawing negative/stressful personal experiences could specifically measure later intrusion development as the key variable of interest. Importantly, given the already common application of drawing during interviews, the feasibility study aimed to help build the evidence base for best practise in the use of drawing as an autobiographical memory aid following negative/stressful experiences (i.e., in eye-witness testimony, arts therapy, psychological assessments).

In summary, across 5 studies, I reviewed and meta-analysed the current evidence-base and empirically tested the effects of drawing on both voluntary and involuntary memory. The first study reports a systematic and meta-analytic review that examined current evidence for the use of arts-based interventions in the treatment of trauma. The second study reports a systematic and meta-analytic review that focused on the effects of *drawing* on memory following traumatic events. The third study reports a set of lab-based studies designed to examine the effects of drawing on both voluntary and involuntary memory using the trauma-film paradigm. The fourth study broadened my investigation to report a mixed-method thematic analysis of the drawings obtained in the previous experimental studies. The final study examined the feasibility of measuring the effects of drawing on event recall and intrusions for negative and/or stressful autobiographical events.

Chapter 2: On the effectiveness of visual arts therapy for traumatic experiences: A systematic review and meta-analysis

Author contributions. I conceptualised the study, including design, method, search strings, coding, analyses, and pre-registration. As a second independent reviewer is required on all meta-analytic reviews, I employed the assistance of Matt W. Christian as the second author on the project. Matt W. Christians role was to independently screen, based on the inclusion and exclusion criteria provided, all articles captured in my searches. Since this was my first meta-analysis, I sort the guidance of statistical expert Paul Williamson. Paul Williamsons role was to evaluate whether I had correctly conducted the analyses using Comprehensive Meta-Analyses (CMA) software. Last, Glen E. Bodner was my principal supervisor at the time the study was conducted, and as such he provided critical revisions on my drafts prior to submission.

Author Note. The authors declare no conflicts of interest. The research was not funded. The project was preregistered at Open Science Framework.

Abstract

Arts therapy is a popular intervention used to work through the effects of traumatic experience. We evaluate previous reviews and report a meta-analysis of the effectiveness of arts therapy following trauma for reducing symptoms of PTSD, enhancing positive outcomes (e.g., quality of life) and decreasing negative outcomes (e.g., depression). Database searches identified 21 (N = 868) randomised controlled trials (RCTs). Outcomes were categorised as PTSD-specific, positive non-PTSD specific, and negative non-PTSD specific. Several moderators were tested: age, diagnosis type, trauma type, intervention instruction, control type, therapy mode, and therapy duration. Overall, random-effects analysis indicated arts therapy was favoured relative to control for positive non-PTSD specific outcomes (g = 1.53, p <.001), but not for negative non-PTSD specific (p = .069) or PTSD specific outcomes *(*g = 0.89, p = .052). Regression analyses indicated that arts therapy was effective in reducing PTSD specific outcomes in children (Z = 2.81, df = 1, p = .005), positive non-PTSD specific outcomes in group-based arts therapy (Z = -2.40, df = 1, p = .016, I^2 = 57.33), and for reducing negative non-PTSD outcomes following acute traumas (e.g., combat related trauma or sexual abuse) (Q = 10.70, df = 3, p = .013, I^2 = 77.09). We highlight the need for additional RCTs and standardised protocols to address heterogeneity. Our review provides an important benchmark for gauging the effectiveness of arts therapy in the treatment of trauma.

Keywords**:** arts therapy; evidence-based interventions; general trauma exposure; PTSD; memory; meta-analysis

Introduction

Arts therapy is broadly defined as the use of "drawing, painting, and sculpture to help clients explore and express unconscious material that is often difficult to articulate in words" (ANZACATA, 2021). Arts-based interventions are commonly used with adults and children who have experienced trauma. For example, arts therapy has been used following traumatic experiences including sexual assault, violence, chronic illness, and exposure to terrorism and war (Cohen-Yatziv & Regev, 2019; Regev & Cohen-Yatziv, 2018; Schnitzer et al., 2021). It has been estimated that 70% of the global population will experience at least one traumatic event in their lifetime (Kessler et al., 2017), and approximately 1 in 11 people worldwide will develop posttraumatic stress disorder (PTSD) (APA, 2021). Individuals who develop PTSD exhibit principal symptoms such as avoidance, negative changes in cognition and mood, and variations in arousal and reactivity (Pai et al., 2017).

A distinguishing feature and crucial criterion for PTSD diagnosis is reexperiencing the traumatic event through involuntary memories, also referred to as *trauma-related intrusions* (Brewin et al., 1996). Trauma-related intrusions are often comprised of visual-mental images (Brewin et al.), leading some to suggest that visual-image creation (e.g., drawing, painting) can help PTSD sufferers access their traumatic memories (e.g., Hass-Cohen-Findlay, 2019; Spiegal et al., 2006). Visual-image creation during arts therapy appears to generate positive outcomes for trauma sufferers (e.g., enjoyment, coping, satisfaction), while reducing adverse outcomes (e.g., PTSD symptoms, depression, anxiety, stress; Schnitzer et al., 2021). Our review explores potential mechanisms through which visual-image creation might yield constructive outcomes in the treatment of trauma, and uses meta-analysis to quantify the therapeutic efficacy of visual arts therapy for traumatic experience.

Visual-Image Creation and Traumatic Memory

One theory of how arts therapy reduces PTSD symptomology is that visual-image creation helps *reconsolidate* traumatic memories (Hass-Cohen-Findlay, 2019; Spiegal et al., 2006; Schnitzer et al., 2021). Research suggests that memories of traumatic experiences are consolidated within the first few hours of an event (see Nader, 2003; see also McGaugh, 2000). Prior to consolidation these memories are malleable (e.g., can be altered, disrupted, or modified), whereas after consolidation they become stable and fixed. However, if a consolidated memory is reactivated it can enter a reconsolidation phase, during which the memory is again rendered malleable (Hass-Cohen, 2019; Nader et al., 2000; Smith, 2016). Trauma sufferers can then work to reconsolidate their traumatic memories in ways that reduce their PTSD symptomology (Hass-Cohen & Findlay; Smith, 2016).

The *dual-representation theory* of PTSD posits that trauma memories are encoded via two distinct memory systems: verbal and visual-perceptual (Brewin et al., 1996; Hass-Cohen & Findlay, 2019). When individuals experience a trauma, aspects of the event that receive a high level of cognitive processing are stored in a verbally accessible memory system. Later, these aspects can be deliberately and voluntarily retrieved from memory. One form of visual-image creation, *drawing*, has been shown to enhance retrieval of voluntary memories relative to traditional talk-only interventions (e.g., counselling; for a review, see Driessnack, 2005). Consequently, drawing has been widely used to facilitate conscious, intentional recall of experienced traumatic events, such as in forensic and eyewitness interviews (Katz & Hamama, 2012; Mattison & Dando, 2020).

Other aspects of traumatic experiences are posited to be stored in a visual-perceptual memory system. Later, these aspects are typically recalled *involuntarily* (e.g., *trauma-related intrusions*; Brewin et al., 1996). Trauma-related intrusions (also referred to as *flashbacks*) are a distinguishing feature of PTSD and contribute to both the development and maintenance of

the disorder (APA, 2013). Unlike purposively retrieved voluntary memories (e.g., during therapy or investigative interviews), trauma-related intrusions are often unintentional, vivid, and distressing (Brewin et al., 1996). Visual image-creation during therapy is theorised to help individuals access involuntary memories due to the intuitive connection between the visual, sensory nature of both image creation and the trauma memory (Hass-Cohen & Findlay, 2019; Schnitzer et al., 2021; Schouten et al., 2015). Consequently, arts therapy may help individuals access, reconsolidate, and reduce trauma-related memories and PTSD symptomology, yielding positive outcomes (e.g., quality of life, enjoyment, coping). However, a quantitative evaluation of arts-based interventions in the treatment of trauma and the mechanisms underlying its efficacy has not been conducted. Our systematic review and meta-analysis filled this knowledge gap.

Previous Systematic Reviews

Since 2000, 12 systematic reviews have examined the therapeutic efficacy of arts therapy—each under a different constellation of inclusion and exclusion criteria (see Table 2.1). The number of included quantitative studies varied from 6 to 28 (mean = 14). As summarized in Table 2.1, although all 12 reviews included *high-quality* evidence (e.g., randomised controlled trials [RCTs]) (see Atkins et al., 2004), an important characteristic of 8 of these 12 reviews was their inclusion of *very low-quality* anecdotal studies (e.g., single case studies) and/or *low-quality* indirect studies (e.g., single pre-post study designs). For example, single pre-post comparisons are low quality because they can only reveal whether a treatment was more useful than the simple passing of time, not whether the treatment produced the observed changes. In terms of sample age, 7 of the 12 reviews included studies of either child or adult samples, 4 included only studies with adult samples, and 1 included only studies with child samples. In terms of diagnosis inclusion, 6 of the 12 reviews included all diagnoses, 3 focused on trauma, and the rest focused on specific groups (1 PTSD, 1 non-psychotic, 1

breast cancer). In terms of therapy type, 8 of the 12 focused on arts therapy, 4 included any creative arts therapy (e.g., drama, dance, music). Finally, 10 of the 12 specified the inclusion of both clinical and nonclinical samples.

Table 2.1

Previous Systematic Reviews of the Efficacy of Arts Therapy: Characteristics of Included Studies

Study	*k*	case study	no control	non-randomised	RCT	age	diagnosis inclusion	therapy inclusion	clinical	non-clinical
Reynolds et al. (2000)	17	x	x	x	x	all	all	any creative	x	x
Slayton et al. (2010)	28	x	x	x	x	all	all	art	x	x
Boehm et al. (2014)	13	-	x	x	x	adults	breast cancer	any creative	-	-
Maujean et al. (2014)	8	-	-	-	x	adults	all	art	x	x
Utley et al. (2015)	15*	-	-	-	x	all	non-psychotic	art	x	x
Shouten et al. (2015)	6	-	-	-	x	all	trauma	art	x	x
Ramirez (2016)	12	-	x	x	x	all	trauma	any creative	x	x
Regev & Cohen-Yatziv (2018)	27	-	x	x	x	adults	all	art	x	x
Baker et al. (2018)	7	-	-	-	x	all	trauma	any creative	x	x
Cohen-Yatziv & Regev (2019)	13*	-	x	x	x	child	all	art	x	x
Newland & Bettencourt (2020)	13	-	x	x	x	all	all	MBAT	x	x
Schnitzer et al. (2021)	7*	x	x	x	x	adults	PTSD	art	x	-
Present Study	19	-	-	-	x	all	trauma	art	x	x

Note. **Bold** = meta-analysis. *k* = number of quantitative studies included (* = number of quantitative studies when qualitative studies were included). *x* = inclusion of characteristic. – = absence of characteristic. *Any creative* includes drama, dance, poetry, play, and music therapy. MBAT = mindfulness-based arts therapy.

In the first of these reviews, Reynolds et al. (2000) noted that quality research in the field of arts therapy was lacking due to the use of inadequate study designs (e.g., single group pre-post comparisons, non-randomised controlled trials), resulting in the inability to be confident in the therapeutic efficacy of arts therapy for specific conditions. Reynolds et al. expressed the hope that, in time, enough high-quality empirical studies would emerge to enable meta-analysis. A decade later, Slayton et al. (2010) updated Reynold et al.'s review and concluded there was modest empirical support for the efficacy of arts therapy interventions across a range of disorders, symptoms, and ages. Nonetheless, they again noted the need for more high-quality studies.

The review by Maujean et al. (2014) was the first review to focus solely on RCTS, of which 8 were included. They reviewed the efficacy of arts therapy for various clinical and non-clinical samples (e.g., schizophrenia, cancer, disability). Arts therapy showed promise for most of these issues (except for psychotic disorders such as schizophrenia). Utley et al. (2015) included child samples but excluded psychotic disorders; their review comprised 15 RCTs. Their view was that meta-analysis was not feasible due to high levels of heterogeneity in the included studies, perhaps due to their inclusion of a wide range of disorders (e.g., depression, Alzheimer's disease, cancer). But their review suggested that arts therapy is a promising and cost-effective intervention with beneficial outcomes for a variety of mental health conditions.

Schouten et al. (2015) was the first systematic review to specifically evaluate the effectiveness of arts therapy for trauma. Schouten et al. included 6 RCTs that examined traumatised adults. However, some of the included studies examined combinations of arts therapy with other psychotherapies (e.g., cognitive therapy; see Volker, 1999)—thus the specific effects of arts therapy could not be isolated. Nonetheless, Shouten et al. reported effect sizes showing favorable outcomes on PTSD-specific measures (e.g., reexperiencing,

avoidance, arousal) in several of the included studies (see Henderson et al., 2007, Stok, 2007; Volker, 1999).

Ramirez (2016) focused on the therapeutic efficacy and underlying mechanisms of arts therapy in the treatment of trauma for military service members and veterans. This review expanded the definition of traumatic experience to include both clinical and non-clinical trauma samples that had "exposure to actual or threatened death, serious injury", as per the DSM-5 (APA, 2013). This broadened definition allowed inclusion of samples that had experienced war (e.g., veterans with combat-related PTSD), as well as chronic illness, sexual abuse, or other personal traumatic experiences. Ramirez concluded that arts therapy programs may reduce PTSD symptoms for veterans and military services members, particularly with early intervention. Ramirez's inclusion of a wide array of traumatic experience was not adopted in subsequent reviews, and was criticized by Schnitzer et al. (2021) though not on theory-based grounds. We adopted Ramirez's inclusion approach on the basis that the mechanisms underlying the effects of arts therapy should function similarly across traumatic experiences unless there are theory-based grounds to expect otherwise.

The next pair of reviews separately examined adults (Regev & Cohen-Yatziv, 2018) and children (Cohen-Yatziv & Regev, 2019), and separated the included studies by trauma type, rather than combining them into one *traumatic experience* category (cf. Ramirez, 2016). In addition, both reviews included low-quality studies. Both reviews demonstrated the potential benefits of arts therapy in the treatment of the target trauma. Although comparing the effects of arts therapy for different trauma types is promising, it is also worthwhile to combine them into one traumatic experience category, as per Ramirez (2016), until the evidence base is large enough to enable finer grained distinctions. Echoing Utley et al. (2015), Regev and Cohen-Yatziv suggested that meta-analysis might not be feasible due to heterogeneity across studies, and they again called for more robust research designs.

Baker et al. (2018) reviewed the effectiveness of a wide range of creative arts therapies (e.g., visual-arts, dance, drama, music) with a focus on PTSD-specific outcomes. Seven studies met their inclusion criteria, 4 of which examined visual-arts therapies. Despite the small number of included studies, Baker et al. concluded that visual-arts therapy may be effective for treating PTSD symptoms. Most recently, Schnitzer et al. (2021) focused on evaluating the efficacy of *visual* arts therapy for the treatment of trauma with a specific focus on PTSD symptomology. Creative therapies other than visual arts therapy were excluded, as per Baker et al. (2018), given that the mechanisms of change likely differ for visual-arts therapy than for non-visual creative therapies (e.g., dance, music). Adult samples with a clinical diagnosis of PTSD were examined on both PTSD-specific outcomes (e.g., reexperiencing, avoidance, arousal) and non-PTSD specific outcomes (e.g., quality of life, depression, satisfaction). Despite the repeated calls for evaluation of high-quality studies in other reviews, Schnitzer et al. included low-quality studies. Schnitzer et al. concluded that while evidence for the efficacy of arts therapy in the treatment of trauma appeared promising, more high-quality research is needed.

Previous Meta-Analytic Reviews

We are aware of only two published meta-analytic reviews on the effects of arts therapy (Table 2.1, bolded studies). Boehm et al. (2014), meta-analytically examined the efficacy of various creative arts therapies (e.g., visual-arts, dance, drama, music) on multiple outcomes (e.g., anxiety, depression, quality of life) across 13 studies of women with breast cancer, including low-quality studies (e.g., non-randomised). Creative arts therapies were suggested to be beneficial in anxiety reduction for these patients. Newland and Bettencourt (2020) meta-analytically examined the efficacy of mindfulness-based arts therapy (MBAT) in diverse samples (e.g., learning disability, cancer) on multiple outcomes (e.g., anxiety, depression, fatigue) across 14 included studies, including low-quality studies. MBAT

interventions were found to be promising in the treatment of varying psychological and/or physical conditions, but the researchers noted the need for more RCTs. In addition, Newland and Bettencourt only compared pre- to post-treatment single group effect sizes in their meta-analysis (e.g., within-subject effects), thus providing limited evidence on the efficacy of arts therapy relative to other treatments, or relative to the absence of a treatment.

Present Systematic Review and Meta-Analysis

Our systematic review and meta-analysis focused on the specific effects of visual-image creation (e.g., drawing) on PTSD-specific outcomes (e.g., trauma-related intrusions). To this end, we defined *visual arts therapy*, as "any creative process used to help participants explore and express traumatic experiences/events using the visual arts, including drawing, painting, and sculpture" (ANZCATA, 2020). Given the import role of imagery in PTSD, non-visual arts therapies were excluded (e.g., dance, drama, music; Schnitzer et al., 2021).

Arts therapy has been used for a wide array of potentially traumatic experiences, thus it is crucial to define the types of experiences included or excluded as a trauma. To this end, we started with a definition of trauma taken directly from the DSM-5 diagnostic criteria for PTSD (APA, 2013). Departing slightly from the APA definition, we omitted the clause stating that "witnessing does not apply to exposure through electronic media, television, movies, or pictures", to allow for the inclusion of trauma analogue studies (e.g., *trauma-film paradigm*; see Arnaudova & Hagenaars, 2017). With this definition, our review captured an array of studies examining traumatic experience, rather than being limited to studies examining clinical and sub-clinical PTSD-diagnosed samples (cf. Ramirez, 2016).

Importantly, our meta-analysis included only high-quality studies, due to the oft-cited criticism of low research quality in the field (e.g., Utley et al., 2015; Schouten et al., 2015; Schnitzer et al., 2021). Unlike previous trauma-focused reviews (see Schnitzer et al., 2021), we excluded case studies, single group pre-post, and non-randomised control studies. Only

posttest RCT comparisons between treatment and control conditions were meta-analysed (e.g., between-groups effects). To help isolate the effects of visual-image creation, when arts therapy was combined with another psychotherapy (e.g., cognitive behavioural therapy; CBT), the study was only included if the control comparison group was the combined comparator (e.g., arts therapy + CBT vs. CBT-only). We also included studies with child or adult samples (cf. Cohen-Yatziv & Regev, 2019; Regev & Cohen-Yatziv, 2018) given that the efficacy of arts therapy has not been hypothesized or shown to differ by age. However, we concur with previous researchers that conditions such as brain injury (as per Schouten et al., 2015) and schizophrenia (as per Utley et al., 2015) may affect visual memory irrespective of traumatic experience (e.g., visual hallucinations), therefore studies using these samples were excluded.

In some prior systematic reviews, researchers have explicitly noted that they did not conduct a meta-analysis due to concerns about the heterogeneity of studies (see Utley et al., 2015; see also Regev & Cohen-Yatziv, 2018). We contend that the extent of variation between studies is best quantified and evaluated statistically (e.g., using the I^2 statistic, see Higgins & Thompson, 2002). Conducting a meta-analysis also serves to benchmark and quantify issues of heterogeneity, as well as to identify potential moderators of the efficacy of arts therapy in the treatment of trauma. To that end, we separated outcomes into three sub-groups in our analyses: positive (e.g., quality of life), negative (e.g., depression), and PTSD-specific (e.g., intrusions).

There has also been some debate in the literature on the inclusion criteria for PTSD diagnosis (e.g., diagnosed, undiagnosed) and on the types of traumatic experience (e.g., chronic illness, sexual assault) (see Schnitzer et al., 2021). Therefore, our meta-analyses included PTSD symptom severity (PTSD-diagnosed, non-PTSD-diagnosed) and trauma type (e.g., chronic illness, sexual assault) as potential moderators.

A unique focus of our review was to examine the possibility that drawing and other types of visual-image creation might help individuals reconsolidate their traumatic memories. Although our meta-analysis focused on visual arts therapy, rather than other non-visual creative arts therapies, our included studies encompassed a range of creative modalities (e.g., sculpture, collage, painting). We therefore examined instruction type (drawing-specific vs. unspecified visual-image creation) as a potential moderating factor.

Waitlist and treatment-as-usual control groups provide weaker evidence for the efficacy of psychotherapies relative to active or placebo control groups (Locher et al., 2018). Therefore, control type (waitlist vs. active) was also examined as a potential moderator. Waitlist control groups most often consist of individuals who are aware they not receiving treatment and are assigned to *wait* for treatment (Gallin & Ognibene, 2012). Consequently, the waitlist control comparison is only informative if the therapy is more useful than the passage of time alone. Similarly, treatment-as-usual is only informative if the therapy is more useful than the absence of the specific treatment of interest.

Arts based interventions can be administered in group or individual one-on-one settings. Little is known about the influences therapy mode may have on trauma-related outcomes. On the one hand, expressing oneself verbally and/or artistically may be difficult in front of others. On the other hand, it has been suggested that group therapy provides an explicit remedy to the social isolation often experienced by trauma survivors, which in turn leads to beneficial psychological outcomes (Ford et al., 2009). Considering the possible unique effects of group therapy in the treatment of trauma, therapy mode (individual vs. group) was therefore examined as a moderating factor. Finally, duration of therapy (in minutes) was also assessed. These analyses enabled us to isolate and examine the effects of arts therapy relative to non-specific treatment effects common in all psychotherapies (e.g., therapeutic alliance, rapport, adherence to treatment protocols; see Chatoor et al., 2001).

Method

The current review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guide (PRISMA; Moher et al., 2009) and was registered with Open Science Framework. Database searches were restricted to SCOPUS and psycINFO for peer-reviewed studies allowing all relevant articles to be captured without producing an unmanageable catalogue, due to the oft cited phrase "the art of…" in academic literature and the term "ART" capturing antiretroviral therapy in medical databases (e.g., Medline). Cochrane was searched for published or pre-registered relevant systematic and meta-analytic reviews. Database searches were conducted between 9 and 25 February 2021 using the following search string:

"art* therapy" or "art* psychotherapy" or "drawing therapy" adjacent/within 10 words of "memory" or "recog*" or "recall" or recollect*" or "reminisce" or "remember" or "flashback" or "intrusion" or "trauma*" or "ptsd" or "posttraumatic"

Meta-analyses, systematic reviews, case studies and clinical trials were included in the initial search (see PRIMSA Flow Diagram, Figure 2.1). Additional literature searches were conducted by reference list *backward* and *forward* checking and citation searching of articles within the database search results. Records were managed using Endnote X4 software, including full text retrieval of articles and de-duplication.

Inclusion/Exclusion Criteria for Studies

The study inclusion/exclusion criteria were:

(a) Included a visual arts therapy intervention, as defined above, or an experimental design measuring the effects of one or more visual arts activities (e.g., drawing, painting); excluded studies that include "other" creative arts therapies (e.g., drama, movement, dance, music therapy);

(b) Included samples that had experienced a traumatic event, as defined above (no exclusions by age, gender, comorbidity of depression or anxiety); excluded samples with severe neurological comorbidity (e.g., traumatic brain injury) or other psychotic illness (e.g., schizophrenia);

(c) Included an active or non-active control comparison group, with random assignment (e.g., treatment-as-usual or waitlist); excluded non-experimental designs (e.g., correlational or survey design, case studies, single-group interventions);

(d) Included arts therapy interventions informed by theory (e.g., Trauma-Focused Arts Therapy, Solution-Focused Arts Therapy, Mindfulness-Based Arts Therapy); excluded studies that did not have a control comparison condition that allowed the effect of the visual arts therapy to be isolated from other interventions (e.g., if arts therapy was combined with CBT, the control comparison group must be CBT only);

(e) Included statistics with enough information to calculate the effects of the visual arts therapy intervention/activity relative to control on psychological outcome measures; excluded studies that did not include enough information to calculate effect sizes, and where the authors could not deliver such details through email follow-up;

(f) Included studies that implemented visual arts therapy interventions/activities in group and/or individual sessions, irrespective of number of sessions or session durations so long as they were reported (e.g., 1-hour weekly group session for 3 weeks);

(g) Included primary, empirical studies (i.e., not literature review, book chapters); excluded articles that provided narrative and/or theoretical reviews of arts therapy;

(h) Included only studies published in English.

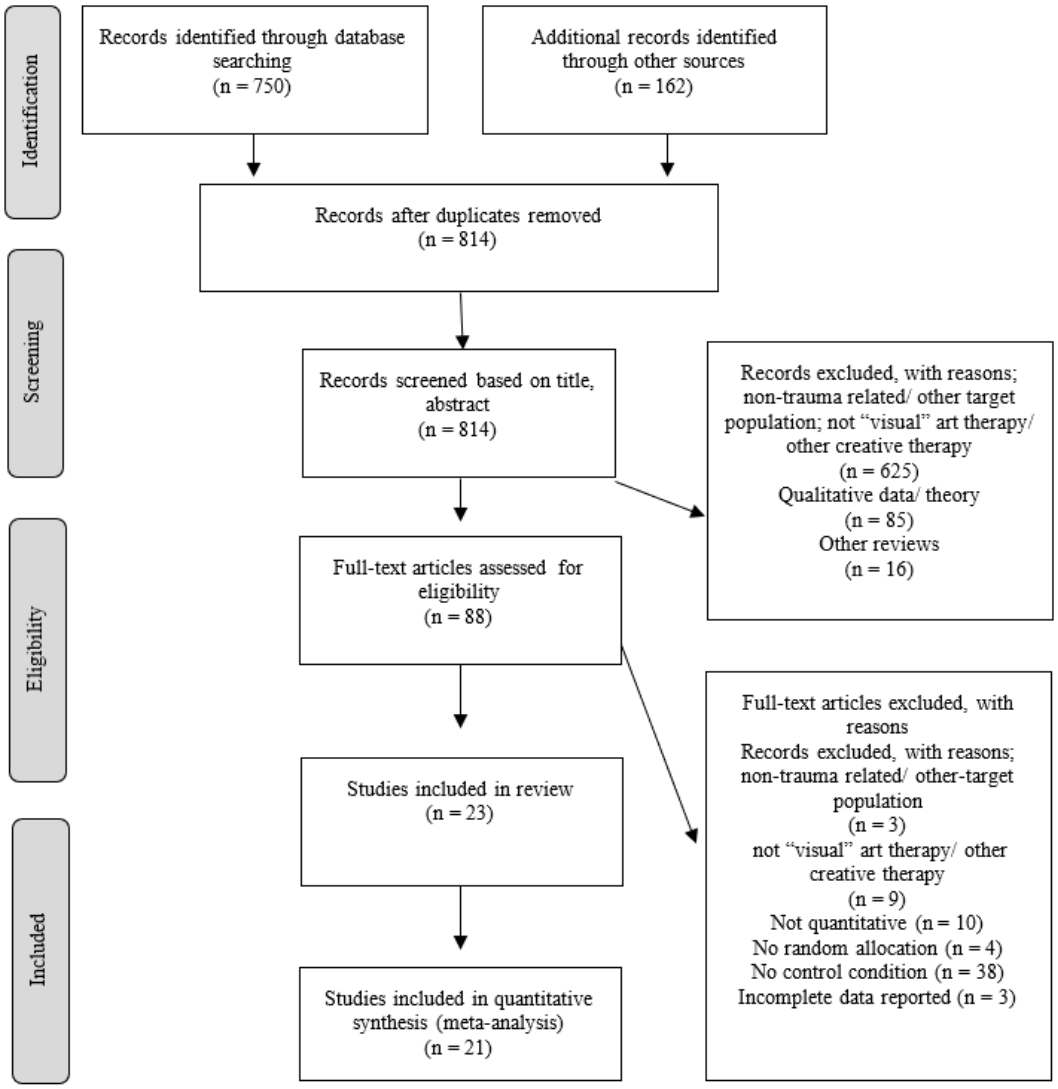
Selection Process

In Step 1, the title, abstract, and keywords for articles from the search results were screened by the first author using the inclusion/exclusion criteria. Articles not meeting the

criteria were removed, and any uncertainties were discussed and resolved with the third author. In Step 2, full-text searches were conducted by screening the articles using the inclusion and exclusion criteria. The third author screened a random 20% of the full-text articles and any discrepancies were discussed and resolved. The most common reasons for exclusion were: (1) not being a visual arts therapy, (2) not including the relevant target population of individuals with PTSD or other experiences of trauma, or (3) no control comparison condition (see Figure 2.1).

Figure 2.1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Flow Diagram of the Studies Included in the Review



Data Extraction Process

Details about the publication, method, and statistics were recorded in a spreadsheet. The data extraction and coding process was conducted by two researchers, each of whom read the full text of included studies and extracted the required information. Where key information was missing (e.g., sample size, statistics for calculating effect size) researchers attempted to contact author(s) by email. One author returned our request for additional data which was then included in our final analysis (see Decker et al., 2018).

Outcome measures were allocated to the following 3 categories: positive non-PTSD specific, negative non-PTSD, and PTSD-specific and intrusion subscales were also examined on their own. Categorisations were made by the first author and were then reviewed by the third author. Positive non-PTSD specific refers to any outcome measure where an *increase* of the outcome measure indicated positive effects of arts therapy (e.g., quality of life). Negative non-PTSD specific refers to any outcome measure where a *decrease* of the outcome measure indicated positive effects of arts therapy (e.g., depression), and PTSD-specific outcomes refers to outcomes measured using a standardised PTSD assessment, such as the posttraumatic cognitions inventory (PTCI; see Foa et al., 1999), posttraumatic checklist (PCL; for example, see Weathers et al., 2013), and the impact of events scale-revised (IES-R; see Weiss & Marmar, 1997). Intrusions/reexperiencing subscales were extracted from 2 published studies (see Erickson, 2008; Gul &Irshad, 2018). Six additional publications also took measures that included intrusions subscales, but did not publish the subscale data, and attempts to obtain this additional information were unsuccessful from all but one author (see Campbell et al., 2016).

A random-effects meta-analysis was conducted using Comprehensive Meta-Analysis Software (Borenstein et al., 2013). Hedge's g was the reported effect size, as it is recommended when sample sizes are small or non-equivalent. The effect of each visual arts

intervention/activity on each PTSD and non-PTSD-related outcome measure was calculated, along with the 95% confidence interval. For studies with more than one control condition (e.g., CBT vs. attention control; see Broome et al., 2001) the effect sizes were calculated by comparing each control condition to the arts therapy intervention separately. The first measurement point after the intervention was used to calculate the effect size. If total composite scores were reported (e.g., SCL-90 total) they were used to calculate the overall effect size of the outcome measure. If only subscales were reported, they were each used to calculate the effect sizes for the outcome measure (e.g., Kopytin & Lebedev, 2013). Moderators coded for analysis were: diagnosis type (PTSD-diagnosed vs. non-PTSD-diagnosed), trauma type (e.g., chronic illness, combat, sexual assault), instruction type (drawing-specific vs. unspecified visual-image creation), control type (active vs. waitlist), therapy mode (group vs. individual), and duration of therapy.

Publication Bias Assessment

The first and third authors assessed each study using the Cochrane risk-of-bias tool for randomised trials (RoB2) to check for potential bias in the selected studies (Sterne et al., 2019). The overall risk of bias (see Table S1) is based on the accumulative scores from each researchers' independent assessment on each of the 5 domains. Results of the assessment indicated that 19 studies had 'low' risk of bias and 2 studies had 'some concerns' of bias. Funnel plot and Egger's test were used to assess publication bias. Inspection of the funnel plot in Figure S1 identified one study as an outlier (Joseph & Bance, 2020). Heterogeneity was very high when studies were combined across all outcomes (i.e., PTSD specific, positive/negative non-PTSD measures, $I^2 = 90.42$), even after removal of the outlier study ($I^2 = 86.21$) indicating considerable variation across studies (Higgins & Green, 2011).

Results

Study Selection

The searches yielded 253 records from SCOPUS, 313 from psycINFO, and 184 from Cochrane (Figure 2.1). Another 162 records were sourced through the grey literature search. Of these 910 records, exclusion of duplicates left 814 records. Screening for inclusion/exclusion based on title, abstract, and keywords (Figure 2.1) left 88 papers, which were then screened and assessed for inclusion/exclusion based on the full texts of the articles (see Figure 2.1 for initial reason for exclusion at this step). Full-text screening left 23 studies for quantitative synthesis and analysis (Tables 2 and 3), comprising 20 journal articles and 3 dissertations. Three studies used the same sample, and as such were counted as one study in all subsequent analyses (see Oster et al., 2006; Svensk, 2009; Thyme et al., 2009), allowing for 21 studies in our meta-analysis.

Study Characteristics

The 23 included studies were published between 1998 and 2020 (Tables 2 and 3) and included a total of 868 participants. In terms of participant characteristics, most studies used adult samples (k = 16), and the rest were split between child or child and adolescent samples (k = 7). Reported participant age ranged from 6-50+ years (M = 27.84, SD = 17.03), and the percentage of female participants ranged from 0-100% (M = 66.28, SD = 32.09). Only 7 studies examined populations with a clinical or subclinical PTSD diagnosis (Table 2.2).

Table 2.2 provides details of participants' trauma type, PTSD diagnosis, and PTSD specific and non-PTSD specific outcome measures (and the measurement instruments used). Most studies (k = 8; e.g., Henderson et al., 2007) involved participants with personal traumatic life experiences (e.g., death or suicide, physical abuse, witness to a traumatic event). The other most common trauma type examined was chronic illness (k = 8; e.g., sickle cell disease, HIV/AIDS, asthma, breast cancer). A few studies examined war and combat

related trauma (k = 3) or sexual assault (k = 2). Only 9 studies used outcome measures specific to PTSD symptomatology (e.g., PTCI, PCL, IES-R), and only 3 of these reported intrusion subscales. Some studies measured positive non-PTSD specific outcomes such as satisfaction, enjoyment, quality of life, coping, compassion, and spirituality (k = 13), though not all could be analysed. All but one study (Gul & Irshad, 2018) measured non-PTSD specific negative outcomes (e.g., depression, anxiety).

Table 2.2

Characteristics of Included Quantitative Studies: Diagnosis, Outcomes, and Measurement Tools

Study	Trauma Type	PTSD diagnosis	PTSD-specific outcomes	Positive non-PTSD related outcomes	Positive non-PTSD related instruments	Negative non-PTSD related outcomes	Negative non-PTSD related instruments
Beebe et al. (2010)	chronic illness (asthma)	no	no	quality of life, coping, resourcefulness, self-concept	PedsQL, HRQOL, FEATS, Beck Youth Inventory	disruptive behaviour, anger, depression, anxiety	Beck Youth Inventory
Broome et al. (2001)	chronic illness (sickle cell disease)	no	no	*Schoolagers' Coping Strategies Inventory, *Adolescent Coping Orientation for Problem Experiences	*SCSI, *A-COPE	emergency room visits, clinic visits, hospital admissions	Health Care Records
Birch (1998)	traumatic life experiences	no	no	meaningful, interesting	mood questionnaire (Pennebaker)	stress, negative affect, sadness, depression, anxiety, health	Mood Questionnaire (Pennebaker), Marlowe-Crowne-Taylor Manifest Anxiety Scale (MC-MAC), Student health records, tallies, and self-report questionnaires
Campbell et al. (2016)	combat related	yes	PTSD Checklist-Military Version (PCL-M)	*satisfaction	subjective rating (Likert Scale)	depression	Beck Depression Inventory- II (BDI-II)
Decker et al. (2018)	combat related	yes	PTSD Checklist-Military Version (PCL-M)	perceived treatment benefits	subjective rating (Likert Scale)	depression	Beck Depression Inventory- II (BDI-II)
Erickson (2008)	traumatic life experiences	no	Trauma Symptom Inventory (TSI)	*enjoyment	*self-report questionnaires	distress	OQ-45.2
Goodrazi et al. (2020)	sexual assault	no	*Impact of Events Scale-Revised (IES-R)	no	n/a	depression, anxiety, shame, guilt	Becks Depression Inventory-II (BDI-II), Beck's Anxiety Inventory (BAI), Personal Feelings Questionnaire (PFQ-II)

Gul & Irshad (2018)	traumatic life experiences	yes	PTSD Evaluation Scale Children and Adolescent Questionnaire (PTSD CAQ)	no	n/a	no	n/a
Henderson et al. (2007)	traumatic life experiences	yes	PTSD symptom severity (PDS)	*spiritual meaning	spiritual meaning scale (SMS)	depression, anxiety, physical symptoms, sick days, physician visits	Becks Depression Inventory-II (BDI-II), State Trait Anxiety Inventory (STAI), *Pennebaker Inventory of Limbic Languidness
Jang et al. (2016)	chronic illness (cancer)	no	no	health-related quality of life	European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30)	depression, anxiety	Personality Assessment Inventory (PAI)
Joseph & Bance (2020)	sexual assault	no	no	self-compassion	self-compassion Scale (SCS)	trauma-related shame	Trauma-related Shame Inventory (TR-SI)
Kopytin & Lebedev (2013)	combat related	yes	no	self-image, emotional content, mood, activity	silver drawing test, general condition activity mood test,	depression, anxiety	Depression Questionnaire, Integrative Anxiety Test (SCL-90)
Liu (2017)	traumatic life experiences	no	Child reaction to traumatic events scale-Revised (CRTES), Connecticut Trauma Screen (CTS)	no	n/a	sleep issues	Sleep Self Report (SSR)
Lyshak-Stelzer et al. (2007)	traumatic life experiences	yes	PTSD symptom severity (UCLA PTSD)	no	n/a	incident reports, seclusions, restraints	Clinical Charts
Monti et al. (2006)	chronic illness (cancer)	no	no	health-related quality of life	medical outcomes Short-Form Health Survey (SF-36)	depression, anxiety	Symptomatic Checklist (SCL-90)
Oster et al. (2006), Svensk (2009), Thyme at el. (2009)	chronic illness (cancer)	no	no	quality of life, positive self-image, coping	Coping Resources Inventory (CRI), Quality of Life (WHOQOL-BREF, EORTC), *Structural	depression, anxiety, negative self-image	Symptomatic Checklist (SCL-90), *Structural Analysis of Social Behaviour (SASB)

					Analysis of Social Behaviour (SASB)		
Pizarro (2004)	traumatic life experiences	no	no	satisfaction	self-report questionnaire	negative affect, social dysfunction, *stress, physical symptoms	Profile of Mood States (POMS), *Global Measure of Perceived Stress (GMPS), *General Health Questionnaire (GHQ-28), *Physical Symptoms Inventory (PSI)
Piasai et al. (2018)	chronic illness (cancer)	no	no	happiness, relaxation	self-report scales	stress	cortisol levels
Puig et al. (2006)	chronic illness (cancer)	no	no	*spirituality, emotional expression	*Expressions of Spirituality Inventory-Revised (ESI-R), *Emotional Approach Coping Scale (EACS)	mood disturbance	Profile of Mood States (POMS)
Rao et al. (2009)	chronic illness (HIV/AIDS)	no	no	no	n/a	anxiety, pain, nausea, tiredness	State Trait Anxiety Inventory (STAI), Edmonton Symptom Assessment Scale (ESAS)
Wang et al. (2015)	traumatic life experience (motor vehicle accident)	yes	Impact of Events Scale-Revised (IES-R), Clinician-Administered PTSD Scale (CAPS), Post-traumatic Growth Inventory (PTGI)	*optimism	*Life Orientation Test-Revised (LOT-R)	depression, anxiety	Hospital Anxiety and Depression Scale (HADS)

Note: * denotes outcome measure could not be analysed due to insufficient or unsuitable data.

In terms of the interventions used, Table 2.3 provides details on type of arts therapy intervention, duration of intervention, therapy mode and type of control comparison, including arts therapy and control group descriptions. A passive control condition such as waitlist, treatment as usual, or no treatment was more common (k = 12) than an active control condition such as, CBT, CPT, writing, or non-event focused drawing (k = 9). More studies used group therapy (k = 15) than individual therapy (k = 6). Various theoretical approaches to arts therapy were used, such as solution-focused arts therapy (Liu, 2017), compassion-focused arts therapy (Joseph & Bance, 2020), visual arts therapy combined with CPT (Campbell et al., 2016; Decker et al., 2018), trauma-focused arts therapy (Lyshak-Stelzer et al., 2007), and mindfulness-based arts therapy (Goodrazi et al., 2020; Jang et al., 2016). Most studies reported using *drawing* as the specific tool (k = 12), with the rest using other forms of visual-image creation (e.g., painting).

Most studies reported some information on intervention duration (Table 2.3). We report the average duration for arts therapy in minutes. If specific duration information was missing, it was estimated based on the available information. For example, if 1-hour sessions were reported over 16 weeks but no indication was made as to how many sessions were held per week, the calculation was based on the premise that one 1-hour session was held each week for 16 weeks (e.g., Lyshak-Stelzer et al., 2007). The mean intervention duration was 505.28 min (about 8.5 hours; SD = 346.90). The briefest intervention was 15 min over 3 consecutive days (Birch, 1998), and the longest was 60 min over 16 weeks (Lyshak-Stelzer et al., 2007).

Table 2.3

Characteristics of Visual Art Therapy Interventions and Comparison Control Condition Descriptions

Study	Intervention Type	Control Type	Therapy/Activity Description	Control Description	Duration	Therapy mode
Beebe et al. (2010)	arts therapy (n = 11)	waitlist (n = 11)	arts therapy tasks designed to encourage expression, discussion, and problem-solving	completed all evaluations at the same intervals as art therapy but did not receive the art therapy interventions.	60 min session, 1x per week, 7 weeks (420 mins)	group
Broome et al. (2001)	arts therapy (n = 19*, 7)	active (cognitive behavioural therapy, attention-control) (n = 9*, 14)	express feelings about pain and develop social skills using art	CBT relaxation for pain; or attention control (e.g., fun activities)	? mins per session, ? x per week, 4-6 weeks (45 mins)	group
Birch (1998)	drawing (n = 13)	2 active controls (write, draw) (n = 14, 9)	asked to draw or write while thinking of upsetting experience	draw for 15 minutes while instructed not to focus on problems	15 mins session, 3 consecutive days (600 mins)	individual
Campbell et al. (2016)	arts therapy +cognitive processing therapy (n = 5)	active (cognitive processing therapy) (n = 6)	based on personal PTSD triggers, participants created a visual trauma narrative	Cognitive Processing Therapy (CPT)	75 min session, 1x per week, 8 weeks (300 mins)	individual
Decker et al. (2018)	arts therapy +cognitive processing therapy (n = 16)	active (cognitive processing therapy) (n = 15)	Arts therapy protocol based on Campbell (2014), e.g., psychoeducation, goal setting, creating a sense of safety, creating and processing	Cognitive Processing Therapy (CPT)+psychotherapy	8 hrs CPT+ 8 hrs AT (960 mins)	group

Erickson (2008)	arts therapy (n = 14)	waitlist (n = 11)	Six different art projects, brief introductory and debriefing group discussions	completed all evaluations at the same intervals as arts therapy but did not receive the arts therapy interventions	60-90 min, 2x per week, 3 weeks (1080 mins)	group
Goodrazi et al. (2020)	mindfulness-based arts therapy (n = 8)	waitlist (n = 8)	draw how their body felt during a mindfulness exercise	no treatment	8 x 2 hr sessions, ? weeks (960 mins)	group
Gul & Irshad (2018)	structured sensory intervention for traumatized children + progressive muscular relaxation (n = 30)	no treatment (n = 30)	drawing and deep muscle relaxation to explore 'big' emotions	no treatment	? mins per session, 8-10 sessions, ? weeks (540 mins)	group
Henderson et al. (2007)	mandala drawing (n = 19)	active (n = 17)	draw a circle and then fill the circle with representations of feelings or emotions related to their trauma using symbols patterns, designs, and colours	day one draws a cup; day two draws a bottle; day three draws some pens	20 min session, 3 consecutive days (60 mins)	group
Jang et al. (2016)	mindfulness-based arts therapy (n = 12)	waitlist (n = 12)	mindfulness art such as self-image picture and mindfulness exercises like meditation	refrain from any art or mindfulness related activities	12 x 45 min sessions, 8 weeks (540 mins)	group
Joseph & Bance (2020)	compassion-focused arts therapy (n = 18)	waitlist (n = 18)	exploration of feelings through 13 modules of CVAT	received CVAT after experiment	60-90 min session, 2 x per week, 7 weeks (980 mins)	group

Kopytin & Lebedev (2013)	arts therapy (n = 62)	active (occupational therapy) (n = 50)	mainly drawing tasks but various arts-based therapies based on different therapeutic needs	occupational therapy	12-14 x 2.5 hr sessions, 4 weeks (1170 mins)	group
Liu (2017)	solution-focused arts therapy (n = 20)	treatment as usual (n = 20)	draw or make crafts to externalise their stress and goals in conjunction with other activities	same group activities except for art therapy	50 min sessions, 2 x per week, 6 weeks (600 mins)	group
Lyshak-Stelzer et al. (2007)	trauma-focused arts therapy (n = 14*)	active (arts & crafts) (n = 14*)	collage, drawing and arts-and-crafts making to depict life story and trauma-sharing	attention control (e.g., arts and craft activities)	60 min session, ? per week, 16 weeks (960 mins)	group
Monti et al. (2006)	mindfulness-based arts therapy (n = 56)	waitlist (n = 55)	mindful exploration of feelings through drawing	waitlist – received treatment after experiment	2.5 hr sessions, ? per week, 8 weeks (720 mins)	group
Oster et al. (2006) Svensk (2009) Thyme et al. (2009)	arts therapy (n = 20)	waitlist (n = 21)	process feelings and body-image during chemotherapy through arts therapies	received chemotherapy but no other intervention	60 min session, 1x per week, 5 weeks (300 mins)	individual
Piasai et al. (2018)	guided-imagination +drawing-storytelling (n = 20)	treatment as usual (n = 20)	30mins guided meditations, followed by 30mins drawing-storytelling	received chemotherapy but no other intervention	1 x 60 min session (60 mins)	group

Pizarro (2004)	drawing (n = 12)	active (write, draw) (n = 15, 14)	draw about a previous personal traumatic experience	write about a personal traumatic experience, or draw a still life	2 x 60 min sessions, ? weeks (120 mins)	individual
Puig et al. (2006)	arts therapy (n = 20)	waitlist (n = 19)	asked to draw on relevant traumatic experiences and complete a counselling session with creative arts therapy	received same treatment after the experiment	60-90 min session, 1x per week 4 weeks (280 mins)	individual
Rao et al. (2009)	arts therapy (n = 40)	active (video on art therapy) (n = 39)	completed arts therapy while being instructed by a therapist	viewed a one-hour long videotape on the uses of arts therapy	1x 60 mins session (60 mins)	individual
Wang et al. (2015)	creative arts program (n = 22)	waitlist (n = 24)	painting and drawing representations of themselves	no treatment?	40 min session, ? per week, 8 weeks (320 mins)	group

Note: If the sample size for each condition differed for reported outcome measures (e.g., UCLA: intervention n = 14, control n = 15, PRN: intervention n = 13, control n = 14) * denotes the mean sample size across the intervention and control condition.

Meta-Analyses

Random-effects analysis of variance was conducted on each outcome measure separately. Arts therapy appeared to be effective for positive non-PTSD specific outcomes (e.g., relaxation, enjoyment, quality of life; see Figure 2.2), $k = 8$, $g = 1.53$, *95% CI* [0.79, 2.28], $p < .001$. However, for negative non-PTSD symptoms the effect failed to reach significance ($p = .069$; see Figure 2.3). The same held true for PTSD specific outcomes ($p = .052$; see Figure 2.4), and meaningful inferences could not be made regarding the effectiveness of arts therapy on intrusions because subscale results were only reported in 3 studies ($k = 3$, $p = .352$). Heterogeneity was high across all outcome measures analysed and thus, several moderator analyses were conducted (Table 2.4; Higgins & Thompson, 2002). All subsequent sub-group analyses were tested with meta-regression using averaged effect sizes for studies where more than one outcome type was assessed. To account for valence of outcome, all effect sizes were coded so that a positive value indicated a beneficial effect for the visual arts therapy treatment.

Figure 2.2

Positive non-PTSD symptoms (Combined): Forest Plot for Art Therapy vs. Control

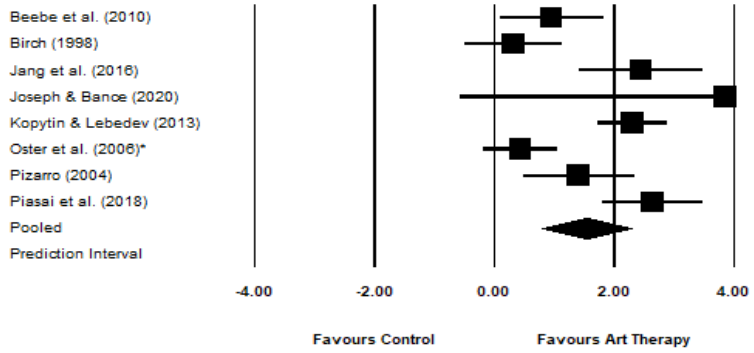


Figure 2.3

Negative non-PTSD symptoms (Combined): Forest Plot for Art Therapy vs. Control

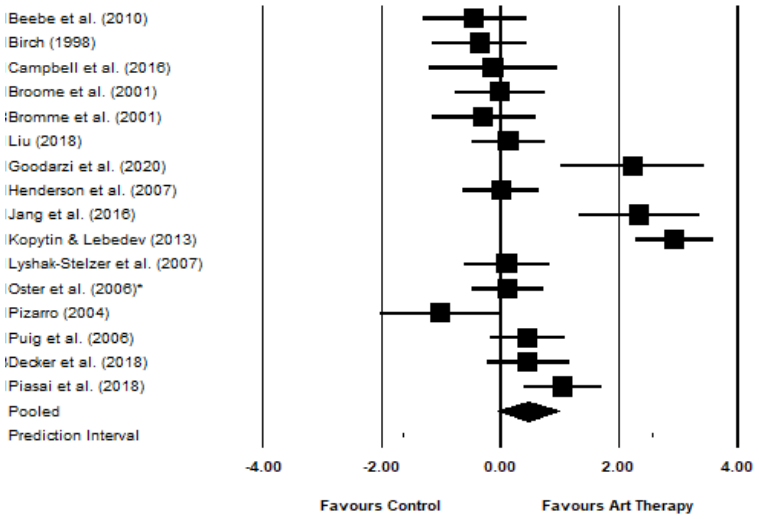


Figure 2.3

PTSD-specific symptoms (Combined): Forest Plot for Art Therapy vs. Control

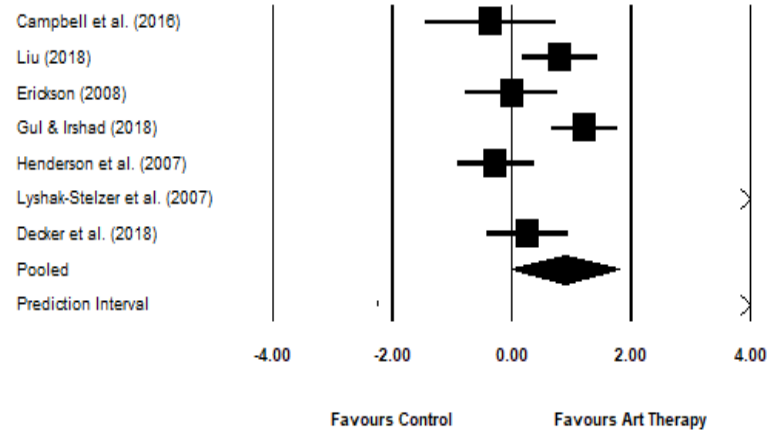


Table 2.4

Results from Random Effects Meta-Analysis of Arts Therapy vs. Control, including Hedge's g, Standard Error, 95% Confidence Intervals and I^2 Tests of Heterogeneity

No Moderator	***k***	***g***	***95% CI***	***p***	***I²***	***Z***
Arts Therapy vs. Control						
Positive non-PTSD specific outcomes only	8	1.53	0.79, 2.28	<.001*	82.55	4.06
Negative non-PTSD specific outcomes only	16	0.47	-0.03, 0.97	.069	85.78	1.81
PTSD specific outcomes	9	0.89	0.29, 1.84	.052	89.71	1.94
Intrusion subscales only	3	0.70	-0.77, 2.18	.352	92.70	0.93
PTSD Specific Outcomes	***k***	***g***	***95% CI***	***p***	***I²***	***Z***

Age						
Children	3	2.48	0.59, 4.37	.010*	93.91	2.57
Adults	4	-0.06	-0.44, 0.31	.722	0.00	-0.35
Diagnosis Type						
PTSD diagnosis (yes)	4	1.64	-0.06, 3.34	.059	93.38	1.89
PTSD diagnosis (no)	3	0.17	-0.49, 0.85	.034*	75.48	0.51
Trauma Type						
Chronic illness	-	-	-	-	-	-
Combat related	2	0.07	-0.51, 0.65	.805	0.00	0.24
Personal traumatic life experiences	5	1.32	0.11, 2.54	.033*	92.57	2.13
Sexual assault	-	-	-	-	-	-
Intervention Instruction						
Drawing specific instructions	4	1.72	0.22, 3.23	.025*	93.97	2.24
Other visual-image creation	2	-0.13	-0.75, 0.50	.689	0.00	-0.40
Control Type						
Waitlist	3	0.71	0.03, 1.38	.039*	68.72	2.07
Active	4	1.26	-0.56, 3.10	.175	93.82	1.35
Therapy Mode						
Individual	3	0.33	-0.26, 0.93	.268	44.01	1.11
Group	4	1.55	-0.09, 3.20	.064	94.42	1.85
Positive Non-PTSD Specific Outcomes	***k***	***g***	***95% CI***	***p***	***I²***	***Z***
Age						
Children	3	1.99	0.47, 3.50	.010*	75.97	2.57
Adults	5	1.35	0.43, 2.28	.004*	86.47	2.88
Diagnosis Type						
PTSD diagnosis (yes)	1	2.29	1.72, 2.87	<.001*	0.00	7.77
PTSD diagnosis (no)	7	1.39	0.60, 2.19	.001*	79.53	3.46
Trauma Type						
Chronic illness	4	1.35	0.25, 2.44	.015*	75.69	2.42
Combat related	1	2.29	1.72, 2.87	<.001*	0.00	7.77
Personal traumatic life experiences	2	0.83	-0.23, 1.90	.126	66.75	1.52
Sexual assault	-	-	-	-	-	-
Intervention Instruction						
Drawing specific instructions	3	1.36	0.13, 2.58	.030*	87.10	2.17
Other visual-image creation	4	1.35	0.25, 2.44	.015*	75.69	2.42
Control Type						
Waitlist	5	1.69	0.59, 2.79	.002*	83.33	3.02
Active	3	1.36	0.13, 2.58	.030*	87.10	2.17

Therapy Mode						
Individual	3	0.65	0.52, 0.03	.033*	44.98	2.13
Group	5	2.21	0.12, 1.44	<.001*	59.27	6.08
Negative Non-PTSD Specific Outcomes	***k***	***g***	***95% CI***	***p***	***I²***	***Z***
Age						
Children	6	0.14	-0.29, 0.57	.524	51.02	0.63
Adults	10	0.69	-0.07, 1.47	.078	89.90	1.76
Diagnosis Type						
PTSD diagnosis (yes)	4	0.86	-0.61, 2.35	.252	93.33	1.15
PTSD diagnosis (no)	12	0.31	-0.14, 0.76	.176	76.05	1.35
Trauma Type						
Chronic illness	7	0.34	-0.19, 0.88	.213	71.91	1.24
Combat related	2	1.43	-1.55, 4.42	.346	95.43	0.94
Personal traumatic life experiences	5	-0.11	-0.45, 0.23	.542	10.19	-0.61
Sexual assault	1	2.23	1.02, 3.44	<.001*	0.00	3.61
Intervention Instruction						
Drawing specific instructions	9	0.54	-0.22, 1.31	.164	89.74	1.39
Other visual-image creation	6	0.24	-0.46, 0.94	.502	76.10	0.67
Control Type						
Waitlist	7	0.76	0.12, 1.39	.020*	80.20	2.33
Active	9	0.22	-0.57, 1.01	.592	89.25	0.53
Therapy Mode						
Individual	7	0.06	-0.26, 0.39	.709	27.87	0.37
Group	9	0.86	0.02, 1.71	.045*	90.29	2.01

Note. * denotes $p < .05$. n = number of participants. k = number of studies.

PTSD-Specific Outcomes

Table 4 presents the random effects meta-analysis for all moderators by outcome. First, we assessed whether the effects of arts therapy differed according to age (children vs. adults, as per Utley et al., 2015) on PTSD specific outcomes. Our regression analysis found age to be a significant unique predictor of the effectiveness of arts therapy, $Z = 2.81$, $df = 1$, $p = .005$, in that, children ($g = 2.48$, $p = .010$) but not adults ($g = -0.06$, $p = .722$) had reduced PTSD symptoms following arts therapy. It is important to note that of the 9 studies that

reported PTSD specific outcomes, only 3 studies use children only samples, and as such any conclusions regarding age as a moderating factor need to be interpreted with caution. Second, we examined diagnosis type (as per Shouten et al., 2015; Baker et al., 2018). Despite a trend toward a large effect favouring arts therapy for PTSD-diagnosed samples, the result failed to reach significance (g = 1.64, p = .059). For non-PTSD-diagnosed samples, there was a significant small effect in favour of arts therapy relative to control (g = 0.17, p = .034; Table 4). However, our meta regression analysis did not identify diagnosis as a significant predictor of intervention efficacy, Z = 1.39, df = 1, p = .164. Third, only two trauma types could be analysed for PTSD specific outcomes, combat related (g = 0.07, p = .805) and personal life experiences (g = 1.32, p = .033). Despite the differences in effect sizes obtained, meta regression indicated that trauma type was not a significant unique predictor of arts therapy efficacy, Z = 1.09, df = 1, p = .273. Forth, intervention instruction was not a significant unique predictor of arts therapy efficacy, Z = -1.53, df = 1, p = .126, despite only drawing specific instructions resulting in a significant large effect when analysed in isolation (g = 1.72, p = .025). Fifth, regression analysis indicated the efficacy of arts therapy on PTSD specific outcomes was not moderated by control type (waitlist vs. active), Z = -0.70, df = 1, p = .486. Sixth, the benefits of arts therapy on PTSD specific outcomes were not moderated by therapy type, Z = -0.96, df = 1, p = .337. For most follow up subgroups analyses heterogeneity remained high (i.e., I^2 > 80.00) and thus some results regarding PTSD specific outcomes remain inconclusive (Table 4).

Positive non-PTSD Specific Outcomes

For positive non-PTSD specific outcomes (e.g., enjoyment, relaxation, improved quality of life) the same follow up subgroup analyses were run (Table 4). Positive non-PTSD outcomes were not moderated by age, Z = 0.70, df = 1, p = .481; diagnosis type, Z = 1.44, df = 1, p = .149; trauma type Q = 1.77, df = 2, p = .413; intervention instruction, Z = 0.01, df =

1, $p = .993$, or control type, $Z = 0.01$, $df = 1$, $p = .993$. However, the benefits of arts therapy on positive non-PTSD specific outcomes were moderated by therapy type, $Z = -2.40$, $df = 1$, $p = .016$, in that the effect was significantly larger for group-based therapy ($g = 2.21$, $p < .001$) than for individual therapy ($g = 0.65$, $p = .003$). Further, heterogeneity was markedly reduced for all positive non-PTSD specific subgroup analyses (i.e., $I^2 > 60.00$), allowing for more confidence in the results obtained.

Negative non-PTSD Specific Outcomes

For negative non-PTSD specific outcomes (e.g., depression, anxiety) the same follow up subgroup analyses were run (Table 4). Negative non-PTSD outcomes were not moderated by age, $Z = -1.10$, $df = 1$, $p = .272$; diagnosis type, $Z = 1.09$, $df = 1$, $p = .276$; intervention instruction, $Z = -0.51$, $df = 1$, $p = .612$, or control type, $Z = -1.57$, $df = 1$, $p = .115$. However, the benefits of arts therapy on negative non-PTSD specific outcomes were moderated by trauma type, $Q = 10.70$, $df = 3$, $p = .013$. In that, negative symptoms were more likely to be alleviated following arts therapy for those with personal traumatic life experiences, than for those with more acute trauma experience (i.e., combat related, sexual assault). Heterogeneity was again high for all negative non-PTSD specific subgroup analyses (i.e., $I^2 < 70.00$), reducing confidence in our results.

A final analysis examined whether duration of therapy in minutes was a unique significant predictor of arts therapy effectiveness (Table 2.3). More time in therapy was associated with more favourable outcomes, $Z = 4.17$, $df = 1$, $p < .001$, $I^2 = 74.76$ (Figure S2).

Discussion

Our systematic review and meta-analysis evaluated the therapeutic efficacy of visual arts therapy RCTs for treating individuals who have experienced trauma. In line with previous meta-analyses, we concur that the efficacy of arts therapy appears promising (Boehm et al., 2014; Newland & Bettencourt, 2020). The 21 eligible studies included in our

meta-analysis indicated arts therapy as the favored treatment relative to control for positive non-PTSD specific outcomes (e.g., enjoyment, relaxation, improved quality of life). However, contrary to our expectation, the efficacy of arts therapy for PTSD specific outcomes measures (e.g., reexperiencing, avoidance, arousal,) failed to reach significance (p = .052). In addition, despite a moderate effect in favour of arts therapy being detected for intrusion only subscales, this result also did not reach significance, perhaps due to a paucity of studies (k = 3). Nonetheless, for child populations, the effectiveness of arts therapy in the reduction of PTSD symptoms was evident, an area that warrants further investigation in future studies. For example, unlike talk-only therapies, arts therapy may promote creativity, playfulness, and curiosity, which in turn help children share traumatic experiences and result in a reduction in PSTD specific symptoms such as avoidance. Indeed, the suitability of arts-based interventions for children following trauma is well documented (Utley et al., 2015).

In line with our predictions, subgroup analyses revealed that arts therapy significantly increased positive outcomes and decreased negative outcomes (e.g., depression, anxiety, stress) across both PTSD clinical and non-clinical populations. However, a reduction in negative non-PTSD specific symptoms (e.g., depression, anxiety) was more likely following arts therapy for those with personal traumatic life experiences (e.g., car accident), than for those with more acute trauma experience (e.g., combat related, sexual assault) —justifying our broadening of the inclusion criteria to all types of traumatic experience, as per the DSM-5 (APA, 2013; see also Ramirez, 2016).

Our attempts to examine whether *drawing* instructions specifically lead to changes in PTSD-specific outcomes, especially for intrusion reduction, were inconclusive. Drawing-specific instructions did not yield significantly more favorable outcomes for PTSD specific outcomes than other non-specific forms of visual-image creation. Nonetheless, these results highlight the importance of providing clear protocols for the application of arts therapy, to

allow closer examination of how the specific processes involved in art making impact the treatment of trauma.

Control type was not a moderating factor for any of our subgroup analyses. Nonetheless, most comparisons suggested that arts therapy was more beneficial when compared to waitlist controls than active control conditions. These results highlight the importance of research design quality; passive control groups cannot provide strong evidence for the efficacy of arts therapy (Locher et al., 2018). Our findings leave open the possibility that arts therapy was simply more useful than waiting, abstaining, or even denying treatment. Further, our results did not provide evidence that arts therapy was more effective in the treatment of trauma than other therapies/activities (e.g., CBT, psychoeducation, craft activities; Table 2.3).

Arts therapy was more beneficial for enhancing positive non-PTSD symptoms (relative to control) in a group therapy setting than when applied in one-on-one therapy. The favorable outcomes obtained through arts therapy in a group setting may therefore be driven by non-specific treatment effects (e.g., enhanced therapeutic alliance and/or rapport due to social support and/or the sharing of traumatic experience within group interactions), rather than due to specific drawing-based mechanisms of change. Alternatively, arts therapy may have distinctive qualities that make it particularly well suited to enhancing positive non-PTSD specific outcomes in group settings, relative to one-on-one therapy—a possibility that warrants further investigation. For example, arts therapy, unlike talk-only therapies, may be more enjoyable for communicating traumatic personal life experiences due to its creative and playful attributes, which in turn may yield positive outcomes such as increased quality of life.

The amount of time spent in therapy was also found to be a unique predictor of arts therapy efficacy: More time engaged in arts therapy resulted in more positive outcomes. These positive outcomes may also be due to non-specific treatment effects rather than to

specific mechanisms of change unique to arts therapy (e.g., therapeutic alliance, rapport, adherence to treatment protocols). Such findings highlight the value of developing standardised arts therapy protocols for the treatment of trauma and PTSD. Arts-based interventions should be designed to allow treatment efficacy to be assessed and replicated.

Limitations and Future Directions

In general, our meta-analytic results must be interpreted with caution given the high levels of heterogeneity across studies, as others have indicated (e.g., Regev & Cohen-Yatziv, 2018; Utley et al., 2015). Despite our efforts to include only the gold standard of RCTs, firm conclusions regarding therapeutic efficacy cannot yet be drawn, owing to differences across the included studies (e.g., protocols, outcome measures). That is, due to small sample sizes and high heterogeneity, in some instances comparisons and conclusions may not be meaningful The issue of heterogeneity can only be resolved by increasing the high-quality research base on the effects of arts therapy for trauma. Nonetheless, the present study provides an important benchmark for gauging this progress. Future studies should also be sure to provide key information to enable their inclusion in future meta-analyses (e.g., means, standard deviations; see Table 2). We concur with previous researchers that more RCTs are needed (see Schnitzer et al., 2021), and we further recommend that active or placebo control comparisons be used to isolate the unique effects of arts therapy relative to non-specific treatment effects. Future research should also use standardised tests to measure and report outcomes, to facilitate comparisons across studies while also making it easier to replicate and extend studies.

There are theoretical reasons why visual-image creation may be effective for trauma sufferers, such as the reduction/reconsolidation of trauma-related memories. However, the absence of standardised protocols hampers establishing the reasons for the observed effects of arts therapy, which in turn might reduce its adoption in some therapeutic settings. More

studies of the underlying mechanisms of change unique to arts therapy in the treatment of trauma are needed—this important research gap is rarely discussed. Until the underlying mechanisms of arts therapy are established through research and used to develop standard protocols, issues surrounding the evidence base will continue to malign research in this area.

It has been suggested that the lack of consistency in the application of arts therapy is intentional and perhaps even appropriate given that arts therapy is known for its holistic approach (Bowen-Salter et al., 2021). However, we argue that providing standard arts therapy protocols will inform best practice and strengthen the evidence base, and that this need not undermine the unique individual therapeutic experience. If arts therapy is effective for trauma sufferers due to unique mechanisms of change, then these mechanisms need to be tested.

Conclusion

This meta-analysis comes more than two decades after being foreshadowed by Reynolds et al. (2000). Even after this long wait, the lack of high-quality RCTs on the effects of arts therapy remains an issue. Our study highlights the need for closer examination of the mechanisms by which arts therapy may uniquely aid in the treatment of trauma. We advocate for future studies to include active comparison groups using RCTs, and to carefully consider the unique role group-based therapy (relative to individual-based therapy) may play in the efficacy of arts therapy for trauma. We encourage the application of standardised outcome measures and sufficient data reporting for inclusion in future meta-analyses (see Schnitzer et al., 2021; see also Bowen-Salter et al., 2021). We further recommend that arts therapy protocols be manualised and validated to allow replication. Finally, we encourage researchers to develop testable accounts of the unique mechanisms of change thought to underlie the beneficial effects of arts therapy. Arts therapy continues to be a popular intervention for trauma sufferers, and as such it is imperative that researchers and practitioners work together to establish a strong evidence base and best practices for its implementation.

Supplementary Materials

Table S2.1

Summary of the Overall Risk of Bias for Included Studies using the Cochrane Risk-of-Bias Tool for Randomized Trials (RoB2)

Study	D1	D2	D3	D4	D5	Overall
Beebe et al. (2010)	-	+	+	+	+	-
Broome (2001)	-	+	+	+	+	-
Birch (1998)	+	+	+	+	+	+
Campbell et al. (2016)	+	+	+	+	+	+
Decker et al. (2008)	-	-	-	-	-	+
Erickson (2008)	+	+	+	+	+	+
Goodrazi et al. (2020)	+	+	+	+	+	+
Gul & Irshad (2018)	+	+	+	+	+	+
Henderson et al. (2007)	-	+	+	+	+	+
Jang et al (2016)	+	+	+	+	+	+
Joseph & Bance (2020)	+	+	+	+	+	+
Kopytin & Lebedev (2013)	+	+	+	+	+	+
Lyshak-Stelzer et al. 2007)	+	+	+	+	+	+
Liu (2017)	+	+	+	+	+	+
Monti et al. (2006)	+	+	+	+	+	+
Oster et al. (2006)	+	+	+	+	+	+
Paisai (2018)	-	-	-	-	-	+
Pizarro (2004)	-	+	+	+	+	+
Puig et al (2006)	+	+	+	+	+	+
Rao et al. (2009)	+	+	+	+	+	+
Wang et al. (2015)	+	+	+	+	+	+

Domains:

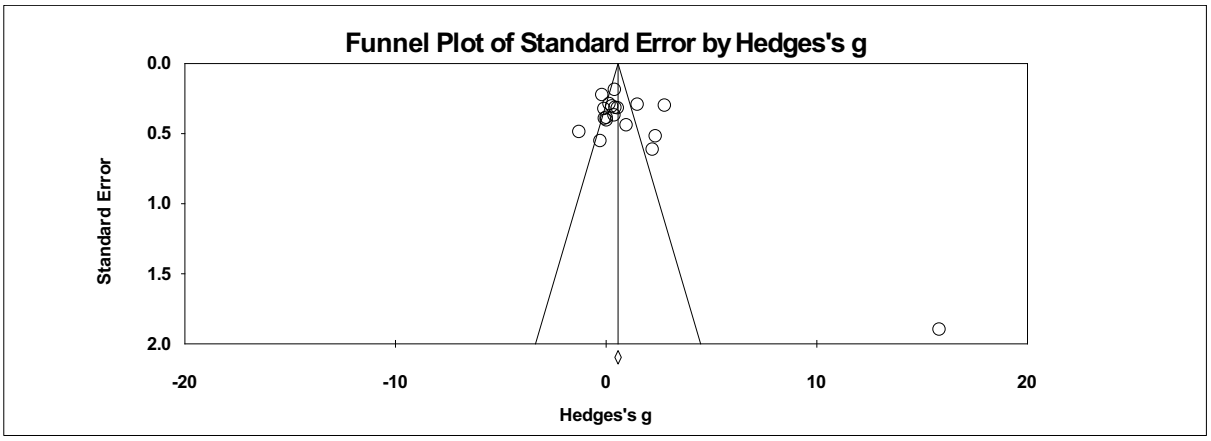
D1: Bias arising from the randomisation process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reporter result.

Judgement

- some concern
+ low concern

Figure S2.1

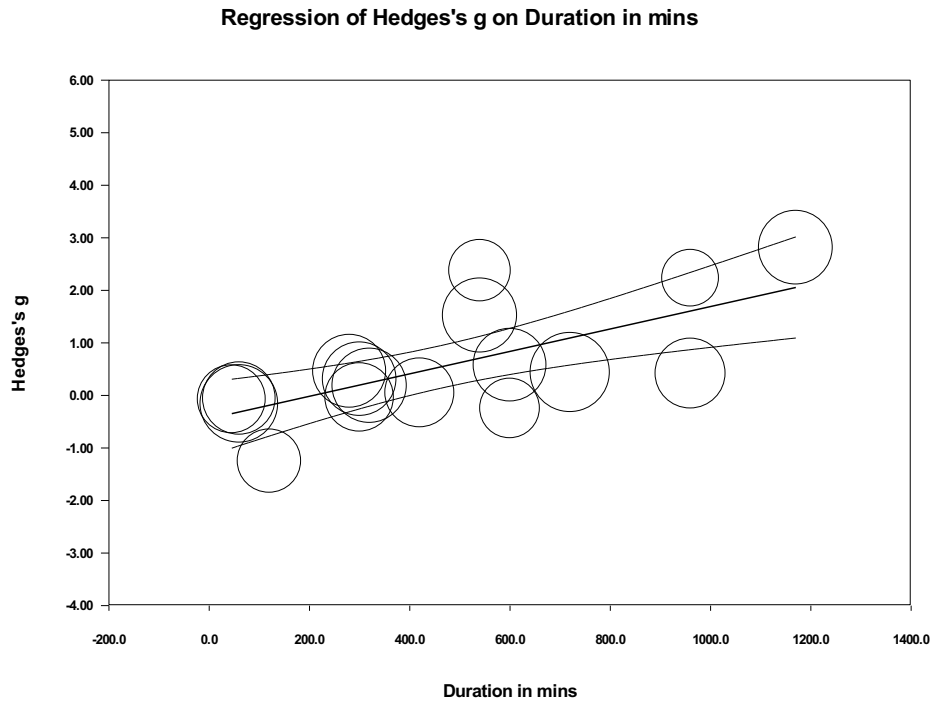
Funnel Plot of Standard Error by Hedge's g Indicating Likelihood of Publication Bias



Note. Outlier study included (Joseph & Bance, 2020).

Figure S2.2

Meta-Regression Scatterplot of Hedge's g on Duration of Therapy (in Minutes) with 95% Confidence Intervals



Chapter 3: Drawing on memory: A meta-analytic review

Author contributions. As with the meta-analytic review in Chapter 2, I conceptualised the study, including design, method, search strings, coding, analyses, and pre-registration. As a second independent reviewer is required on all meta-analytic reviews, I employed the assistance of Matt W. Christian as the third author on the project. Matt W. Christians role was to independently screen, based on the inclusion and exclusion criteria provided, all articles captured in my searches. Since this was only my second meta-analysis, I sort the guidance of statistical expert Paul Williamson. Paul Williamsons role was to review I had conducted the correct analyses using Comprehensive Meta-Analyses (CMA) software. Last, Glen E. Bodner was my principal supervisor at the time the study was conducted, and as such provided critical revisions on my drafts prior to submission.

Author Note. The authors declare no conflicts of interest. No funding for the review was provided. The project was preregistered at Open Science Framework

Abstract

Drawing is commonly used to facilitate event recall in eyewitness and therapeutic settings. Building on Derkson and Connolly's (2022) review, we meta-analytically examined how drawing affects memory relative to purely verbal methods of communication (e.g., "talk only" interviews). Database searches identified 36 randomised controlled trials of the effect of drawing-based interventions on event memory (N = 2013). Our memory outcome measures were amount and accuracy of information reported, errors, and confabulations. Random-effects analysis indicated drawing was favoured relative to verbal controls across these four outcomes. Drawing enhanced the amount (g = 0.63, p <.001) and accuracy (g = 0.29, p = .014) of information reported, but did not reduce errors (g = 0.05, p = .633) or confabulations (g = .0.22, p = .488) relative to control. The memory benefits of drawing were not moderated by age (children vs. adults), event type (autobiographical vs. live/staged vs. video), control type (image-active vs. verbal-only), or task timing (immediate vs. delay). Two potential moderators could not be analysed due to the paucity of studies: event focus (trauma-related vs. non-trauma-related) and drawing focus (event-focused vs. non-event-focused). Our meta-analysis indicates that drawing is a valuable facilitator of event recall relative to traditional methods of communication. However, our review also highlights the need for more trauma specific studies. We address and offer practical recommendations for future studies to address potential risks that may result from using drawing in applied settings.

Keywords**:** drawing; memory; event recall; meta-analysis; review

Introduction

Drawing is a simple act of image creation, and yet it can also serve as a complex form of nonverbal communication (Toomela, 2002). Drawing can help us explore, express, and communicate about past experiences, perhaps especially those that are difficult to articulate in words alone. Communicating accurately about difficult and/or traumatic events is fundamental in many applied situations. For these reasons, drawing is currently used by police, therapists, and others to facilitate memory retrieval in settings such as forensic interviews, psychology, art therapy, and counselling (e.g., Mattison & Dando, 2020). For example, accurate eyewitness testimony in forensic interviews can lead to justice for victims of crime (Gardner et al., 2020), and complete accounts of some lived experiences can aid in correct clinical diagnosis and treatment formulation (Wesson & Salmon, 2001).

A seminal study by Butler et al. (1995) illustrates the potential value to memory of drawing an experienced event. Butler et al. gave child participants an eventful tour of a fire station. The next day, a *draw group* was asked to draw everything they remembered from the tour and a *tell group* was asked to verbally describe what had happened. The draw group reported more accurate information in the memory interview, particularly in response to specific cued-recall questions such as “tell me how you got there”. A follow-up experiment obtained similar results when the drawing task occurred a month after the fire station tour. Many studies have since reported that drawing improves the accuracy and/or amount of information reported for an event (see Derksen & Connolly, 2022; Driessnack, 2005).

The first—and only—meta-analysis examining the effects of drawing as a facilitator of memory and communication was reported over 15 years ago (Driessnack, 2005), and it focused solely on studies using child participants. In recent years, more studies have examined the impacts of post-event drawing, including several with adult participants. These studies suggest that drawing can enhance memory relative to verbal interventions such as oral

retelling (e.g., Barlow et al., 2011; MacLeod et al., 2013; Otgaar et al., 2016; Patterson & Hayne, 2011; Strange et al., 2003), or providing a written account (Krackow, 2011; Matsuo & Miura, 2017). Given more recent research contributions examining the impacts of drawing on memory since the Dreissnack (2005) review (e.g., Derksen & Connolly, 2022), a new meta-analysis review was warranted.

Our study quantified the extent to which drawing may be a more effective tool for enhancing event recall than more traditional verbal methods of communication (e.g., "talk only" interviews, writing). We examined both the amount and accuracy of information reported after drawing relative to verbal controls. Where studies examined memory for personal experiences (e.g., autobiographical memories), the accuracy/inaccuracy of information reported typically cannot be determined, thus measuring the amount of information reported serves as a relevant measure of event memory. Two of the most common measures of inaccurate event recall are errors (e.g., "the car was blue" when in fact the car was red) and confabulations (e.g., "there was a dog in the car" when no dog was present). Researcher-provided events (e.g., live/staged, or videoed events) allow measurement of both the amount and accuracy/inaccuracy of reported information. Little is known about whether the benefits of drawing on memory differ depending on the type of event being reported. Indeed, there has been some critique on the lack of ecological validity when using live/staged or videoed events rather than autobiographical ones (Poole et al., 2011). Accordingly, we examined whether the effects of drawing on memory differed as a function of whether the event was live/staged, or videoed, or autobiographical.

We also examined additional factors that might moderate the effects of drawing on memory. To begin, drawing is often used in applied settings with children and other vulnerable persons (Mattison & Dando, 2020; see Driessnack, 2005). Although researchers have suggested that drawing may be especially advantageous for those requiring extra

support (e.g., children, elderly, autism spectrum disorder; see Derksen & Connolly, 2022), it is not yet known if the effects of drawing on event recall are moderated by age. Although some researchers suggest that age is not necessarily a moderating factor (e.g., Katz & Hershkowitz, 2010), others suggest that children may struggle with self-generated memory retrieval cues more than adults do (Jack et al., 2015). Potentially, then, children may benefit more than adults from the use of drawing as a memory aid.

Mental imagery, often referred to as *mental reinstatement of context*, is also used to facilitate event recall in forensic settings (Dando et al., 2020; Eastwood et al., 2018; 2019; Mattison et al., 2015). Indeed, there is evidence that memory is improved by both drawing and by creating mental images when encoding new information (Wammes et al., 2018), as well as during memory retrieval (Dando et al., 2009; 2020; Eastwood et al., 2019; Mattison, 2015). Thus, we examined the effectiveness of drawing when compared to two types of control groups: other image-based retrieval techniques (e.g., mental reinstatement of context), and verbal-only controls (e.g., tell-only) (see Table 2).

Drawing has also been shown to enhance memory recall whether the drawings are created immediately after an event or after long delays, ranging from 24 hours to 1 year (e.g., Butler et al. 1995; Bruck et al., 2000; Gardner et al. 1995; Gross & Hayne, 1999; Katz & Hershkowitz, 2010). Drawing is theorised to help with the retrieval of information from long term memory, as it can act as a self-generated retrieval cue (Dando, 2013; Jack et al., 2015). However, it is not yet known if drawing can protect memory from the decay that typically occurs after long delays (Derksen & Connolly, 2022). Consequently, we examined whether the impact of drawing on event recall differed as a function of task timing, or if the delay between the event and recall might moderate the drawing effect.

Drawing is sometimes used in applied settings to comfort and/or distract individuals during the interview process when the events being discussed are emotional and/or difficult

to relive (e.g., Poole & Dickson, 2014). A recent study using word lists found that non-event focused drawing (e.g., doodling) did not enhance recall (i.e., the drawing effect was absent relative to writing each word; Meade et al., 2019). And a study by MacLeod et al. (2016) found children who were not directed to specifically draw the target event made less accurate statements (i.e., more errors and confabulations). Indeed, there is a risk that cognitively demanding tasks, such as drawing, may deplete the mental resources required for complete and accurate recall (Macleod et al., 2016; Poole & Dickson, 2014). However, Poole and Dickson (2014) theorised that non-event focused drawing may help to reduce stress (e.g., comfort individuals during interviews), which in turn could benefit event recall given that stress is often shown to impair memory. Further, MacLeod et al. (2016) found that allowing free choice of drawing subject matter led to more errors and confabulations, relative to when participants were explicitly directed to draw the target event (i.e., event-focused drawing). Therefore, we also examined whether non-event focused drawing benefits, impairs, or has no impact on subsequent event recall.

Finally, it has been suggested that drawing is a useful tool for eliciting recall of traumatic experiences, such as during police eyewitness interviewing (Dando et al., 2009; Mattison et al., 2016), psychological assessments (Veltman & Browne, 2002; Woodford et al., 2015) and therapeutic interventions (Clements, 1996; Hass-Cohen & Findlay, 2019). Indeed, visual image-creation during therapy has been theorised to help individuals access trauma-related memories due to the intuitive connection between the visual-sensory nature of image creation and one's memory of the trauma (Hass-Cohen & Findlay, 2019; Schnitzer et al., 2021; Schouten et al., 2015). In addition, drawing during therapy (e.g., arts therapy) may generate positive outcomes for trauma sufferers (e.g., enjoyment, coping, satisfaction), while reducing adverse outcomes (e.g., PTSD symptoms, depression, anxiety, stress; see Schnitzer et al., 2021). Here we examined whether the effects of drawing on memory are more robust

for traumatic events than for non-traumatic events, given that memories following traumatic events are often vivid and image-based (Mace, 2008).

Present Review

Our meta-analytic review aimed to quantify the efficacy of drawing on event recall across four outcome measures: *amount of information* reported, *accuracy of information* reported, and inaccuracy of information reported in terms of both *errors* and *confabulations*. Based on a previous meta-analysis and review, we expected that drawing would enhance event recall, including both the amount of information reported and the accuracy of information reported (Driessnack, 2005), whereas it might not reduce inaccuracies (Derksen & Connolly, 2022), relative to verbal methods of communication (e.g., talk-only, writing). We also explored several potential moderators including sample age (e.g., children vs. adults), event type (i.e., live/staged vs videoed vs autobiographical), control conditions (i.e., visual-active vs verbal-only), task timing (e.g., immediate vs. delayed), drawing focus (event-focused vs. non-event focused), and event focus (trauma-related vs. non-trauma related)

Method

Our review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guide (PRISMA; Moher et al., 2009) and was registered with the (citation removed for anonymised review). Figure 3.1 provides a flowchart outlining the screening and selection process. Databases searched were SCOPUS, PsycINFO, Web of Science, and Cochrane. Due to the common use of the term "drawing" unrelated to our research interests (e.g., "drawing on the theory of…"), searches were restricted to only subject areas of interest (e.g., "psychology", "health professions", "arts", "criminology"). Searches began on the May 6 and concluded on October 18 of 2022, and captured all articles from inception to October 18, 2022, using the following search term combinations:

"draw*" or "sketch*" or "memor*" or "recog*" or "recall" or "recollect*" or "flashback" or "intrusion*" or "involuntary" or "remember" or "interview"

The initial search included meta-analyses, systematic reviews, case studies, clinical trials, and dissertations. Additional searches were also conducted by reference list *backward* and *forward* citation searching within relevant papers obtained. Records were managed using Endnote X4 software, including full text retrieval of articles and de-duplication.

Inclusion/Exclusion Criteria

To be included, a study had to use a drawing task to measure the effects of drawing on recall of an event from memory. Studies were included whether the event was supplied (e.g., crime videos, staged events) or autobiographical (e.g., lived experiences examined during investigative forensic interviews). Studies were excluded if they examined memory for outcomes unrelated to event memory, such as learning of word lists.

The included studies were randomised control trials that compared drawing to a purely verbal communication method (e.g., talking, writing). We excluded studies that used drawing for the purposes of neuropsychological assessment such as the Rey-Osterrieth complex figure, the clock drawing test for dementia (e.g., Mainland & Shulman, 2016), or projective personality assessments such as the House-Tree-Person Test (e.g., Becker-Weidman, 2017). Studies were excluded if the drawing(s) were supplied to the participant rather than drawn by the participant such as the human-figure drawing (e.g., Aldridge et al., 2004). They were also excluded if the drawings were used as a measure of memory ability (e.g., identifying one's own or another's drawing, remembering/drawing map routes).

We included neurotypical samples within studies examining neurodiversity (e.g., autism), but excluded samples with severe neurological comorbidity (e.g., traumatic brain injury, dementia), cognitive difficulties (e.g., learning disabilities, autism), physical deficits that could affect visual and/or verbal functioning (e.g., deaf, or blind, visual agnosia,

language delay), or other psychotic illness (e.g., schizophrenia). We included only studies published in English.

Based on the pre-specified inclusion and exclusion criteria, two researchers (first and third author) independently screened articles based on title/abstract/keywords, removing non-relevant articles and duplicates (see Figure 3.1). Full text articles that met inclusion criteria independently were assessed by both researchers. Any discrepancies in inclusion decisions were discussed and resolved.

Data Extraction Process

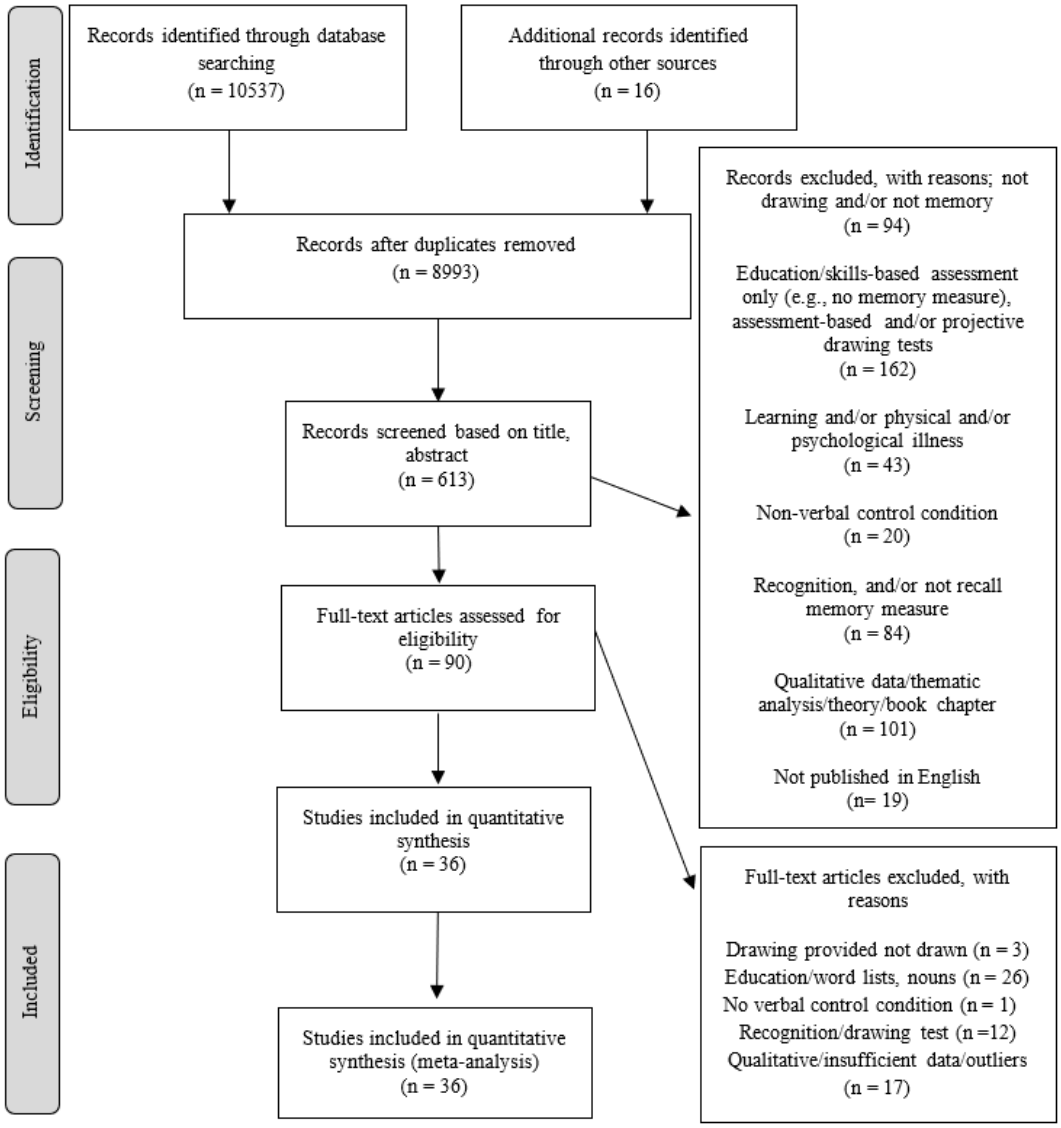
The data extraction process, including the coding and recording of publication details, method, and statistics reported was performed by the first and third author. In instances where an important detail was missing and when reported data could not be used to calculate the effect size (i.e., using inferential statistics or webplotdigitizer; see Rohatgi, 2021) the authors were contacted to request the information. If the authors did not respond within 2 weeks, then the study was excluded from review.

The four memory outcome measures coded by the first and third author were: amount of information reported, accuracy of information reported, errors, and confabulations. Comprehensive Meta-Analysis Software (Borenstein et al., 2013) was used to conduct random-effects meta-analyses. Hedge's *g* and its associated 95% confidence interval are reported to gauge the effects of drawing on each outcome measure. Where more than one measurement point was measured, the first measurement point was used to calculate the effect size. For studies that used more than one drawing or control condition, the effect size was calculated using the means and standard deviations from the combined multiple groups. Six potential moderating factors were also coded: age (e.g., children vs. adults), event type (i.e., live/staged vs videoed vs autobiographical), control conditions (i.e., visual-active vs verbal-only), task timing (e.g., immediate vs. delayed), drawing focus (event-focused vs. non-

event focused), and event focus (trauma-related vs. non-trauma related). All measures of the same outcome within a study were pooled, and the pooled effect size was then used in the meta-analyses (as per Cuijpers, 2016).

Figure 3.1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Flow Diagram



Results

Study Selection

Database searches yielded 10,567 articles and 16 additional records were uncovered during citation list searches. Removal of duplicates left 8,977, of which 619 were deemed eligible for abstract and title screening. Common reasons for exclusion at this stage are listed in Figure 3.1. The remaining 90 full text articles were then assessed against inclusion/exclusion criteria. At the full text stage, the most common reason for exclusion was that the study examined the effect of drawing on memory for word lists rather than events. Full text screening left 36 studies for quantitative analysis and review.

Publication Bias Assessment

Funnel plot (see Figure S3.1) and Egger's test were used to assess publication bias. Eggers test was significant $t(34) = 2.15$, $p = .039$, and 5 studies were identified as outliers (Dando, 2013; Gross & Hayne, 1998; Gross & Hayne, 1999; Lambert, 2007; Vrij et al., 2020); with their removal, Eggers test for the remaining 31 studies was not significant, $t(29) = 1.81$, $p = .079$ (Table 3.3). Results with outliers included are reported in text and results excluding outliers can be seen in Table S3.1. The Cochrane risk-of-bias tool for randomised trials (RoB2) was also used to check for potential publication bias in the selected studies (Sterne et al., 2019). The overall risk of bias based on the accumulative scores on each of the 5 domains indicated that 35 studies had 'low' risk and 1 study had 'some concerns' of bias (Table S3.2).

Table 3.1

Memory Outcome Measures Reported in Included Studies

Study	Amount	Accuracy	Errors	Confabulations
Barlow et al. (2011)	-	x	x	-
Brennan (1996)	-	x	x	-
Bruck et al. (2000)	-	x	x	-
Butler et al. (1995)	x	x	-	-
Dando et al. (2009)	-	x	x	x
Dando et al. (2011)	-	x	x	x
*Dando et al. (2013)	-	x	x	x
Dando et al. (2020)	-	x	x	x
Deeb et al. (2021)	x	x	-	-
Eastwood et al. (2018)	x	x	x	-
Eastwood et al. (2019)	-	x	x	-
Edwards & Forman (1989)	-	x	x	-
Gardner et al. (2020)	x	x	-	x
Gentle et al. (2014)	-	x	x	x
Gross et al. (2009)	x	x	-	-
*Gross & Hayne (1998)	x	-	-	-
*Gross & Hayne (1999)	x	x	-	-
Iordanou (2018)	x	-	-	-
Izotovas et al. (2017)	x	-	-	-
Jack et al. (2015)	x	x	x	-
Katz & Hershkowitz (2010)	x	-	-	-
*Lambert (2007)	x	x	-	-
MacLeod et al. (2016)	x	-	x	x
Magnusson et al. (2020)	-	x	-	-
Maras et al. (2014)	x	x	x	-
Matsuo & Miura (2016)	-	x	x	-
Mattison et al. (2015)	-	x	x	x
Poole & Dickinson (2014)	x	-	-	-
Salmon & Pipe (2000)	x	x	x	-
Salmon et al. (2012)	x	x	x	-
*Vrij et al. (2020)	x	-	-	-
Wesson & Salmon (2001)	x	-	-	-
Willcock (2004)	x	-	-	-
Williams et al. (2002)	x	x	-	-
Woolford et al. (2015)	x	-	-	-

Note. Mattison et al. (2015) and Mattison et al. (2018) used the same data so only the earlier study is listed in the table.

Table 3.2

Summary of Characteristics of Included Studies

Study	Intervention Type	Control Type	Memory Material Description	Task Focus	Event Focus	Time since Event (mins)	Test Mode
Barlow et al. (2011)	Draw-and-tell only, interactive draw-and-tell, (n = 20, 20)	Tell-only, interactive tell-only (n = 20, 20)	Amusing 'child-friendly' 5min video	Event-focused	Non-trauma related	1,440 (1 day)	Investigative-style Interview
Brennan (1996)	Draw (n= 20, 38)	Tell-only (n = 18, 38)	Red Cross video	Event-focused	Maybe-trauma related	10,080 (7 days)	Investigative-style interview
Bruck et al. (2000)	Draw (n = 45, 87)	Tell-only (n = 42, 87)	Magician 'live event'	Event-focused	Non-trauma related	34,560	Investigative-style interview
Butler et al. (1995)	Draw (n = 16, 32)	Tell-only (n = 16, 32)	Fire station tour 'live event'	Event focused	Non-trauma related	1,440 43,790	Investigative-style interview
Dando et al. (2009)	Sketch (n = 20, 60)	Tell-only or MRC (n = 40, 60)	Stimulus film	Event focused	Non-trauma related	2,880	MRC (investigative) style interview
Dando et al. (2013)	Sketch (n = 17)	Tell-only or MRC (n = 17, 17)	Unexpected live event	Event focused	Non-trauma related	2,880	MRC (investigative) style interview
Dando et al. (2020)	Sketch (n = 47, 134)	MRC/control (n = 92, 134)	Live mock witness event	Event focused	Non-related trauma	2,880	Investigative-style interview
Deeb et al. (2021)	Sketch (n = 121, 243)	Tell-only (n = 122, 243)	Lie or truth event	Event focused	Non-related trauma	10,080	Investigative-style interview

Eastwood et al. (2018)	Sketch (n = 29, 88)	MRC/control (n = 59, 88)	Interaction event	Event focused	Non-related trauma	5	Investigative-style interview
Eastwood et al. (2019)	Sketch, free recall and explain (3 groups) (n = 74, 123)	MRC/control (n = 49, 123)	Mock crime video (non-violent)	Event focused	Non-related trauma	10	Investigative-style interview
Edwards & Forman (1989)	Draw or dolls (n = 30, 45) (15/gp)	Tell-only (n = 15, 45)	Info on sexual abuse video	Event focused	Trauma related	330	Investigative-style interview
Gardner et al. (2020)	Draw (n = 63)	Tell-only (n = 62)	Fire station interaction	Event focused	Non-related trauma	43,680	Investigative-style interview
Gentle et al. (2014)	Draw (n = 70, 145)	MCR/control (n = 75, 145)	Magic show live event	Event focused	Non-related trauma	10,080	Investigative-style interview
Gross et al. (2009)	Exp. 1 – Draw (n = 29, 58) Exp. 2 – Draw (n = 18, 36)	Exp. 1 – Tell-only (n = 29, 58) Exp. 2 – Tell-only (n = 18, 36)	Exp.1 – excursion Exp. 2 - excursion	Exp. 1 - Event-focused Exp. 2 – Event-focused	Exp. 1- Non-related trauma Exp. 2 – Non-related trauma	Exp. 1 – 2,160 Exp. 2 – 305,760	Exp. 1 – Investigative-style interview Exp. 2 – Investigative-style interview
Gross & Hayne (1998)	Draw (n = 20, 40)	Tell-only (n = 20, 40)	Personal experience	Event focused	Non-related trauma but emotional	30	Investigative style interview
Gross & Hayne (1999)	Draw (n = 28, 57)	Tell-only (n = 27, 57)	Chocolate factory event	Event focused	Non-related trauma	1,440 525,600	Investigative-style interview
Iordanou (2018)	Draw (n = 81)	Tell-only (n = 81)	Classroom altercation	Event focused	Non-related trauma	1,440	Investigative-style interview
Izotovas et al. (2017)	Sketch (n = 23)	Tell-only /event-line (n = 24)	Mock intelligence operations video	Event focused	Non-related trauma	1,440 20,160	Investigative-style interview

Jack et al (2015)	Sketch (n = 12, 144)	Tell-only (n = 12, 144)	Non-violent crime video	Event-focused	Non-related trauma	60	Investigative-style interview
Katz & Hershkowitz (2010)	Draw (n = 69, 125)	Tell-only (n = 56, 125)	Sexual abuse memories	Event focused	Trauma related	54,187	Investigative-style interview
Lambert (2007)	Draw (n = 15, 30)	Tell-only (n = 15, 30)	Problem-solving task	Event focused	Non-related trauma	1,440 43,800	Investigative-style interview
MacLeod et al. (2016)	Directed/Undirected Draw (n = 28, 21)	Tell-only (n = 25)	Boat interactive event	Event focused & Non-event focused	Non-related trauma	2,880	Investigative-style interview
Magnusson et al. (2020)	Draw (n = 42, 83)	Tell-only (n = 41, 83)	Pirate event	Event focused	Non-related trauma	10,080	Investigative-style interview
Maras et al (2014)	SAI (n = 34, 68)	SR (n= 34, 68)	Violent video	Event-focused	Non-trauma related	30	SAI interview booklet
Matsuo & Miura (2016)	SAI (n = 60, 180)	CI (n = 120, 180)	Crime video	Event focused	Non-related trauma	10* 1,440	Investigative-style interview
Mattison et al. (2015)	Sketch (n = 30, 90)	MRC/control (n = 60, 90)	Unspecified film	Event focused	Non-related trauma	10*	Investigative-style interview
Poole & Dickinson (2014)	Draw (n = 111, 38)	Tell-only (n = 108, 17)	‘Mr Science’ live event ‘Dog Lady’ live event	Non-event focused.	Non-trauma related.	525,600 15	Investigative-style Interview
Salmon & Pipe (2000)	Draw (n = 51, 101)	Tell-only (n = 50, 101)	Routine health assessment	Event focused	Non-trauma related	4,320 525,600	Investigative-style interview

Salmon et al. (2012)	Draw (n= 19, 58)	Re-enactment and Tell-only (n = 39, 58)	Scared or happy memory	Event focused	Non-trauma related	5*	Investigative-style interview
Vrij et al. (2020)	Draw (n = 30)	Tell-only (n = 30)	Going to a café to meet 'agent'	Event focused	Non-trauma related	10*	Investigative-style interview
Williams et al. (2002)	Draw (n = 26, 52)	Tell-only (n = 26, 52)	'Mrs Flour' cake interaction	Event focused	Non-trauma related	10*	Investigative-style interview
Wesson & Salmon (2001)	Draw (n = 20)	Re-enactment and Tell-only (n = 20, 20)	Personal emotional experience	Event focused	Non-trauma related but emotional	10,080	Investigative-style interview
Woolford et al. (2015)	Draw (n = 15)	Tell-only (n = 15)	Mental Health assessment	Event focused	Non-trauma related	5*	Investigative-style interview

Note: (*) donates time since event that was imputed based on available reported information, due to no time specific time specification reported. MRC = Mental Reinstatement of Context, PCI = Police Cognitive Interview, CI = Cognitive Interview, MPCI = Mental Police Cognitive Interview, SAI = Self-administered Interview, SR = Structure Recall (writing). Brennan (1996) 'Maybe-trauma related' was classified as 'trauma-related' in the sub-group analysis.

Study Characteristics

Table 3.1 lists the included studies and their memory measures, and Table 3.2 lists their characteristics. The 36 included studies were published between 1989 and 2021 and included a total of 2013 participants, ranging from 30-274 participants (M = 62.45, SD = 46.07). Most studies used child participants (k = 25), rather than only adults (k = 12). Participant age ranged from 5-60+ years (M = 16.83, SD = 18.07), and the percentage of female participants ranged from 0-100% (M = 55.84, SD = 13.42). Most studies measured the amount of information reported (k = 23) and the accuracy of information reported (k = 25); fewer reported errors (k = 17) and confabulations (k = 8). Most studies used a live interactive event (k = 21), or videoed event (k = 10), rather than an autobiographical event (k = 5). Most studies either compared drawing to a verbal-only control (e.g., talk-only; k = 33) or to another visual-active task (e.g., mental reinstatement of context; k = 15). A similar number of studies used an immediate task (k = 15) versus a delayed task (k = 26); a few used both (k = 5). Almost all studies used event-focused drawings (k = 35) rather than non-event focused drawings (e.g., comfort drawing; k = 1). Surprisingly, almost all studies used non-trauma related events (k = 33) rather than traumatic event stimuli (k = 3).

Meta-Analyses

The random-effects analyses of variance results from our meta-analyses are presented in Table 3.3. Drawing was favoured across outcome measures with and without outlier removal (see Table S3.2). Drawing was found to enhance the amount (g = 0.63, 95% CI [0.39, 0.86] $p < .001$, I^2 = 55.50) and accuracy (g = 0.29, 95% CI [0.06, 0.52], p = .014, I^2 = 54.13) of information reported, but it did not reduce errors (g = 0.05, 95% CI [-0.46, 0.94], p = .633, I^2 = 7.30) or confabulations (g = 0.22, 95% CI [-0.16, 0.14], p = .488, I^2 = 90.46), relative to control.

Table 3.3

Drawing vs. Control Random Effects Meta-Analyses Results by Outcome Measure and by Moderator

Amount of Information Reported	*k*	*g*	*95% CI*	*p*	I^2	*Z*
No Moderator	23	0.63	0.39, 0.86	< .001*	55.50	4.73
By Age						
Children	18	0.57	0.29, 0.84	< .001*	76.01	4.12
Adults	6	0.83	0.50, 1.16	< .001*	45.92	4.93
By Event Type						
Live/Staged Event	15	0.59	0.27, 0.91	< .001*	73.01	3.59
Video Event	3	0.81	0.27, 1.33	< .001*	43.34	2.98
Autobiographical Event	5	0.62	0.30, 0.96	< .001*	41.78	3.64
By Control Type						
Verbal-only	21	0.71	0.45, 0.97	< .001*	78.94	5.43
Visual-Active	5	0.35	0.02, 0.69	.040*	35.93	2.05
By Task Timing						
Immediate	13	0.70	0.41, 1.00	< .001*	71.14	4.65
Delayed	12	0.47	0.14, 0.79	.005*	80.99	2.83
Accuracy of Information Reported	*k*	*g*	*95% CI*	*p*	I^2	*Z*
No Moderator	25	0.29	0.06, 0.52	.014*	54.13	3.01
By Age						
Children	16	0.01	-0.21, 0.24	.913	57.40	0.12
Adults	10	0.75	0.45, 1.05	< .001*	57.42	4.93
By Event Type						
Live/Staged Event	15	0.17	-0.18, 0.52	.347	82.03	0.94
Video Event	9	0.45	0.23, 0.65	< .001*	0.00	4.14
Autobiographical Event	1	0.56	0.05, 1.06	.031*	0.00	2.16
By Control Type						
Verbal-only	23	0.35	0.06, 0.64	.017*	81.38	2.39
Visual-Active	12	0.43	0.18, 0.70	.001*	54.01	3.26
By Task Timing						
Immediate	9	0.36	0.09, 0.63	.008	37.35	2.63
Delayed	17	0.29	-0.02, 0.60	.063	79.96	1.86

Inaccuracy	*k*	*g*	*95% CI*	*p*	I^2	*Z*
No Moderator						
Errors	17	0.05	-0.15, 0.25	.633	7.31	-0.14
Confabulations	8	0.22	-0.40, 0.84	.488	90.46	0.66
By Age						
Children	11	-0.16	-0.46, 0.14	.293	67.83	-1.05
Adults	8	0.28	-0.08, 0.64	.133	62.39	1.50
By Event Type						
Live/Staged Event	10	-.005	-0.39, 0.38	.980	80.63	-0.02
Video Event	8	-0.05	-0.22, 0.32	.704	24.89	0.38
Autobiographical Event	-	-	-	-	-	-
By Control Type						
Verbal-only	17	-0.02	-0.29, 0.26	.911	74.36	-1.45
Visual-Active	11	0.18	-0.09, 0.46	.188	51.48	1.32
By Task Timing						
Immediate	7	-0.12	-0.36, 0.12	.327	2.01	-0.97
Delayed	11	0.08	-0.29, 0.45	.677	80.56	0.42

Note. (*) denotes $p < .05$. *n* = number of participants. *k* = number of studies. *Inaccuracy* subgroup analyses were conducted using the combined effects of errors and confabulations. (-) indicates the subgroup analyses could not be performed.

Of the six coded moderating factors (see Method), there were only enough studies to meaningfully analyse age, event type, control type, and task timing (see Table 3.3). The moderating effects of drawing task type (event-focused, non-event focused) and event focus (trauma-related, non-trauma related) could not be meaningful interpreted for any of the four outcomes (i.e., amount, accuracy, errors, and confabulations) given that only a small number of studies examined each factor.

Figure 3.2

Amount of Information Reported: Forest Plot for Drawing vs. Control

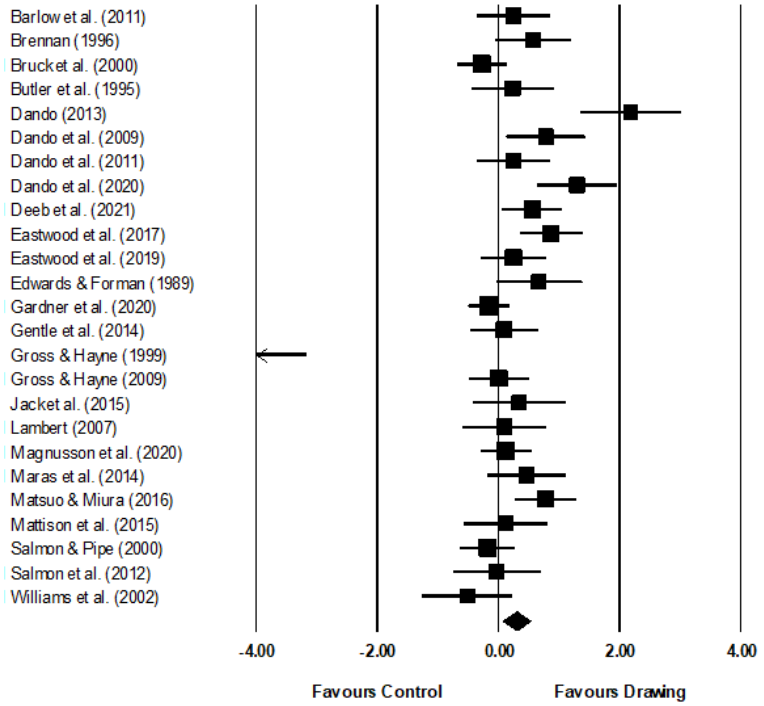
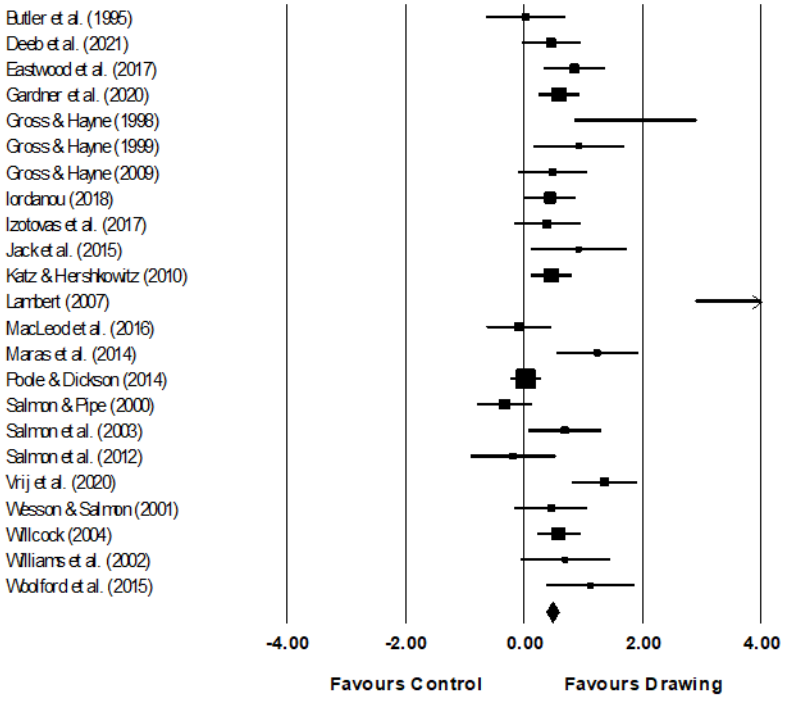


Table 3.3 presents the random effects meta-analysis results for all moderators by outcome. Figure 3.2 presents a forest plot of the amount of information reported before subgroup analyses. Four key outcomes are noteworthy. First, the benefits of drawing on the amount of information reported were not moderated by age; our regression analyses did not differ between adult and child studies, $Z = -0.87$, $df = 1$, $p = .382$, $I^2 = 79.36$. Second, regression analyses indicated the memory benefits of drawing on the amount of information reported were not moderated by event type, $Q = 0.47$, $df = 2$, $p = .790$, $I^2 = 77.83$; the effect was significant for live/staged events, video events, and autobiographical events. Third, benefits of drawing on the amount of information reported held irrespective of when compared to other image-based retrieval techniques and when compared to verbal-only controls, as shown by our regression analyses $Z = 1.19$, $df = 1$, $p = .233$, $I^2 = 79.96$. Fourth, regression analyses indicated effects of drawing were not moderated by task timing, $Z = 1.10$, $df = 1$, $p = .272$, $I^2 = 79.12$; they held when the task was performed immediately after the

event and after a delay. A meta-regression was also conducted using time since event (in minutes; see Table 3.2) revealing that time was not a significant unique predictor of drawing efficacy, $Z = -1.33$, $df = 1$, $p = .183$, $I^2 = 55.46$ (see Table 3.2).

Figure 3.3

Accuracy of Information Reported: Forest Plot for Drawing vs. Control

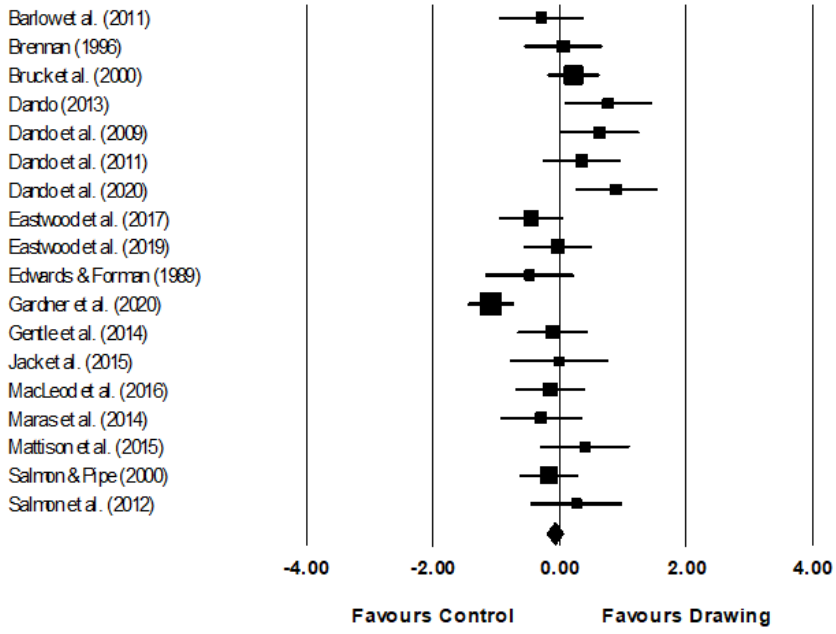


For accuracy, the same follow-up subgroup analyses were run (Table 3.3; Figure 3.3). Although the benefits of drawing on the accuracy of information appeared to be moderated by age, a follow up meta-regression found no significant difference between the effect size obtained for the child versus adult studies, $Z = -1.06$, $df = 1$, $p = .289$, $I^2 = 77.32$. Accuracy also appeared to be moderated by event type, but autobiographical events could not be meaningfully interpreted due to the lack of relevant studies ($k = 1$). There was no reported benefit from drawing for live/staged events, whereas the benefits of drawing on the accuracy of information reported appeared evident for videoed events; but meta regression did not show a significant difference between these effect sizes, $Q = 1.25$, $df = 2$, $p = .535$, $I^2 = 73.53$. The benefits of drawing on the accuracy of information reported held when compared to both

visual-active retrieval techniques and when compared to verbal-only controls; control type was not a moderating factor, $Z = 0.08$, $df = 1$, $p = .943$, $I^2 = 65.31$. Meta regression also revealed that the accuracy of information reported was not moderated by task timing, $Z = 0.25$, $df = 1$, $p = .799$, $I^2 = 65.69$; despite benefits from drawing seeming larger when the task was performed immediately rather than after a delay.

Figure 3.4

Errors and Confabulations (Combined): Forest Plot for Drawing vs. Control



Due to the small number of studies looking at errors and confabulations separately, these two indicators were combined to examine inaccuracy (Tables 3.3; Figure 3.4). Drawing had no significant effects on the inaccuracy of information reported. Furthermore, our meta regression indicated that inaccuracy was not moderated by age, $Z = -1.53$, $df = 1$, $p = .127$, $I^2 = 68.38$, event type, $Q = 0.05$, $df = 1$, $p = .815$, control type, $Z = -0.76$, $df = 1$, $p = .444$, $I^2 = 76.41$, or task timing, $Z = 0.53$, $df = 1$, $p = .599$, $I^2 = 74.64$. In summary, the meta-analysis showed evidence of a drawing effect only for amount and accuracy of information reported. However, no evidence was found that this effect varied across levels of any of our potential moderators.

Discussion

Our meta-analytic review indicates that post-event drawing can provide an effective tool for improving the completeness and accuracy of memory for events, as suggested by previous reviews (Derksen & Connolly, 2022; Driessnack, 2005). Across the 36 studies included in our meta-analysis, drawing an event was found to increase both the amount and accuracy of information reported relative to purely verbal methods of communication (e.g., talking, writing). Importantly, drawing was not found to increase memory inaccuracies (errors, confabulations) relative to verbal methods. However, only two studies used non-event focused drawing (see MacLeod et al., 2016; Poole & Dickson, 2014), thus drawing for comfort and/or diversion during investigative interviews might yield different outcomes—our meta-analysis cannot speak to these uses of drawing. Nonetheless, our results suggest that event-focused drawing provides a useful memory retrieval strategy. Further, our analysis suggests that drawing is beneficial for event recall irrespective of whether the drawing is performed immediately post-event or after a delay. Although the fullness of eyewitness accounts is often reduced after a delay (Dando et al., 2020), time-since-event did not uniquely predict the efficacy of drawing on event recall.

Drawing was favoured when compared to other visual imagery recall tasks, such as mental reinstatement of context (e.g., Dando et al., 2020; Izotovas et al., 2017). This result suggests that the *physical* act of drawing—beyond elaboration or mental imagery—can benefit memory retrieval. Perhaps the difficulty of physically illustrating an experience (rather than merely re-imagining it) leads individuals to focus only on key event details. For example, drawing may demand individuals make more practical decisions about what is relevant versus irrelevant event information to include in one's drawing. These possible mechanisms underlying the effect would benefit all age groups (Jack et al., 2015), consistent with us observing effects for both child and adult participants.

Drawing was favored for all types of event stimuli, whether they be live/staged, videoed, or autobiographical. Only four studies required participants to recall personal life events, however, perhaps because the accuracy of autobiographical reports cannot be verified easily by researchers. The lack of studies examining the effect of drawing on memory for autobiographical events remains an important gap in the literature—one that undermines ecological validity, as noted by Derksen and Connolly (2022).

In the same vein, few studies specifically examined the effect of drawing on memory for traumatic events. Our review uncovered only two studies with a specific trauma-focus (Edwards & Forman, 1989; Katz & Hershkowitz, 2010), plus a third study that used a first-aid video with children (Brennan, 1996); other studies focused on emotional but non-trauma related experiences (Gross & Hayne, 1998; Wesson & Salmon, 2001). This is surprising given that drawing is often claimed to be beneficial in facilitating recall of traumatic events such as sexual abuse (Katz & Hamama, 2012; Katz & Hershkowitz, 2010). Indeed, Derksen and Connolly's (2022) review of this literature opened with a hypothetical scenario in which a 5-year-old child is asked to draw details of their suspected sexual abuse during a forensic interview. Given that researchers commonly recommend that drawing be used to facilitate communication and recall following traumatic experiences, it is vital for future research to target this specific knowledge gap.

Our meta-analysis also highlights that few randomised controlled trials have examined the effects of drawing on memory for trauma specific events. We are of the opinion that more studies using trauma specific stimuli is needed in memory research, especially as two distinct types of memory can result following traumatic experience. That is, previous research has predominantly focused on examining the effects of drawing on *voluntary* memory, rather than *involuntary* memory. Voluntary memories are theorised to be more verbally accessible than involuntary memories, whereas involuntary memories are theorised

to be more visual, sensory, and image-based (Brewin et al, 1996). Importantly, *trauma-related intrusions*, are a specific type of *involuntary* memory that often results from trauma specific experiences (e.g., Mace, 2008). Therefore, future research could measure and gauge the effects of drawing on trauma-related intrusions, in addition to voluntary event recall which may have important practical implications. It is likely the paucity of studies examining the effects of drawing on both memory types is due to the difficultly in staging traumatic events in an ethical manner. Nonetheless, doing so would allow researchers to measure both the accuracy of participants event recall and any subsequent intrusion development. One suggestion would be to use the trauma-film paradigm. The trauma-film paradigm is used a lot in memory research and was developed to provide an ethical analogue of a lived traumatic experience (Arnaudova & Hagenaars, 2017). Examining all types of memory using trauma specific stimuli is important given that drawing is used in several professional settings to facilitate recall of traumatic events (Mattison & Dando, 2020).

Conclusion

Our study comes more than 15 years after an initial meta-analysis of the effect of drawing on children's memory for events (Driessnack, 2005). With the inclusion of new studies and studies including adult participants, our meta-analysis confirms that event-focused drawing offers a valuable tool for facilitating event recall. However, drawing is also used in professional settings (e.g., forensic, clinical, therapeutic) to help comfort and/or distract individuals when experiences are difficult to discuss (MacLeod et al., 2013; Poole & Dickson, 2014). Thus, more studies are required to examine the effects of non-event focused drawing (e.g., comfort and/or diversional drawing) on event recall. Our study also highlights the need for further tests of the effects of drawing following traumatic experiences, particularly its effects on trauma-related intrusions. Of the literature reviewed, no studies examined the possibility that drawing despite being a known memory enhancer that serves to

facilitate conceptual processing of traumatic experiences, it may also serve as a sensory/perceptual task that can inhibit the encoding of traumatic memories, thereby reducing PTSD symptoms, a possibility addressed in our next series of experimental studies. Drawing continues to be a popular tool for aiding communication and event recall in professional settings with vulnerable individuals, such as children, the elderly, and victims of crime. Consequently, it is imperative that researchers and practitioners work together to establish a strong evidence base and best practice for its implementation.

Supplementary Materials

Table S3.1

Drawing vs. Control Random Effects Meta-Analyses Results with Outliers Included: Overall, by Outcome Measure, and by Moderator

	D(n)	*C(n)*	*k*	*g*	*95% CI*	*p*	I^2
Overall	1,013	1,000	36	0.39	0.23, 0.54	< .001*	62.76
With Outliers Removed	928	915	31	0.26	0.17, 0.40	< .001*	35.43
By Outcome Measure							
Amount of Information Reported	634	622	19	0.43	0.25, 0.61	< .001*	55.50
Accuracy	551	553	22	0.28	0.09, 0.46	.003*	54.13
Errors	353	355	16	-0.01	-0.16, 0.14	.885	7.31
Confabulations	186	185	7	0.24	-0.46, 0.94	.505	90.47
By Age							
Children	714	695	21	0.19	0.01, 0.33	.006*	35.53
Adults	226	232	9	0.51	0.32, 0.70	< .001*	35.42
By Event Type							
Live/Staged Event	591	589	17	0.20	0.26, 0.75	.019	49.33
Video Event	198	199	10	0.37	0.17, 0.57	< .001*	< 0.01
Autobiographical Event	139	127	4	0.51	0.03, 0.37	< .001*	< 0.01
By Control Type							
Verbal-only	875	820	28	0.28	0.15, 0.42	< .001*	< 0.01
Image-Active	259	277	13	0.33	0.15, 0.51	< .001*	3.55
By Task Timing							
Immediate	428	416	15	0.34	0.19, 0.49	< .001	4.51
Delayed	664	661	19	0.24	0.08, 0.40	.003	2.96
By Drawing Task Type							
Event-focused	792	782	29	0.32	0.19, 0.44	< .001*	31.60
Non-event Focused	111	108	1	0.03	-0.23, 0.29	.829	< 0.01

Note. * denotes $p < .05$. *n* = number of participants. *k* = number of studies. *D(n)* = total number of participants in the drawing condition, *C(n)* = total number of participants in control condition.

Table S3.2

Summary of Overall Risk of Bias for Included studies using Cochrane Risk-of-Bias Tool for Randomized Trials (RoB2)

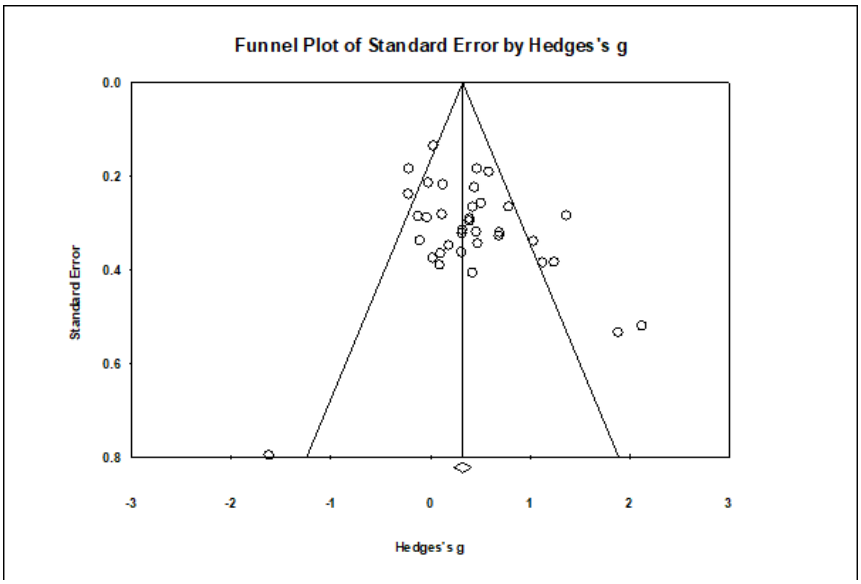
	Risk of bias domains					
Study	D1	D2	D3	D4	D5	Overall
Barlow et al (2011)	+	+	+	+	+	+
Brennan (1996)	+	+	+	+	+	+
Bruck et al (2000)	+	+	+	+	+	+
Butler et al (1995)	+	+	+	+	+	+
Dando et al (2009)	+	+	+	+	+	+
Dando et al (2011)	+	+	+	+	+	+
Dando et al (2013)	+	+	+	+	+	+
Dando et al (2020)	+	+	+	+	+	+
Deeb et al (2021)	+	+	+	+	+	+
Eastwood et al (2017)	+	+	+	+	+	+
Eastwood et al (2019)	+	+	+	+	+	+
Edwards and Foreman (1989)	+	+	+	+	+	+
Gardner et al (2020)	+	+	+	+	+	+
Gentle et al (2014)	+	+	+	+	+	+
Gross and Hayne (1998)	+	+	+	+	+	+
Gross and Hayne (1999)	+	+	+	+	+	+
Gross et al (2009)a	+	+	+	+	+	+
Gross et al (2009)b	+	+	+	+	+	+
Iordanou (2018)a	+	+	+	+	+	+
Iordanou (2018)b	+	+	+	+	+	+
Izotovas et al (2015)	+	+	+	+	+	+
Jack et al (2015)	+	+	+	+	+	+
Katz and Hershkowitz (2010)	+	+	+	+	+	+
Lambert (2007)	+	+	+	+	+	+
MacLeod et al (2016)	+	+	+	+	+	+
Magnusson et al (2020)	+	+	+	+	+	+
Maras et al (2014)	+	+	+	+	+	+
Matsuo and Miura (2016)	+	+	+	+	+	+
Mattison et al (2015)	+	+	+	+	+	+
Poole and Dickinson (2014)	+	+	+	+	+	+
Salmon and Pipe (2000)	+	+	+	+	+	+
Salmon et al (2003)	+	+	+	+	+	+
Salmon et al (2012)	+	+	+	+	+	+
Vrij et al (2020)	+	+	+	+	+	+
Wesson and Salmon (2001)	+	+	+	+	+	+
Williams et al (2002)	+	+	+	+	+	+
Woolcock (2004)	+	+	+	+	+	+
Woolford et al (2015)	+	-	+	+	+	-

Domains:
D1: Bias arising from the randomisation process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reporter result.

Judgement
- Some concerns
+ Low

Figure S3.1

Funnel Plot of Standard Error by Hedge's g Indicating Likelihood of Publication Bias



Note. Dando (2013), Gross & Hayne (1998), Gross & Hayne (1999), Lambert (2007) and Vrij et al. (2020) were deemed outliers and were excluded from final analysis.

Chapter 4: Gauging the Effects of Post-Event Drawing on Memory for a Traumatic Event

Author contributions. I conceptualised and ran the study, including design, method, participant recruitment, coding, analyses, and pre-registration. Glen E. Bodner was my principal supervisor at the time the study was conceptualised, while Ryan Balzan was my principal supervisor during the final study stages. As such both supervisors provided critical revisions on my drafts, prior to submission, during their time as my principal.

Author Note. The authors report no conflict of interest. No funding was provided. The project was preregistered at Open Science Framework. This research was approved by the Flinders University Human Research Ethics committee, Project 2816.

Abstract

Drawing can enhance *voluntary memory* following traumatic events, but its effects on *involuntary memory* (i.e., intrusions) is unknown. We tracked the effects of a draw versus verbal task on both memory types over 3 days using the trauma-film paradigm. In Experiment 1 (n = 60) an event-focused drawing versus verbal task was performed immediately after the trauma film (Day 1). Event-focused drawing failed to enhance event recall (Days 1-3) and led to significantly more intrusions 24-hrs later (Day 2). In Experiment 2 (n = 60) the tasks were performed after a *delay* (on Day 2), and no differences were found for either memory type. In Experiment 3 (n = 28), a non-event focused drawing task reduced accuracy, but not intrusions, relative to Experiment 1. Overall, drawing did not yield consistent positive effects on memory. Our results highlight the need for further investigation into the effects of drawing traumatic events on memory.

***Keywords*:** drawing, posttraumatic stress, trauma-film paradigm, memory, intrusions

Introduction

Drawing is commonly used to facilitate communication and event recall with individuals who have experienced a traumatic event. Drawing can be used immediately, such as after a car accident to facilitate event recall in eyewitness testimony (Matsuo & Miura, 2017), or after a delay, such as in therapeutic settings to work through past trauma (Katz & Hamama, 2012). Indeed, drawing is commonly used by eyewitness interviewers, psychologists, counsellors, and art therapists (see Mattison & Dando, 2020). Although drawing has been found to improve memory for stimuli ranging from words lists (e.g., Wammes et al., 2016) to events (e.g., Driessnack, 2005; Maddox et al., 2023), research on its effects on memory for traumatic events is scarce. Moreover, previous research examining the effects of post-event drawing has focused solely on *voluntary* memory (i.e., conscious event recall), rather than *involuntary* memory (e.g., vivid, image-based intrusions). Our study examined the impact of drawing on both types of memory.

The Benefit of Drawing on Event Recall

Several studies have examined the effects of drawing on voluntary memory for an event. In a seminal study, Butler et al. (1995) had children, aged 5-6, experience a tour of a fire station. The next day, a verbal group verbally described, and another group drewwhat happened during the tour. The children were then interviewed using free recall (e.g., open-ended questions such as “tell me what happened”), direct recall (e.g., cued recall questions such as “tell me how you got there”) or photo recall (e.g., asked to identify which of a set of images were from the event). The draw group reported almost twice as much accurate information during a memory interview as the verbal group, especially for direct recall questions. This pattern held even when the manipulation occurred after a month.

Many studies have since established that drawing an event can enhance memory relative to verbal interventions such as oral retelling (e.g., Butler et al., 1995; Barlow et al.,

2011; Otgaar et al., 2016; Patterson & Hayne, 2011; Strange et al., 2003) or providing a written account (Krackow, 2011; Matsuo & Miura, 2017). These effects have been found both with children (see Driessnack, 2005 for a meta-analytic review; see also Maddox et al., 2023) and adults (Dando, 2013; Dando et al., 2009; Matsuo & Muira, 2017). Enhanced event recall has been detected whether drawings are created immediately following the event or after a delay ranging from a 1 day to 1 year (e.g., Butler et al. 1995; Bruck et al., 2000; Gardner et al. 2020; Gross & Hayne, 1999; Katz & Hershkowitz, 2010).

Drawing Traumatic Events

Drawing has also been deemed as a useful tool for eliciting recall of traumatic experiences, such as drawing during forensic interviews (Dando et al., 2009; Mattison et al., 2016; Otgaar et al., 2016), clinical assessments (Veltman & Browne, 2002; Woodford et al., 2015) and therapeutic interventions (Clements, 1996; Cohen-Yatziv & Regev, 2019; Shouten et al., 2019). Despite its common use in these settings, experiments on the effects of drawing on memory for traumatic events are also rare. Some research has examined the effects of drawing on voluntary memory for traumatic autobiographical events, such as sexual abuse (Katz & Hamama, 2012; Katz & Hershkowitz, 2010) or other emotionally laden events (MacLeod et al., 2013; Wesson & Salmon, 2001; Salmon et al., 2003). However, the *accuracy* of participants' memories for personal events cannot be determined, thus this research could only measure the *amount of information* reported. Other research has examined the effects of drawing on memory for crime events in a controlled laboratory setting to enable accuracy to be measured. However, these studies typically used non-traumatic events (Dando et al., 2009; Krackow, 2012; Matsuo & Miura, 2017), despite a goal of the research being to evaluate the application of drawing after *traumatic* experiences.

The lack of research using trauma-specific stimuli to examine the effects of drawing on memory may reflect perceived ethical risks to participants. A practical way to examine the

effects of drawing on memory for traumatic events is to use an ethical analogue of a lived traumatic experience. To this end, the trauma-film paradigm (Arnaudova & Hagenaars, 2017), in which participants watch a film with distressing content (Holmes & Bourne, 2008), can be useful. Such events allow researchers to measure the effects of various manipulations on both *voluntary* memory (including accuracy) and *involuntary* memory in a controlled setting, thus enabling causal inferencing (Arnaudova & Hagenaars, 2017).

Voluntary vs. Involuntary Memory Following Trauma

Voluntary memories are purposefully brought into consciousness, whereas *involuntary* memories are unintentional, and are often spontaneous automatic and unwanted (Mace, 2005). The *dual-representation theory* of PTSD posits that memories are encoded via two distinct memory systems, one *verbal* and one *visual* (Brewin et al., 1996). When individuals are exposed to a traumatic event, certain aspects of the event are said to be stored in a verbally accessible memory system from which they later can be voluntarily retrieved. Other aspects are stored in a visually assessable memory system from which they later can be involuntarily retrieved (e.g., as intrusions). Both types of memory arise in everyday life (Mace, 2005). For example, intrusions can occur when trying to recall words in a list (e.g., Thomas et al., 2018). However,involuntary memories for a *traumatic* event (termed *trauma-related intrusions*)are characteristically vivid, visual, sensory, repetitive, and *distressing* (APA, 2013). Importantly, such intrusions are recognised as one of the central characteristics of posttraumatic stress disorder (PTSD) and performing *visual-motor* tasks (akin to drawing) have been found to provide a "cognitive vaccine" that reduces trauma-related intrusions (see Deeprose et al., 2012; Hagenaars & Antz, 2012; Holmes et al., 2010).

Visual-Motor Tasks and Intrusion Reduction: The Cognitive Vaccine

While watching segments of road traffic accidents, Brewin and Saunders (2001) had some participants perform a visual-motor task (tapping predetermined sequences on a

keyboard), whereas others did not (i.e., a no-task control condition). Distress ratings were measured pre- and post-trauma film, and again after performing the task or not. Voluntary memory for the film was then tested using cued recall (e.g., "what colour was the car?"), and involuntary memory was measured via a daily-intrusion diary kept for 2 weeks. Keyboard tapping significantly reduced intrusions over the 2-week period compared to the no-task control condition. However, voluntary memory for the event and self-reported distress ratings did not differ between groups. In line with the dual-representation theory of PTSD (Brewin et al., 1996), Brewin and Saunders posited that the visual-motor task interfered with the consolidation of involuntary memories by competing for visual-perceptual resources.

Since Brewin and Saunders' (2001) study, the effectiveness of a variety of tasks for reducing trauma-related intrusions has been examined (see Brewin, 2014 for review). This research suggests that for intrusions to be reduced, a task must include both a *visual* and a *motoric* component. For example, tasks such as playing the computer game Tetris, shaping plasticine, and keyboard tapping have been found to reduce intrusions post-trauma event (Brewin, 2014). Playing Tetris has also been shown to reduce intrusions while leaving voluntary memory intact (for review see Brewin, 2014). However, motoric-only tasks such as bicycle riding and chewing gum, or visual-only tasks such as using mental-visual imagery, do not appear to reduce intrusions (Brewin, 2014). Surprisingly, despite drawing involving both a *visual* and *motoric* component, its usefulness as an intervention for reducing intrusions has not been thoroughly assessed. Our study provides this assessment.

Task Timing

The effectiveness of drawing for reducing intrusions following traumatic events may depend on task timing. In particular, drawing may need to be performed *during* the period of memory consolidation to compete with the cognitive resources required for involuntary memory processing (for review see Brewin, 2014; see also James et al., 2015). Memories

may be consolidated within a few hours following a traumatic experience (e.g., Nader & Hardt, 2009). Prior to consolidation, however, memories are malleable and thus, can be altered, disrupted, or modified. In line with this claim, intrusion reduction typically occurs when visual-motor tasks are performed during or *immediately* after a traumatic event (e.g., Deeprose et al., 2012; Hagenaars et al., 2017; Holmes et al., 2010; see also Brewin, 2014 for review). And yet, in forensic, clinical, and therapeutic settings, drawing is typically performed long after traumatic events, and therefore after memory consolidation. Thus, it is critical to examine the effects of drawing when it is performed immediately after a traumatic event as well as when it is performed after memory consolidation has occurred.

Non-event focused drawing

The effects of drawing on intrusions may also depend on whether the drawing task focuses on the event or not. Drawing focused on the traumatic experience itself may have different cognitive consequences than drawing that is unrelated to the trauma (e.g., *comfort drawing*). On the other hand, unstructured drawing is often used in applied settings to engage, calm, and reassure interviewees (Bekhit et al., 2005; Malchiodi, 1998, cited in MacLeod et al., 2016), especially when the events being discussed are difficult to talk about (e.g., child sexual abuse). A review and meta-analysis by Maddox et al. (2023) identified only two randomised control trial studies that have examined the effects of non-event-focused drawing on memory for an event (MacLeod et al., 2016; Poole & Dickson, 2014).

MacLeod et al. (2016) had children, aged 5-6, tour a harbour in a boat and perform various memorable activities. A day or two later, the children were interviewed about the event. A *talk-only* group verbally described everything they remembered about the boat trip, a *directed-draw* group drew everything they remembered, and an *undirected-draw* group drew “whatever they wanted”. The three groups reported similar *amounts* of information. However, the undirected-draw group reported more errors and confabulations (i.e., fantasy-

based errors) than the other groups. MacLeod et al. suggested that event-focused drawing may be better than non-event focused drawing as an interview aid.

Poole and Dickson (2014) examined whether non-directed drawing improves children's autobiographical reports in forensic interviews by reducing stress (i.e., comforting). Children aged 5-12 participated in a remote event experienced 1-2 years before the interview and an event experienced the day of the interview. The children were assigned either to a comfort drawing group (i.e., a non-event focused drawing task), in which they drew whatever they wished while being interviewed about the event, or to a no-drawing group. Comfort drawing did not influence the amount or accuracy of children's event recall for remote or recent events.

It is worth noting that it is unclear whether children in the non-event-focused conditions in these studies included event details in their drawings. In addition, neither study used a traumatic event. Thus, to date the effects of non-event focused vs. event-focused drawing on memory accuracy using trauma specific stimuli have not been systematically studied. It also remains to be tested whether non-event focused drawing can reduce trauma-related intrusions the way "cognitive vaccines" have been purported to do (e.g., Deeprose et al., 2012; Hagenaars & Antz, 2012; Holmes et al., 2010).

Our study reports three experiments that used the trauma-film paradigm to investigate the effects of drawing on *voluntary* and *involuntary* memory following an analogue trauma. In each experiment we measured both voluntary event recall (i.e., accuracy, amount of information reported and errors) and involuntary memory intrusions (i.e., frequency and distress ratings) over 3 consecutive days. Experiment 1 examined the effects of a draw versus verbal task on both voluntary event recall and involuntary intrusions when the intervention was performed *immediately* after the trauma film (e.g., before memory consolidation). In Experiment 2, the same interventions occurred after a 24-hr *delay* (e.g., after memory

consolidation; see Figure 1). Experiments 1 and 2 were run in parallel. Finally, Experiment 3 examined the effects of a non-event focused drawing task.

Experiment 1: Immediate Intervention

Experiment 1 examined whether drawing a traumatic event immediately after experiencing it increases the accuracy and amount of information voluntarily recalled, and whether it decreases the frequency and distress of subsequent intrusions. Other visual-motor tasks have been reported to reduce trauma-related intrusions (e.g., Tetris; see Holmes et al., 2010). Intrusion reduction occurs when a visual-motor task is performed soon after a traumatic event (e.g., immediate interventions), before memory consolidation (Brewin, 2014). In this way, performing a visual-motor task is theorised to interfere with, and to compete for, visuospatial cognitive resources during memory consolidation. We sought to determine if a drawing task might have the same impact as other intrusion reducing visual-motor tasks, by interfering with the consolidation of trauma memories. If so, drawing should enhance voluntary event recall while decreasing trauma-related intrusions.

Method

The experiment was preregistered on Open Science Framework (OSF) at https://doi.org/10.17605/OSF.IO/HXYTK

Participants

The sample size selected was comparable to other trauma-film paradigm studies (see see Arnaudova & Hagenaars, 2017 for review) and consisted of 60 students (32 verbal, 28 draw; 41 female, 19 male; $M = 23.15$, $SD = 6.29$), who each received either course credit, or a $30 participation payment. Participants were tested in the lab (pre COVID-19) or online (post COVID-19). Participants with missing data were retained and included in analyses where possible.

Materials, Measures, and Tasks

Trauma Film. The video was a 4 min United Kingdom public service announcement depicting a graphic car accident; this event has been used in previous studies (e.g., Strange & Takarangi, 2012; Takarangi et al., 2014; see Arnaudova & Hagenaars, 2017 for review).

Pre- and Post-trauma Film Measures. Pre-trauma film levels of distress were measured by asking participants to indicate their current distress levels using a visual analogue scale (0 = not at all, 100 = extremely). After the trauma film, participants rated on visual analogue scales: 1) how much attention they paid to the film (0 = very little, 100 = all), 2) the personal relevance of the film (0 = not at all, 100 = extremely), and 3) their current level of distress (0 = not at all, 100 = extremely).

DASS-21. The Depression, Anxiety and Stress Scale (DASS-21) was used to measure aspects of participants' mental health. The DASS-21 is a structured self-report questionnaire consisting of a total 21 items, with 7 items per subscale: depression, anxiety, and stress. Participants were asked to complete every item on the 4-point scale (0 = did not apply to me at all, 3 = applied to me very much). Sum scores were computed by adding up the scores on all the items and multiplying by a factor of 2. Total sum scores range from 0-120 and subscale scores range from 0-42 (Lovibond & Lovibond, 1995).

Voluntary Memory Measures. Voluntary memory for the event was measured online via a Qualtrics survey using a 6-item questionnaire (see Appendix A). The same questionnaire was presented to participants each day for 3 consecutive days, with question order counterbalanced. Participants were asked to type their responses into text boxes. Two independent researchers, blind to task conditions, later coded the responses. Participants received 1 point per correct response (as per Butler et al., 1995). For example, for the question "can you describe the vehicles involved in the accident", the answer "three cars, one was red, and one was silver" would receive 3 points. Incorrect responses were coded as errors

(e.g., “the car was blue”). The amount of information reported was measured as the sum of the word counts across the 6 responses.

Daily-Intrusion Measures. Participants recorded intrusions via an online survey each evening, over 3 consecutive days. Participants were asked to record the number of intrusions experienced that day and to write a brief description of each intrusion. They then rated on a visual analogue scale the vividness of each intrusion (0 = not at all vivid, 100 = extremely vivid) and how distressing it was (0 = not at all distressing, 100 = extremely distressing). Participants were also asked to categorise each intrusion as either an “image”, “thought” or “combination” of both by ticking a box (as per Holmes et al., 2004).

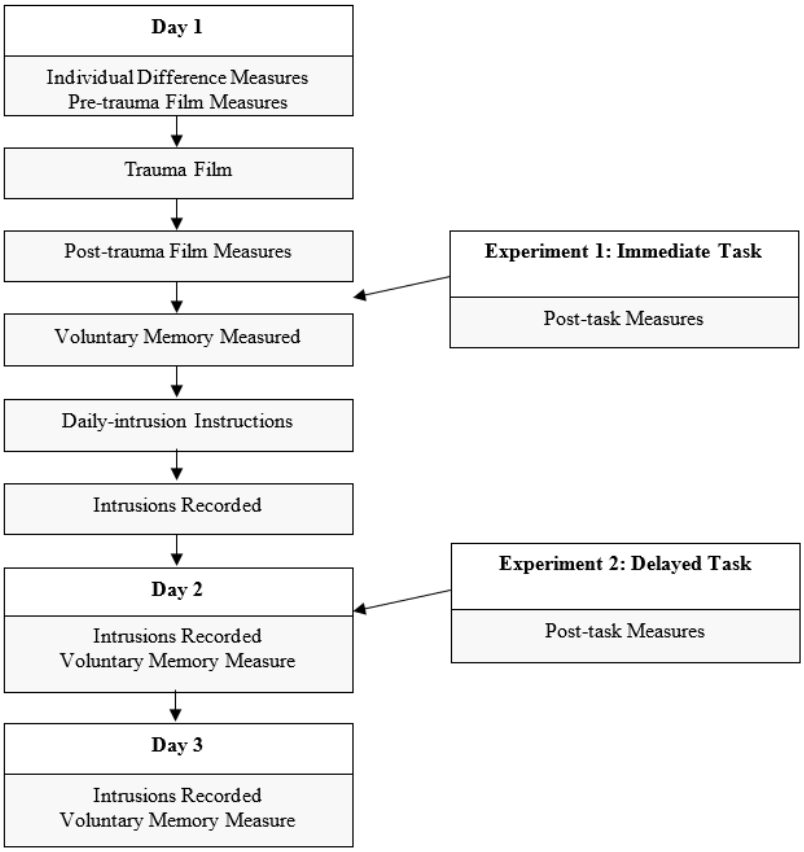
Draw vs. Verbal Task. Draw condition participants were asked to “draw in as much detail as possible everything that happened in the film for 5 minutes” on a piece of paper. Verbal condition participants were asked to “verbally describe in as much detail as possible everything that happened in the film for 5 minutes”. To ensure compliance with task directives participants were asked to provide their drawing or audio recording via upload to the survey software. Participants then rated 1) how difficult and 2) how distressing they found the task (0 = not at all, 100 = extremely).

Procedure

Figure 4.1 illustrates the experimental design. The study was conducted using Qualtrics online software, and participants were tested individually over 3 consecutive days. After providing consent, participants provided demographic information (age, gender), completed the DASS-21, and reported their current state of distress. They then watched the trauma film and completed the post-trauma-film measures. The program then randomly allocated participants to the draw or verbal group. Participants were told they had 5 minutes to complete their assigned task and a count-down timer appeared on screen. Participants then

completed the post-task measures followed by the 6-item voluntary memory questionnaire (see Appendix A)**Figure 4.1**

Procedure for Experiments 1 (Immediate Task) and 2 (Delayed Task)



Note. The procedure was identical for the immediate and delayed task conditions, except in the later condition the task occurred between 9-11 am on Day 2.

Participants then read information about involuntary memory intrusions, including what they feel like and how to record them in the online survey each evening. It was explained that intrusions are any image-based and/or thought-based involuntary memories of the film that "pop up" spontaneously and unexpectedly. Those who did not experience any intrusions indicated this when prompted by the survey. Participants were told they would be required to report their intrusions for 3 consecutive days, beginning that evening (e.g., Day 1). They were also told that on Day 2 and 3, after reporting their intrusions, they would also answer specific questions about their memory for the film (i.e., the 6-item memory

questionnaire). After completing the memory surveys, participants received a debriefing and a contact for counselling services in case they had any concerns.

Results

Individual Difference Measures, Film Ratings and Task Ratings by Condition

The draw and verbal task groups were similar in age, $t(58) = 0.97$, $p = .337$, $d = 0.25$. Descriptive statistics for the individual difference measures appear in Table 4.1.1 There were no differences between the groups on the DASS-21 scales, rated attention to the film, rated personal relevance of the film, or rated distress of the film. However, task difficulty was rated higher by the draw group than the verbal group.

Table 4.1.1

Experiment 1: Individual Difference Measures, Film Ratings, and Task Ratings by Condition

Measure/Ratings	**Draw**	**Verbal**		
	M (SD)	*M (SD)*	*t*(58)	*p*
DASS-21				
Depression	5.07 (4.11)	5.35 (4.75)	0.24	.814
Anxiety	4.93 (3.61)	5.86 (5.41)	0.57	.570
Stress	8.23 (4.38)	7.80 (4.64)	-0.37	.709
Film Ratings				
Pre-Film Distress	19.32 (19.99)	14.39 (16.42)	-1.48	.141
Post-Film Distress	51.50 (25.05)	49.67 (24.96)	-0.39	.690
Attention Paid	91.35 (13.01)	89.47 (12.58)	0.80	.425
Personal Relevance	29.98 (25.16)	33.71 (27.64)	0.77	.445
Task Ratings				
Distress	45.67 (24.45)	41.62 (27.71)	-0.59	.553
Difficulty	50.14 (26.97)	33.46 (25.12)	-2.48	.016

Note. Draw ($n = 28$) Verbal ($n = 32$)

Manipulation Check

The trauma film was distressing: post-film distress (M = 52.55, SD = 25.25) was greater than pre-film distress (M = 15.75, SD = 19.28), $t(59)$ -13.81, $p < .001$, d = 1.78.

Voluntary Memory Outcomes

Interrater reliability was acceptable for both accurate details (α = .85) and errors (α = .76), as per Cronbach's Alpha analysis (Taber, 2018). A 2(task type: draw, verbal) × 3(memory-measure timepoint: post-task, 24-hr follow up, 48-hr follow up) mixed ANCOVA was used to examine each voluntary memory outcome (i.e., accuracy, inaccuracy, and amount of information reported). For each analysis, task type was the between-group factor and memory-measure timepoint was the within-subjects factor. Covariates in the model for each analysis were individual differences at baseline (age, gender, DASS-21 scores, film ratings). Figure 4.2.1 provides the means; Table 4.1.2 provides the ANCOVA results.

Table 4.1.2

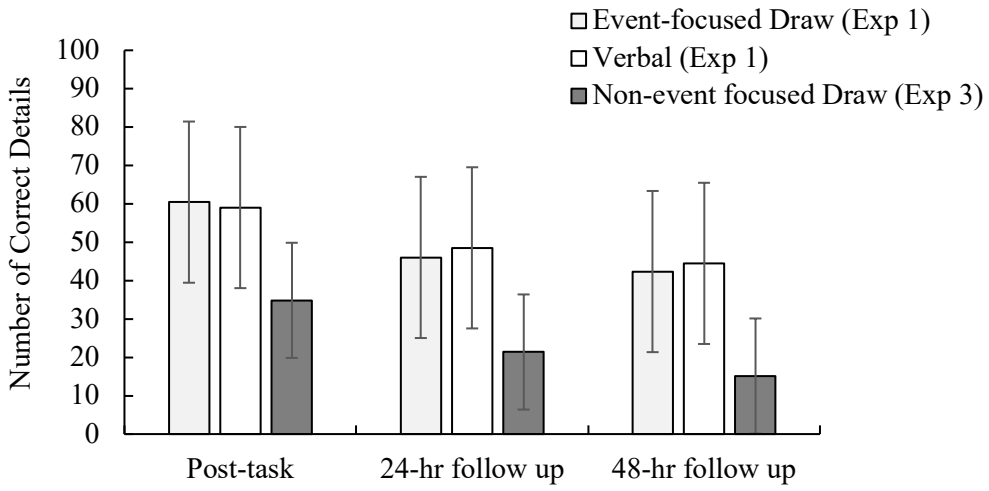
Experiment 1: Immediate Task ANOVAs Results for Voluntary Memory Measures

Voluntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Accuracy					
Task	1, 44	3.69	0.03	.957	<.001
Memory-measure Timepoint*	2, 88	3823.62	17.03	<.001	.279
Task × Memory-measure Timepoint*	2, 88	261.94	0.58	.449	.013
Errors					
Task	1, 43	1.84	0.42	.518	.010
Memory-measure Timepoint	2, 86	0.39	0.29	.744	.007
Task × Memory-measure Timepoint	2, 86	0.17	0.21	.814	.005
Word Count					
Task	1, 44	36591.81	1.38	.246	.030
Memory-measure Timepoint*	2, 88	17771.87	30.51	<.001	.410
Task × Memory-measure Timepoint*	2, 88	3120.46	0.58	.560	.013

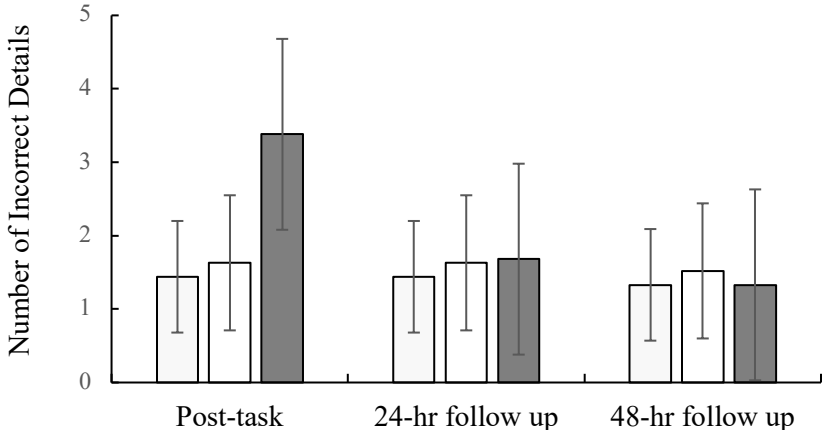
Note. *Huynh-Feldt correction applied because sphericity assumption failed (Mauchly's test).

Figure 4.2.1*Experiments 1 and 3, Voluntary Memory: Accuracy, Word Count and Errors*

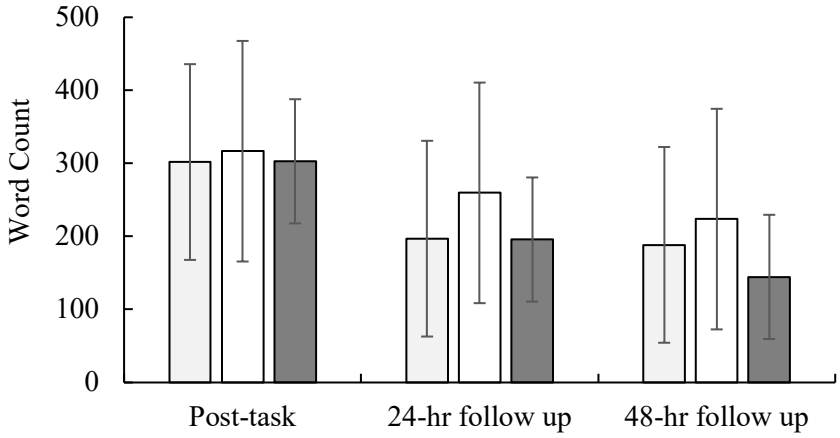
a) Accuracy



b) Errors



c) Word Count



Note. Error bars represent 95%

Memory Accuracy. The number of accurate details reported was similar after the draw and verbal task. Accuracy was also similar across the three timepoints: post-task, 24-hr and 48-hr follow up. The interaction between task type and memory-measure timepoint was not significant (Figure 4.2.1).

Memory Inaccuracy. The number of errors reported was similar after the draw and verbal task. Inaccuracy was also similar across timepoints. The interaction between task type and memory-measure timepoint was not significant (Figure 4.2.1).

Amount of Information Reported. The amount of information reported was similar after the draw and verbal tasks, but word counts were higher post-task than at 24-hr follow up, or at 48-hr follow up; however, these differences were not influenced by task type (Figure 4.2.1).

Involuntary Memory Outcomes

To measure the impact of drawing on involuntary memory, we next analysed both intrusion frequency and rated intrusion distress. Each measure was analysed using a 2(task type: draw, verbal) × 3(memory-measure timepoint: post-task, 24-hr follow up, 48-hr follow up) mixed ANCOVA. Task type was the between-group factor and memory-measure timepoint was the within-subjects factor. Figure 4.4.2 provides the means; Table 4.1.3 provides the ANCOVA results.

Table 4.1.3

Experiment 1: Immediate Task ANOVAs Results for Involuntary Memory Measures

Involuntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Frequency					
Task	1, 41	7.11	1.72	.196	.040
Memory-measure Timepoint*	1.89, 77.56	35.81	18.61	<.001	.312
Task × Memory-measure Timepoint*	1.89, 77.56	6.22	3.23	.047	.073
Distress					

Task	1, 41	2646.53	10.26	<.001	.200
Memory-measure Timepoint*	1.66, 68.10	533.50	0.19	.781	.005
Task × Memory-measure Timepoint*	1.66, 68.10	27813.11	0.48	.584	.012

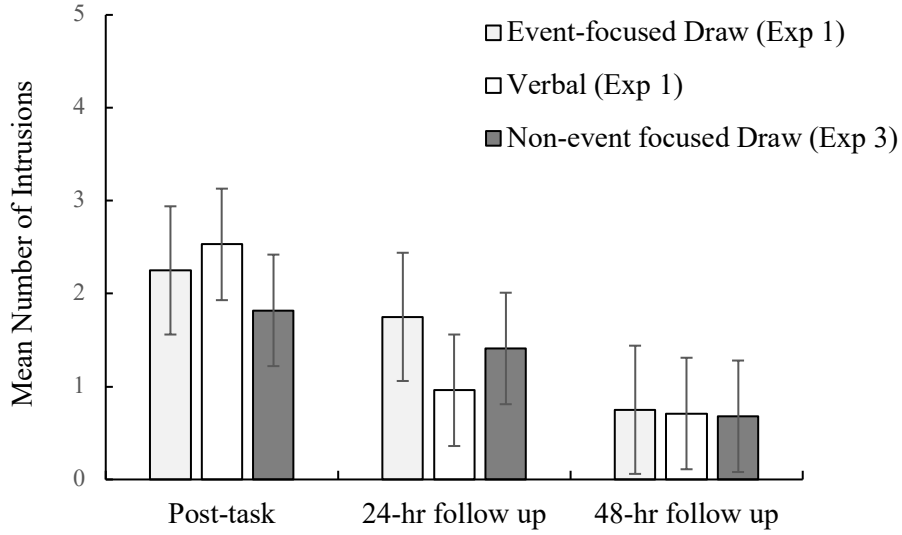
Note. *Huynh-Feldt correction applied because sphericity assumption failed (Mauchly's test).

Intrusion Frequency. There was a significant interaction between task type and timepoint (Table 3.1). ost hoc analyses were conducted comparing the between group means at each timepoint. Immediately post-task, intrusion frequency was similar for the draw and verbal tasks, $F(1, 41) = 0.08$, $p = .775$, $\eta^2_p = .002$. However, at 24-hr follow up, intrusion frequency was greater for those who performed the draw task than for those who performed the verbal task, $F(1, 41) = 6.46$, $p = .015$, $\eta^2_p = .136$. At 48-hr follow up, intrusions were minimal for both the draw and verbal task groups, and not significantly different $F(1, 41) = 0.70$, $p = .407$, $\eta^2_p = .017$ (see Figure 4.2.2).

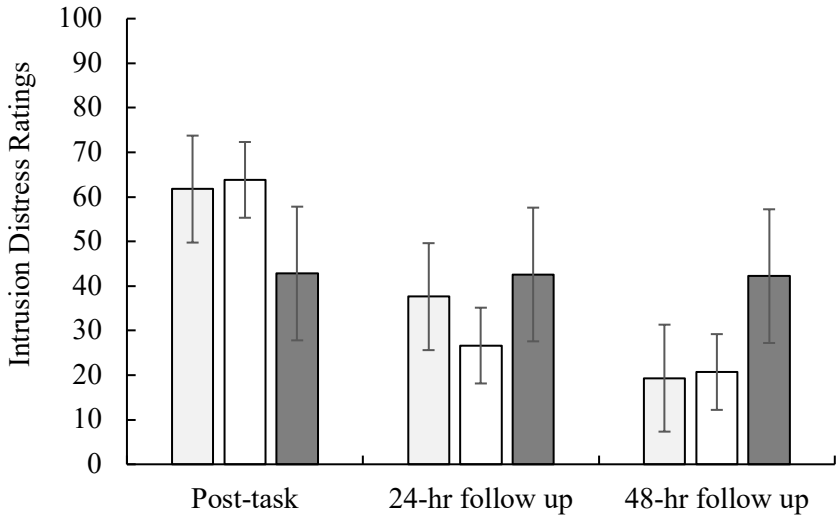
Intrusion Distress. Rated intrusion distress was similar following the draw and verbal task. Although intrusion distress appeared to be greater immediately post-task than at 24-hr or 48-hr follow up, this effect of timepoint was not significant. The interaction between task type and memory-measure timepoint was not significant (see Figure 4.2.2).

Figure 4.2.2*Experiments 1 and 3, Involuntary Memory: Intrusion Frequency and Intrusion Distress Ratings*

a) Frequency



b) Distress



Note. Error bars represent 95% CI.

Intrusion Consistency. We next examined whether drawing led to intrusions that were more consistent over time (albeit not more distressing). The consistency of participants' intrusion descriptions was coded as 1 when an intrusion description was largely the same on Day 2 as on Day 1 (see Table 4.1.4), otherwise it was coded as 0. The percentage of matching

intrusion descriptions reported at 24-hr follow up was then calculated. The rate of consistent intrusions was 62.0% after the draw task (n = 15; SD = 44.04) and only 37.2% after the verbal task (n = 16; SD = 42.3), but this difference was not significant $F(1, 30) = 2.66$, p = .113, η^2_p = .081.

Table 4.1.4

Experiment 1: Involuntary Memory: Intrusion Descriptions and Scoring for Consistency

Condition	Intrusion Description Day 1 (Task Day)	Intrusion Description Day 2 (24-hrs follow-up)	Scoring
Draw	"…and seeing the bloody faces of the girls getting tossed around the car"	"…I immediately thought of the 3 friends laughing just before the accident"	Inconsistent (**0**)
Verbal	"… the shot of the dead infant with wide open eyes"	"…the girl was screaming in agony"	Inconsistent (**0**)
Draw	"… I pictured her bright blue eyes just starting into nothing"	"… the babies' blue eyes. They are just sticking with me"	Consistent (**1**)
Verbal	"…the guy in the blue shirt trying to get the door open and yelling for an ambulance"	"… the man yelling for an ambulance"	Consistent (**1**)

Intrusion Qualities. For completeness, the qualitative nature of participants' intrusions was analysed using a 2(task type: draw, verbal) multivariate ANCOVA analyses. The dependent variables were number of intrusions categorised as: 1) thoughts, 2) images, 3) combination of both thoughts and images). Intrusions in the two groups were similarly likely to be classified as thoughts, $F(1, 58) = 0.08$, p = .782, η^2_p = .001, as images, $F(1, 58) = 0.25$, p = .616, η^2_p = .004, or as a combination, $F(1, 58) = 0.58$, p = .449, η^2_p = .010.

Discussion

Contrary to expectations, relative to verbal debriefing, drawing did not enhance voluntary memory (either accuracy or amount of information reported) about the trauma film immediately post-invention, after 24 hrs, or after 48 hrs. That the amount of information

reported decreased after 24 hours could reflect memory deterioration, but we acknowledge that it might simply reflect participants choosing not to re-enter their memory for the event in as much detail on Days 2 and 3.

Perhaps our most interesting finding was that drawing did not result in fewer subsequent intrusions at 24-hr follow up relative to verbal debriefing. Drawing (in theory) was expected to compete for the visual-perceptual cognitive resources required to consolidate involuntary memories, and thus was expected to reduce intrusions. Contrary to that possibility, drawing failed to reduce post-task intrusion frequency, and in fact led to *more* intrusions 24 hrs after the event. Importantly, these intrusions appeared to be more persistent over time with 62% of the intrusions in the second report being the same as those reported on the day of the event. However, these intrusions were no more distressing for the draw group than for the verbal group. In contrast, the verbal group reported a significant decline in intrusions after the first day. By the final day of reporting intrusion frequency was extremely minimal for both groups, though it remained comparable to previous studies using the same trauma film (M = 0.47, 95%CI [0.23, 0.71], p <.001; see Arnaudova & Hagenaars, 2017).

Experiment 2: Delayed Intervention

Experiment 2 was the same as Experiment 1, except the draw/verbal task was *delayed* until the second day of the experiment (see Figure 4.1). Drawing is often used in applied settings anywhere from days to years after initial exposure to a traumatic event (see Derksen & Connolly, 2022 for review) and, thus, well after memory consolidation. Drawing has been shown to enhance voluntary event recall, relative to verbalising, whether applied immediately or after a delay (e.g., Gross & Hayne, 1999). Thus, we expected that drawing would enhance voluntary event recall in Experiment 2. Intrusions, on the other hand, should only be reduced if a visual-motor task is performed prior to memory consolidation (as per the dual-coding theory of PTSD; see Brewin et al., 1996). By this account, we would not expect to see a

reduction in intrusion frequency due to drawing in Experiment 2. In fact, visual image-creation (like drawing) during therapy is theorised to help individuals *access* involuntary memories due to the connection between the visual, nature of both image creation and trauma-related memories (Hass-Cohen & Findlay, 2019; Schnitzer et al., 2021; Schouten et al., 2015). In this scenario, post-event drawing after a delay in Experiment 2 might actually increase intrusion frequency or distress ratings relative to the verbal task.

Method

The experiment was pre-registered on Open Science Framework (OSF) at https://doi.org/10.17605/OSF.IO/HXYTK.

Participants

The sample size selected was comparable to other trauma-film paradigm studies (see see Arnaudova & Hagenaars, 2017 for review) and consisted of 60 participants (32 verbal, 28 draw; 48 female, 12 male; $M = 23.98$, $SD = 9.03$, see Table 2). Due to COVID-19, participants were tested online via videoconference at a location of their choosing. Participants with missing data were retained and included in analyses where possible. The participants in Experiment 2, were not the same as those recruited for Experiment 1.

Materials, Measures, and Tasks

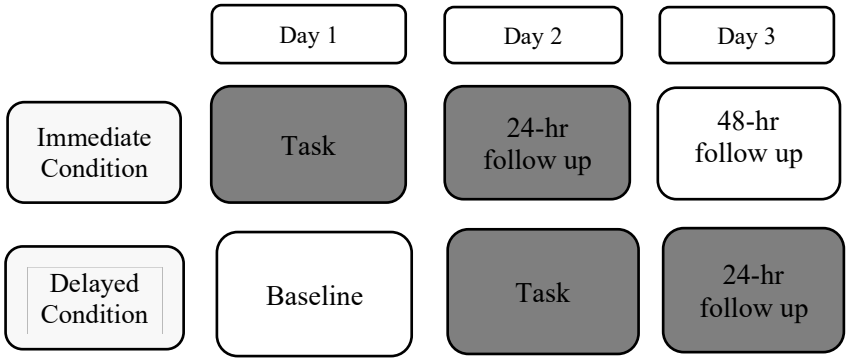
The materials, measures and intervention tasks were identical to Experiment 1.

Procedure

The procedure followed Experiments 1, except the draw or verbal task was delayed until the day after participants watched the trauma film. Specifically, the task in Experiment 2 occurred between approximately 9-11 am on Day 2, prior to the memory measures being taken.Figure 4.1 illustrates the sequence of tasks. A direct comparison of the immediate (Experiment 1) and delayed (Experiment 2) experiments is shown in Figure 4.3.

Figure 4.3

Illustration of the Immediate (Experiment 1) versus Delayed (Experiment 2) Task Factor



Note. The trauma-film was always played on Day 1. Shaded boxes indicate the memory-measure timepoints used in all subsequent analyses.

Design

A 2(task type: draw, verbal) × 2(memory-measure timepoint: post-task, 24-hr follow up) mixed-factor design was used. Task type was the between-group factor and memory-measure timepoint was the within-subjects factor. The design of Experiment 2 afforded additional baseline memory measures; these were entered as covariates along with the covariates used in Experiment 1 to further control for baseline differences (see Figure 4.3).

Results

Individual Difference Measures, Film Ratings and Task Ratings by Condition

The draw and verbal task groups were again similar in age, t(58) = 0.21, p .832, d = 0.05. The means and standard deviations for other individual difference measures are presented in Table 4.2.1. As can be seen in Table 4.2.1, there were no differences between groups on any of the DASS-21 scales, film, or task ratings.

Table 4.2.1

Experiment 2: Individual Difference Measures, Film Ratings, and Task Ratings by Condition

Measure/Ratings	Draw	Verbal		
	M (SD)	*M (SD)*	*t*(58)	*p*
DASS-21				
Depression	5.70 (5.31)	3.90 (3.67)	-1.53	.133
Anxiety	4.83 (4.21)	3.06 (2.57)	-1.96	.056
Stress	8.26 (4.83)	6.13 (4.31)	-1.80	.077
Film Ratings				
Pre-Film Distress	21.10 (19.72)	14.17 (13.99)	-1.57	.122
Post-Film Distress	53.20 (23.48)	43.80 (25.22)	-1.49	.141
Attention Paid	88.03 (13.48)	92.87 (9.67)	1.59	.116
Personal Relevance	27.50 (20.76)	23.87 (23.44)	-0.63	.528
Task Ratings				
Distress	17.83 (18.75)	15.44 (17.45)	-0.51	.615
Difficulty	42.36 (27.03)	33.44 (28.11)	-1.24	.219

Note. Draw (n = 28) Verbal (n = 32)

Manipulation Check

The trauma film was distressing: post-film distress (M = 48.50, SD = 24.62) was greater than pre-film distress (M = 17.63, SD = 17.31), t(59) -9.80, p < .001, d = 1.27.

Voluntary Memory Outcomes

Interrater reliability was acceptable for voluntary memory accuracy (α = .92) and error scores (α = .76). A 2(task type: draw, verbal) × 2(memory-measure timepoint: post-task, 24-hr follow up) mixed ANCOVA was used to examine each voluntary memory outcome (i.e., accuracy, inaccuracy, and amount of information reported). For each analysis, task type was the between-group factor and memory-measure timepoint was the within-subjects factor. Covariates in the model for each analysis were the same as Experiment 1. Figure 4.4.1 provides the means; Table 4.2.2 provides the ANCOVA results.

Table 4.2.2

Experiment 2: Delayed Task ANOVAs Results for Voluntary Memory Measures

Voluntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Accuracy					
Task	1, 44	95.95	0.13	.713	.003
Memory-measure Timepoint	1, 44	296.71	1.88	.177	.041
Task × Memory-measure Timepoint	1, 44	3.41	0.02	.884	.001
Errors					
Task	1, 44	1.27	0.25	.622	.006
Memory-measure Timepoint	1, 44	1.26	1.16	.287	.026
Task × Memory-measure Timepoint	1, 44	0.02	0.02	.894	.001
Word Count					
Task	1, 44	19224.49	1.64	.206	.036
Memory-measure Timepoint	1, 44	2.265	0.01	.976	.001
Task × Memory-measure Timepoint	1, 44	1291.81	0.40	.528	.009

Memory Accuracy. The number of accurate details reported was similar after the draw task and the verbal task. As per Experiment 1, accuracy was not affected by time. The interaction between task type and memory-measure timepoint was also not significant (see Figure 4.4.1).

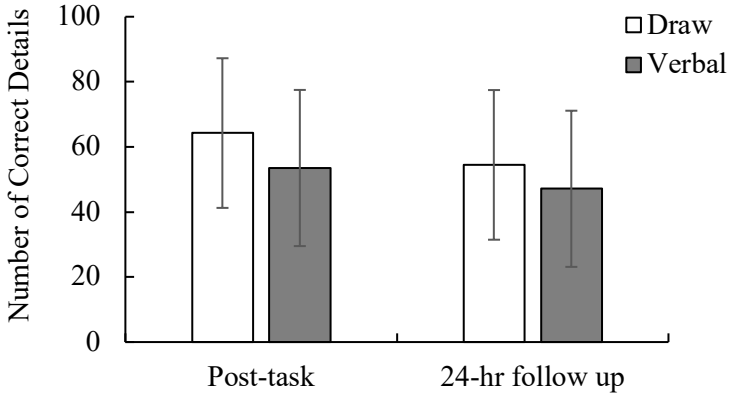
Memory Inaccuracy. The number of errors reported was similar between task types and across timepoints. The interaction between task type and memory-measure timepoint was not significant (see Figure 4.4.1).

Amount of Information Reported. The amount of information was also similar between task types and across timepoints. The interaction between task type and memory-measure timepoint was not significant (see Figure 4.4.1).

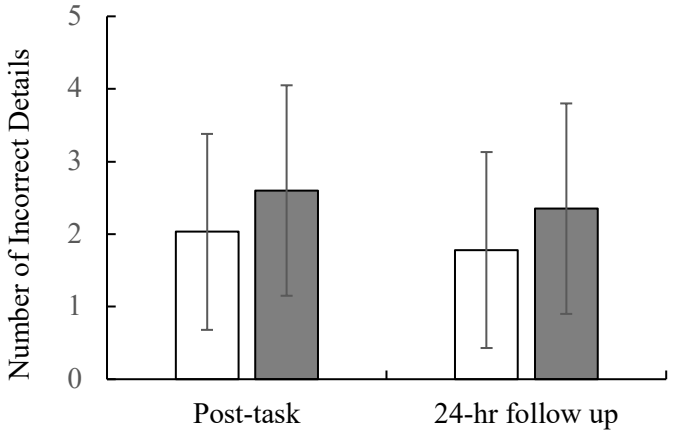
Figure 4.4.1

Experiment 2, Voluntary Memory: Accuracy, Word Count and Errors

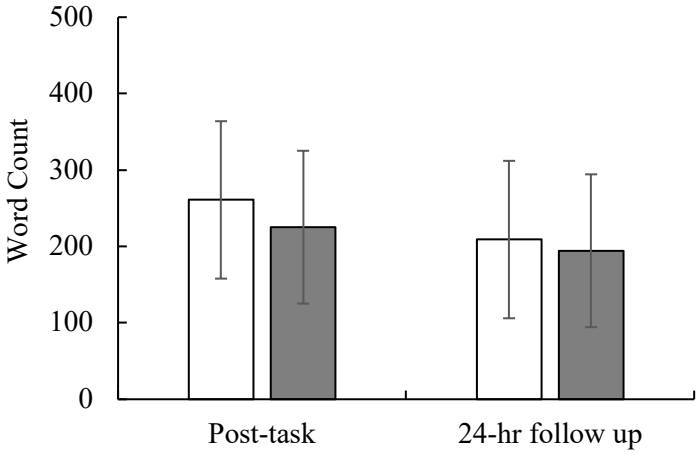
a) Accuracy



b) Errors



c) Word Count



Note. Draw (n = 29), Verbal (n = 27). Error bars represent 95% CI.

Involuntary Memory Outcomes

Analysis of the involuntary memory outcomes matched Experiment 1 (except for the inclusion of the additional baseline covariates, as noted above). The ANCOVA results can be seen in Table 4.2.3 and the descriptive statistics are provided in Figure 4.4.2.

Intrusion Frequency. There was no main effect of task, no main effect of time, and no significant interaction between task type and memory-measure timepoint (see Figure 4.4.2).

Table 4.2.3

Experiment 2: Delayed Task ANOVAs Results for Involuntary Memory Measures

Involuntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Frequency					
Task	1, 47	0.07	0.83	.776	.002
Memory-measure Timepoint	1, 47	2.55	6.39	.015	.120
Task × Memory-measure Timepoint	1, 47	0.36	0.89	.348	.019
Distress					
Task	1, 47	0.16	<.001	.987	<.001
Memory-measure Timepoint	1, 47	1229.55	4.06	.050	.080
Task × Memory-measure Timepoint	1, 47	0.96	0.00	.955	<.001

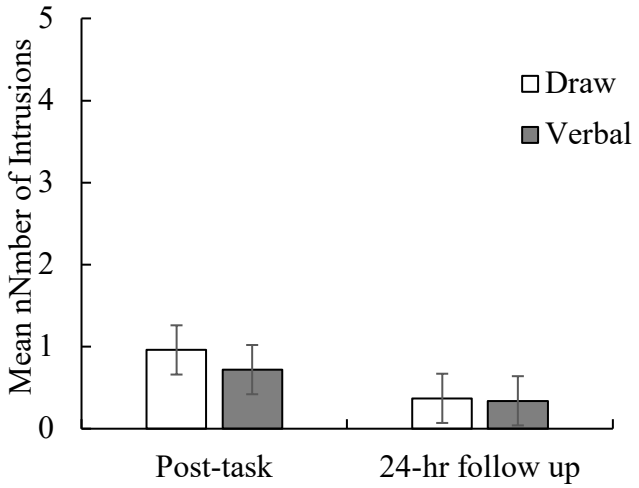
Intrusion Distress. As shown in Table 4.2.3, there was no main effect of task, or memory-measure timepoint. The interaction between task type and memory-measure was not significant (see Figure 4.4.2).

Intrusion Qualities. No significant differences emerged between intrusion classifications across the groups; they were equally likely to be classified as thoughts, $F(1, 49) = 0.02$, $p = .904$, $\eta^2_p < .001$; as images, $F(1, 49) = 0.07$, $p = .788$, $\eta^2_p = .001$, or as a combination of thoughts and images, $F(1, 49) = 0.01$, $p = .990$, $\eta^2_p < .001$.

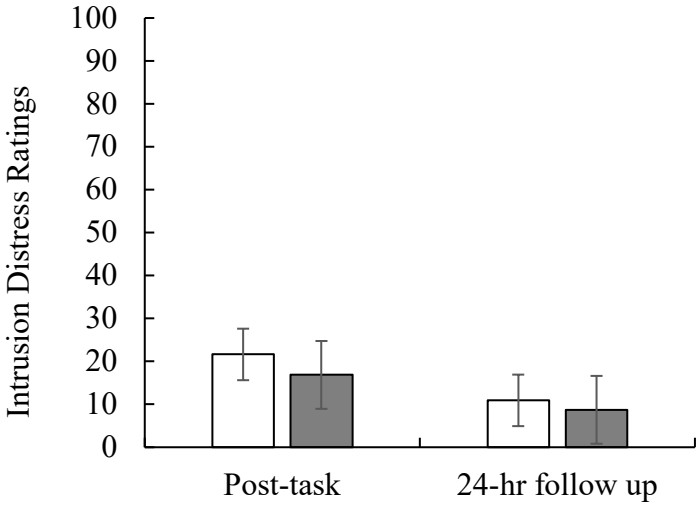
Figure 4.4.2

Experiment 2, Involuntary Memory: Intrusion Frequency and Intrusion Distress Ratings

a) Frequency



b) Distress



Note. Error bars represent 95% CI.

Discussion

When implemented after a delay, drawing did not enhance the accuracy or the amount of information reported about the trauma-film relative to verbally debriefing, irrespective of when voluntary memory was tested (i.e., post-task, 24-hr follow up). Unlike Experiment 1, the amount of information reported did not differ over the 24-hr period. Thus, in Experiment 2 we failed to replicate the effects of previous studies that found drawing enhanced voluntary

memory, even when performed long after initial exposure to an event, ranging from a 1 day to 1 year (e.g., Butler et al. 1995; Bruck et al., 2000; Gardner et al. 2020; Gross & Hayne, 1999; Katz & Hershkowitz, 2010). In Experiment 2, no differences between task types on intrusion frequency and distress ratings were observed. Thus, drawing again failed to affect post-task intrusion frequency.

Our failure to see a reduction in intrusion frequency when the drawing task was delayed may be due to the task being performed after the memory consolidation phase. To restate, prior to consolidation memories are considered malleable within the first few hours following a trauma (e.g., Nader & Hardt, 2009). Performing a visual-motor task within these first few hours may interfere and/or compete for visuospatial cognitive resources, thus reducing intrusions (e.g., Deeprose et al., 2012; Hagenaars et al., 2017; Holmes et al., 2010; see also Brewin, 2014 for review). A drawing task performed after the memory consolidation phase, however, is considered unlikely to influence intrusions, as such memories are already consolidated, stored and now unlikely to be altered. However, our result also leaves open the possibility that we failed to detect an effect due to floor effects.Nonetheless, as drawing is typically performed after long delays following traumatic events, our Experiment 2 results may also shed light on the practical implications of drawing as it is currently applied in many professional settings (e.g., forensic interviews).

Experiment 3: Non-Event Focused Drawing Group

Tasks that reduce intrusions typically do *not* focus on the to-be-remembered event (e.g., Tetris; see Brewin, 2014 for review). However, one notable exception is Hagenaars and Arntz (2012). These researchers compared the effects of event-focused versus non-event focused tasks by asking participants to either 1) mentally reimagine a trauma event, 2) mentally reimagine a trauma event but change the ending to be positive (i.e., a visual event-focused task with a non-event focused ending), or 3) only imagine something positive (e.g., a

visual *non-event focused* task). Mentally reimagining the traumatic event (e.g., an event-focused task) enhanced voluntary memory for the event and changing the ending of the traumatic event to something positive (e.g., a non-event focused task) significantly reduced intrusions. The positive imagery-only condition had no effects on either memory type. Hagenaars and Arntz's (2012) findings suggest that the lack of a drawing effect on intrusions reduction in Experiments 1 and 2 may have been due to our drawing task being *event focused*.

Clinical theories of PTSD (e.g., Brewin et al., 1996) posit that traumatic events are processed via two distinct systems. One system is predominately visual, sensory, and perceptual and the other system is more verbal, linear, and contextual (Brewin et al., 1996; Ehlers & Clark, 2000; Holmes & Bourne, 2008). After experiencing a trauma, if the information is processed in a *balanced* way between these two cognitive systems (e.g., visual-perceptual vs. verbal-contextual), then the development of trauma-related intrusions is theorised to be unlikely. However, if more visual-perceptual processing of the trauma event ensues, then intrusions should be more likely. Therefore, shifting one's cognitive processing of a traumatic event *towards* visual-perceptual processing and *away* from verbal-contextual processing might yield an increase in intrusions. The event-focused drawing task used in Experiments 1 and 2 may have generated a shift *towards* visual-perceptual processing, which in turn may have failed to protect against intrusion development. Thus, generating a shift *towards* more verbal-contextual processing might prevent the onset of intrusions; this has been coined a "*pro-verbal*" shift (Holmes & Bourne, 2008). Explicit instructions that increase visuospatial processing may fail to protect against intrusions (Holmes & Bourne, 2008).

In sum, the event-focused drawing task used in Experiments 1 and 2 may have inadvertently shifted participants toward processing visual-perceptual elements of the trauma, thus failing to protect them from intrusion development. To examine this possibility,

participants in Experiment 3 performed a *non-event focused* draw task immediately following the event, which we then compared to our Experiment 1 task conditions (i.e., event-focused draw vs. non-event focused draw vs. verbal-only task), in a quasi-experimental design.

Method

Participants

The final sample consisted of 27 students (19 female, 8 male; $M = 24.59$, $SD = 7.32$); our recruitment pool closed before we could recruit the final 3 participants we sought. The participants in Experiment 3, were not the same as those recruited for Experiment 1, or 2.

Procedure

The materials and measures were identical to Experiment 1. Here, however, a drawing non-event focused drawing task was used in which participants were instructed to draw flowers from memory in as much detail as possible for 5 min. Flowers were chosen as they provided enough complexity for a 5 min task while also accommodating varying levels of drawing skill. The procedure for Experiment 3 was otherwise identical to Experiment 1.

Design

A 3(task type: non-event focused draw group in Experiment 2, event-focused draw group from Experiment 1, verbal group from Experiment 1) × 3(memory-measure timepoint: post-task, 24-hr follow up, 48-hr follow up) mixed-factor design was used. Task type was the between-group factor and memory-measure timepoint was the within-subjects factor. Covariates in the model for each analysis were the same as Experiment 1.

Results

Individual Difference Measures, Film Ratings and Task Ratings by Condition

The draw and verbal task groups were similar in age, $F(2, 86) = 0.84$, $p = .432$, η^2 - .004. Table 4.3.1 provides descriptive statistics for the individual difference measures. There were no differences between the groups on the DASS-21 scales, or film ratings, or task

distress ratings. The non-event focused draw task was rated as significantly less difficult than the non-event focused draw or verbal task.

Table 4.3.1

Experiment 1 vs 3: Individual Difference Measures, Film Ratings, and Task Ratings by Condition

Measure/Ratings	Exp 3 Non-event Focused Draw	Exp 1 Event-focused Draw	Exp 1 Verbal		
	M (SD)	*M (SD)*	*M (SD)*	*F*	*p*
DASS-21					
Depression	4.85 (5.55)	5.07 (4.11)	5.35 (4.75)	.077	.926
Anxiety	5.74 (5.65)	4.93 (3.61)	5.86 (5.41)	.186	.831
Stress	8.44 (5.86)	8.23 (4.38)	7.80 (4.64)	.127	.881
Film Ratings					
Pre-Film Distress	24.00 (24.67)	19.32 (19.99)	14.39 (16.42)	2.32	.104
Post-Film Distress	57.93 (27.79)	51.50 (25.05)	49.67 (24.96)	.458	.634
Attention Paid	81.96 (19.30)	91.35 (13.01)	89.47 (12.58)	2.59	.081
Personal Relevance	26.67 (24.42)	29.98 (25.16)	33.71 (27.64)	1.65	.197
Task Ratings					
Distress	34.56 (26.19)	45.67 (24.45)	41.62 (27.71)	1.26	.287
Difficulty	15.04 (18.09)	50.14 (26.97)	33.46 (25.12)	14.91	<.001

Note. Non-event Focused Draw (n = 27), Event-focused Draw (n = 27), Verbal (n = 28).

Manipulation Check

The trauma film was distressing: post-film distress (M = 54.22, SD = 26.02) was greater than pre-film distress (M = 18.31, SD = 21.30), t(86) -19.43, p < .001, d = 0.86.

Voluntary Memory Outcomes

Interrater reliability was acceptable for accuracy (α = .84) but not for errors (α = .36). Nonetheless, errors are reported for completeness. A 3(task type: non-event focused draw, event-focused draw, verbal) × 3(memory-measure timepoint: post-task, 24-hr follow up, 48-

hr follow up) mixed ANCOVA was used to examine each voluntary memory outcome. For each analysis, task type was the between-group factor and memory-measure timepoint was the within-subjects factor. Covariates in the model for each analysis were individual to Experiment 1. Figure 4.2.1 provides the means; Table 4.3.2 provides the ANCOVA results.

Table 4.3.2

Experiment 3: Immediate Task ANOVAs Results for Voluntary Memory Measures

Voluntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Accuracy					
Task	2, 70	16000.61	14.55	<.001	.294
Memory-measure Timepoint*	1.96, 137.75	6637.60	41.12	<.001	.370
Task × Memory-measure Timepoint*	3.93, 137.75	79.31	0.50	.739	.014
Errors					
Task	2, 69	7.05	0.78	.462	.022
Memory-measure Timepoint*	1.32, 91.43	19.81	3.42	.056	.047
Task × Memory-measure Timepoint*	2.65, 91.43	7.19	1.24	.298	.035
Word Count					
Task	2, 70	29300.11	0.86	.427	.024
Memory-measure Timepoint*	1.99, 139.60	385315.82	53.25	<.001	.432
Task × Memory-measure Timepoint*	3.98, 139.60	11903.60	1.95	.106	.053

Note. *Huynh-Feldt correction applied because sphericity assumption failed (Mauchly's test).

Memory Accuracy. The overall number of accurate details reported was significantly lower for the *non-event* focused draw task, than for the event-focused draw task, or verbal task.. The interaction between task type and memory-measure timepoint was not significant.

Memory Inaccuracy. The number of errors reported appeared much higher immediately post task for the non-event focused group than the event-focused draw or verbal

groups. However, the interaction between task type and memory-measure timepoint was not significant.

Amount of Information Reported. The amount of information reported was similar amongst task groups. There was no significant interaction between task type and memory-measure timepoint.

Involuntary Memory Outcomes

Involuntary memory outcomes were analysed as in Experiment 1 except with 3 groups instead of 2 groups. The ANCOVA results for the involuntary memory measures can be seen in Table 4.3.3 and the descriptive statistics are depicted in Figure 4.2.2.

Table 4.3.3

Experiment 3: Delayed Task ANOVAs Results for Involuntary Memory Measures

Involuntary Memory Measure	*df*	*MSE*	*F*	*p*	η^2_p
Frequency					
Task	2, 62	4.23	0.87	.423	.027
Memory-measure Timepoint*	1.91, 118	42.03	22.03	<.001	.262
Task × Memory-measure Timepoint*	3.82, 118	3.32	1.74	.148	.053
Distress					
Task	2, 67	7474.69	1.14	.325	.033
Memory-measure Timepoint*	1.85,124	17820.53	8.85	<.001	.117
Task × Memory-measure Timepoint*	3.70, 124	5107.29	2.53	.048	.070

Note. *Huynh-Feldt correction applied because sphericity assumption failed (Mauchly's test).

Intrusion Frequency. The number of intrusions reported was similar across the 3 groups. The interaction between task type and memory-measure timepoint was not significant.

Intrusion Distress. The effect of task type was not significant, but there was a significant interaction (see Figure 4.2.2). Intrusion distress remained constant overtime for the non-event focused draw group $F(2, 66) = 0.32$, $p = .969$, $\eta^2_p = .00$. And yet, intrusion distress significantly declined over time for the event-focused draw group, $F(2, 66) = 3.88$, $p = .026$, $\eta^2_p = .105$, and verbal task groups $F(2, 66) = 5.64$, $p = .005$, $\eta^2_p = .146$.

Intrusion Qualities. No significant differences emerged across the 3 groups in terms of how often intrusions were classified as thoughts, $F(2, 59) = 1.58$, $p = .214$, $\eta^2_p = .051$, images, $F(2, 59) = 2.35$, $p = .103$, $\eta^2_p = .074$, or a combination, $F(2, 59) = 0.44$, $p = .646$, $\eta^2_p = .015$.

Discussion

In Experiment 3, a non-event-focused drawing task led to decreased *accuracy* and appeared to increase errors on Day 1 (though the low interrater reliability for the latter hampers interpretation), while the *amount* of information reported did not differ across groups. Thus, our results concur with those of MacLeod et al. (2016) and suggest that a non-event focused drawing task appears to divert attention away from recalling *accurate* details about the target event. In line with MacLeod et al., it appears that drawing is more likely to enhance voluntary recall if the interviewee is explicitly instructed to draw the target event.

Our non-event focused drawing task did not affect intrusion *frequency* relative to event-focused drawing or verbal tasks. However, across timepoints we found that intrusion *distress* ratings remained high following the non-event focused drawing task. This pattern might indicate that intrusion distress increased due to the drawing instructions (i.e., “draw a vase of flowers”) compelling participants to *supress* thoughts of the trauma film (i.e., *thought suppression*; see Magee et al., 2012). Indeed, supressing negative thoughts been linked to increased feelings of discomfort following traumatic experiences. Moreover, the effect of thought suppression on later intrusion development may contribute to both the development

and maintenance of disorders including PSTD (Magee et al., 2012). It is important to note that our non-event focused task differed from previous comfort drawing experiments (see Poole & Dickson, 2014; see also MacLeod et al., 2016) in that we specifically directed participants to draw something unrelated to the target event. That is, in previous studies the participants are invited to draw whatever they choose, and as such they leave open the possibility that the target event is still depicted. Thus, we speculate that thought suppression may have contributed to enhanced intrusion distress in Experiment 3, having specifically directed participants to draw something unrelated to the target event.

General Discussion

Three experiments examined whether drawing after witnessing a traumatic event enhances voluntary event recall and/or decreases subsequent intrusions relative to a verbal debriefing task. In Experiment 1, participants performed an event-focused drawing or verbal debriefing task immediately after watching a trauma film. In Experiment 2, one of these tasks was performed 24-hrs after watching the trauma film. Finally, in Experiment 3, all participants performed a *non-event focused* drawing task.

When an event-focused drawing task was used, whether performed immediately (Experiment 1) or after a delay (Experiment 2), we did not see enhanced voluntary memory accuracy, or an increase in the amount of information reported relative to verbal debriefing. Moreover, when a *non-event focused* drawing task was used (Experiment 3), accuracy of event memory decreased, and errors increased, relative to the event-focused draw task and verbal task in Experiment 1. These results run contrary to previous studies (for review see Driessnack, 2005; see also Maddox et al., 2023), which have predominately exposed participants to *non-traumatic* content prior to measuring voluntary memory. Thus, our failure to replicate the beneficial effects of drawing on event recall, may be due to our use of *trauma-specific* stimuli.

Informing participants about the drawing portion of the study prior to viewing the film may have inadvertently encouraged them to employ memory strategies while watching it that have been found to enhance memory (e.g., akin to the "drawing effect"; see Fernandes et al., 2018). For example, rather than passively viewing the trauma film, participants may have been actively considering how they would draw the events unfolding (e.g., "how would I draw this?"), supporting deeper, more elaborative encoding. However, participants were randomly allocated to task only after watching the trauma film, thus all participants would likely have employed this strategy. However, in Experiment 3, all participants were told they would be drawing a vase of flowers after the event, and therefore this group was unlikely to contemplate how to draw the event. Consequently, we acknowledge that having advanced knowledge of the task to be performed may not have captured the same effects of drawing on voluntary memory as studies of the effects of drawing on autobiographical memories. In addition, we acknowledge that differences in the procedures/directives required to draw vs. verbally describe the events call on a range of complex cognitive skills, which in turn, may make drawing firm inferences from the effects obtained difficult.

It should also be noted that our participants provided written voluntary memory reports. Written recall may have affected voluntary memory output differently than verbal recall or may have differentially interaction with drawing versus verbalizing after the event. However, written voluntary memory reports are common in the literature (e.g., self-administered interview; see Matsuo & Miura, 2017) and their use in our experiments would not explain the decrease in accuracy we observed following the non-event focused drawing task in Experiment 3. Moreover, our use of written recall removed the possibility of interviewer bias (e.g., use of encouragers; "ah", "go on", "I see"). Nonetheless, an important area of future research will be to examine the effects of drawing performed *during* verbal interviews on both voluntary and involuntary memory.

In general, we found that drawing following a traumatic event (whether event-focused or not) was not more favourable for voluntary memory than simply verbally describing the event. Furthermore, we found some evidence that drawing might sometimes increase intrusion development. Specifically, event-focused drawing immediately after watching the trauma film led to more intrusions on the second day (i.e., 24-hrs post-trauma film) than verbal debriefing; we also found some evidence that these intrusions were also more persistent (albeit not more distressing). However, when we examined whether participants reported experiencing the *same* intrusions on Days 1 and 2, we found that only 62% were reexperienced intrusions. Thus, a sizeable number of intrusions reported on Day 2 were newly experienced images and/or thoughts. Interestingly, this pattern did not hold for non-event focused drawing in Experiment 3. That is, contrary to our expectations based on the literature, non-event focused drawing did not reduce subsequent intrusions (cf. previous visual-motor tasks; for review see Brewin, 2014), nor did it increase intrusions reported 24-hrs post-trauma film (cf. event-focused drawing). Instead, following a non-event focused drawing task it was intrusion *distress* not intrusion *frequency* that persisted. In Experiment 3, we discussed the possibility that this result may indicate that drawing something unrelated to the target event encourages *thought suppression*, which is known to enhance intrusion discomfort (for review see Magee et al., 2012). Interestingly, when tasks were performed after a delay in Experiment 2, no task effects on involuntary memory were observed.

Limitations and Future Directions

We faced several challenges in completing these experiments, predominately a result of COVID-19 restrictions, consequently our results will need to be interpreted with caution. First, the move to online testing partway through Experiment 1 meant that participants viewed the event under a variety of screen sizes, a factor we could not control. However, this variability was likely the same for all groups, and mimics the variability in viewing

conditions experienced by witnesses in the real world (see Lindsay et al., 1998). Second, although participants were informed of the importance of performing the post-event task, and although they were asked to upload their drawing or audio recordings, not all drawings or audio recordings were captured. Thus, compliance with task directives could not be assured in all instances. Third, measures for some participants were missing on Days 2 or 3. Fourth, although participants were prompted to report at the same time each day (each evening between 3pm – 9pm), some did not. Fifth, our reliance on self-report, as well as our wide range of available reporting time (i.e., between 3pm and 6pm) may have led to less accurate and/or valid intrusion measures than those obtained when participants report them *in the moment* (i.e., ecological momentary assessments; see Rattel et al., 2019; Takarangi et al., 2014). However, Rattel et al al. found that similar intrusion rates with retrospective and in-the-moment intrusion reporting. Nonetheless, it would be worthwhile for future studies to examine the effects of drawing on involuntary memory when intrusions are recorded by participants right after they occur. Fifth, we acknowledge that evidence for our effects across conditions was generally weak. Thus, further studies using larger sample sizes, or more robust manipulations of drawing vs. verbalising are needed before firm conclusions can be made.

Numerous studies have found that drawing enhances event recall when applied in interview settings, but rarely are these events personal and/or trauma-specific (see Driessnack 2005; see also Maddox et al., 2023). However, these studies did not measure involuntary memory outcomes. In most forensic and clinical settings, drawing is performed after *personal* experiences of trauma, and it is performed long after initial exposure to the event(s). Thus, the effects of drawing *during* verbal interviews on both memory types for trauma-specific autobiographical events is another important line of future enquiry.**Conclusion**

Our study provides an important attempt to benchmark the effects of drawing on event recall and intrusion development. But further research will be needed to examine the effects of drawing following trauma-specific events on both memory types, and to specify the underlying mechanisms of change where visual arts-based interventions affect voluntary memory, involuntary memory, and/or PTSD symptomology. Nonetheless, our study suggests that event-focused and non-event focused drawing potentially have drawbacks, at least when performed immediately after exposure to a traumatic event. Such results, if replicable, have important implications for professional practices that use drawing with vulnerable individuals following traumatic experiences, such as in forensic, clinical, and therapeutic settings.

Chapter 5: What do drawings reveal about later recall and intrusions for a traumatic event? Insights from a mixed-method thematic analysis

Author contributions. I conceptualised the study, including design, method, coding, analyses, and pre-registration. As a second independent researcher is required on all thematic analyses, I employed the assistance of Matt Thompson as the third author on the project. Matt Thompson was to collaboratively conduct an inductive thematic analysis, develop the drawing analysis framework and final coding instructions. Since this was only my first mixed-method thematic analysis, I sort the guidance of statistical expert Paul Williamson. Paul Williamsons role was to review the validity of my statistical approach to the analyses. Last, Glen E. Bodner was my principal supervisor at the commencement of this study, while Ryan Balzan was my principal supervisor during the final study stages, as such both provided critical revisions on my drafts prior to submission.

Author Note. The authors report no conflict of interest. No funding was provided. The project was preregistered at Open Science Framework

Abstract

Drawings can provide rich information about cognitive processes and memory, and recent advances in research tools have made them easier to measure. Drawings are commonly used to facilitate event recall in forensic, clinical, and therapeutic settings, potentially offering unique insights about the processing of traumatic stimuli. We report a mixed-method thematic analysis that explores the relationship between drawings made following an analogue trauma event and subsequent memory for this event. Using NVivo, 12 regional coding and inductive thematic analyses informed by the dual-representation theory of PTSD, we analysed the relationship between qualitative aspects of drawings (n = 51) and quantitative outcomes for voluntary memory (event recall) and involuntary memory (intrusions). Themes were categorised as verbal-contextual or visual-perceptual. Representational quality was categorised as detailed-realistic or simple-naïve. The number of traumatic elements drawn was also measured. Results were analysed using simultaneous regression and correlation analyses. We found that the inclusion of verbal-contextual details (but not visual-perceptual details) was associated with *lower* intrusion rates. However, we found no evidence that the representational quality of drawings related to later event memory. On the other hand, the number of traumatic elements drawn was positively correlated with voluntary memory outcomes. These results suggest intrusions may be related to the *quality* of drawn trauma-related elements, whereas their *quantity* impacts voluntary memory.

Keywords**:** drawing, trauma, event recall, memory, intrusions

Introduction

Drawing is a picture created using simple tools, but it is also a complex form of nonverbal communication that can aid memory retrieval (for reviews see Driessnack, 2005; Maddox et al., 2023). Creating a visual image requires the integration of several cognitive processes known to enhance memory, such as mental imagery, elaboration, and generation (Wammes et al., 2018). Drawings may also offer unique insight into memory, not only as external mental representations, as well as into emotional states and individual viewpoints (Bainbridge, 2022). Given recent advances in research tools for measuring drawings, a rich and systematic examination of the relationships between image creations and memory outcomes has become much easier to do. Despite these advances, to date only a few mixed-method studies have related measures of the representational qualities of drawings to voluntary memory outcomes for events (for exceptions see Barlow et al., 2011; Butler et al., 1995; Gross & Hayne, 1999; Wesson & Salmon, 2001).

In an early study, Butler et al. (1995) provided 20 adults with a brief description of the target event ("tour of a fire station") and asked them to rate the representational quality of children's drawings (1 = *worst*, 16 = *best*). They found a positive relationship between drawing quality and the amount of information children recalled about the event, especially in relation to direct recall questions by interviewers (e.g., "draw/tell me where you went"). Gross and Hayne (1999) provided 20 adults with a brief description of their event and asked them to rate the representational quality of each child's drawing (1 = *lowest*, 27 = *highest*). Again, a positive relationship between drawing quality and recall was found.

Wesson and Salmon (2001) used a similar approach with autobiographical memories. Children were asked to draw times when they had felt sad, scared, or happy. Twenty adults were provided details on the emotion the child was attempting to depict and were then asked to rate the representational quality of the drawings (1 = very poor; not recognisable, 7 =

extremely good, clearly recognisable). In contrast to Butler et al. (1995) and Gross and Hayne (1999), the relationship between the number of details recalled and drawing quality was not significant. Similarly, Barlow et al. (2011) provided 10 adults with a description of the video event the children had been asked to draw in their interviews. They then had the adults' rate how closely the drawing represented the video it was depicting (1 = *lowest*, 20 = *highest*). As in Wesson and Salmon (2001), the relationship between the representational quality of the children's drawings and their subsequent event recall was not significant.

In sum, the results of this small set of studies have been split. Interestingly, the 2 studies that found a positive relationship between voluntary memory and drawing quality used live staged events (i.e., Butler et al., 1995; Gross &Hayne, 1999). Whereas the 2 studies that failed to replicate these effects used autobiographical memory or video stimuli (i.e., Barlow et al., 2011; Wesson & Salmon, 2001). Thus, it is possible that live staged events provide more visuospatial information from which to draw, which in turn may provide more opportunity for enhanced representational quality. Importantly, all of them focused on only one type of memory (i.e., *voluntary*), and most of them only used neutral events (cf. Wesson & Salmon, 2001). To our knowledge, no previous studies have directly examined qualitative aspects of participant drawings in relation to subsequent *involuntary* memories following *trauma-specific* events. We felt that this was an important knowledge gap that warranted attention, given that voluntary memories are distinct from *involuntary* memories and may be processed in very different ways during and after a traumatic event.

Drawing is commonly used after a traumatic event in several professional practices (e.g., forensic, clinical, therapeutic). Traumatic events often lead to trauma-related *intrusions*, a specific type of involuntary memory. Importantly, intrusions following traumatic events can affect an individual's clinical cognition (e.g., the development and maintenance of posttraumatic stress disorder, *PTSD*); APA, 2013). Clinical models of PTSD theorise those

traumatic events are likely to be encoded and processed via two distinct cognitive systems: one visuospatial, sensory, and perceptual, and one verbal and contextual (see Brewin et al., 1996; Ehlers & Clark, 2000; see also Holmes & Bourne, 2008). According to these models, traumatic aspects of events are more likely to be encoded and retrieved in visuospatial, perceptual, and sensory ways, whereas neutral aspects of events are more likely to be encoded and retrieved in verbal and contextual ways.

Currently, no data exist on the questions of whether post-event drawing increase or decrease subsequent *trauma-related intrusions*, and whether the qualities of those drawings also impact intrusion development. Therefore, using data we collected in a recent study (Maddox et al., 2023), we examined whether qualitative elements of drawings were predictive of later voluntary memory (in terms of accuracy, amount of information reported, and errors) and intrusions (in terms of frequency and distress ratings). Based on the findings of Butler et al. (1995) and Gross and Hayne (1999), we might find that drawings higher in graphical integrity (e.g., more detailed, realistic) and/or representational quality (e.g., greater match between the film events and image depiction) are associated with better voluntary event recall. However, due to discrepancies in the results obtained in previous studies, especially when using video stimuli (i.e., Barlow et al., 2011), it was also possible we would fail to detect a relationship between the representational quality of drawings produced and enhanced *voluntary* event recall (as per Wesson & Salmon, 2001; Barlow et al, 2011).

Our examination of the relationship between drawing themes and later involuntary memory intrusions was exploratory. Nonetheless, clinical models of PTSD (e.g., Brewin et al., 1996; see also Holmes & Bourne, 2008) posit that tasks such as drawing may interfere with memory processing for a traumatic event. On the one hand, drawing may tip the balance of visual and verbal cognitive processing *towards* more visual-perceptual details of the traumatic event (e.g., blood, shattered glass), increasing post-event intrusions (as per Maddox

et al., 2023). On the other hand, drawing may compete for the visual cognitive resources required for involuntary memory consolidation, thus reducing intrusions. Verbal tasks are *not* theorised to compete with the visual system for resources required for memory consolidation. Thus, drawings with more verbal details (e.g., words, numbers) than visual details might be negatively correlated with intrusion frequency and distress ratings.

Method

Participants

The sample of 51 drawings were obtained by Maddox et al. (2023) from 51 undergraduate participants (36 female, 15 male; $M = 23.61$, $SD = 8.21$), who each received course credit or a $30 payment. Participants were either tested in the lab (pre COVID-19) or online (post COVID-19). Their drawings were scanned and uploaded into NVivo 12 (QSR International PTY Ltd, 2020) for thematic analysis.

Procedure

The full details are provided in Maddox et al. (2023). Participants were tested individually. The study was conducted using Qualtrics online software. After consenting, they provided demographic information (age, gender), then completed the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). The event was a 4 min video of a public service announcement depicting a graphic car accident; it has been used in several studies of memory for traumatic events (e.g., see Arnaudova & Hagenaars, 2017 for review). Before and after watching the video participants rated their distress level (0 = not at all, 100 = extremely). After the video they also rated how much attention they paid to the film (0 = *very little*, 100 = *all*), 2) and the film's personal relevance (0 = *not at all*, 100 = *extremely*).

After the film and ratings, participants were asked to "draw in as much detail as possible everything that happened in the film for 5 minutes" on a sheet of paper. They then

rated how 1) difficult and 2) distressing they found the drawing task (0 = *not at all*, 100 = *extremely*).

To measure voluntary memory for the event, a 6-item questionnaire was then administered via an online survey. Participants typed in their responses. Two independent researchers, blind to the task conditions later counted the number of *accurate* and *inaccurate* elements in their responses. To calculate accuracy scores, participants received 1 point per *correct* element (as per Butler et al., 1995). For example, for the question "*can you describe the vehicles involved in the accident*", the answer "*three cars, one was red, and one was silver*" would receive 3 points. To calculate inaccuracy (i.e., errors), participants received 1 point per *incorrect* element. The *amount* of information reported was calculated by totalling the word count from each of the 6-item responses.

To measure involuntary memory, between 3-9 pm on the day of the study participants were prompted to complete an online survey in which they were asked how many intrusions they had experienced (intrusions were defined for them earlier in the experiment). They also provided a brief description of each intrusion and rated how distressing they found each intrusion (0 = *not at all distressing*, 100 = *extremely distressing*).

Drawing Analyses Framework

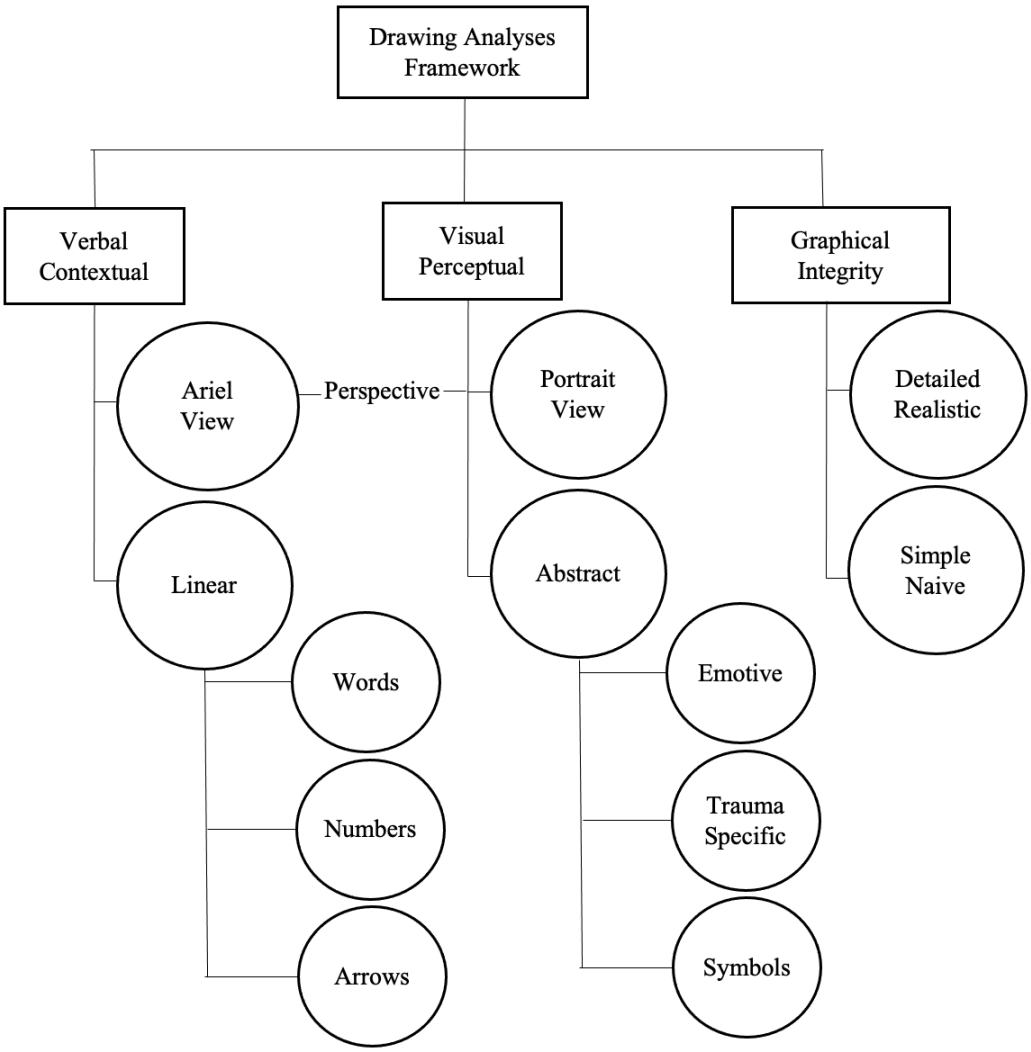
Thematic Analysis

The first and third authors used inductive thematic analysis to determine the features of the drawings relevant to theoretical clinical models of PTSD (e.g., verbal-contextual vs visual-perceptual; Brewin et al., 1996). To develop the coding framework, they undertook thematic analysis on a subset of the total drawing sample (n = 28). The final coding instructions were based on the drawing framework themes and subthemes determined by extensive discussion between the two researchers. This drawing framework was then used by

the first author to code all participants drawings (n = 51) using NVivo 12 (QSR International PTY Ltd, 2020).

Figure 5.1

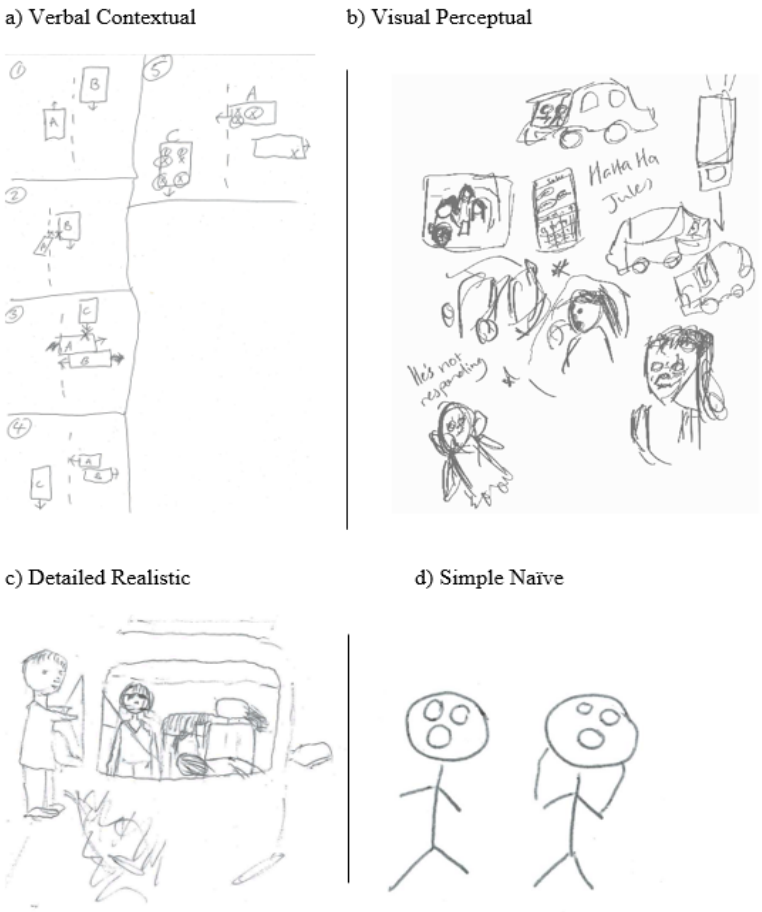
Drawing Analyses Framework



Note. Main themes: Verbal-contextual, visual-perceptual, and graphical integrity. Codes are nested within each subtheme and main theme.

Figure 5.2

Drawing Examples of Main Themes; Verbal-Contextual, and Visual-Perceptual, and Graphical Integrity (Detailed Realistic, Simple Naïve)



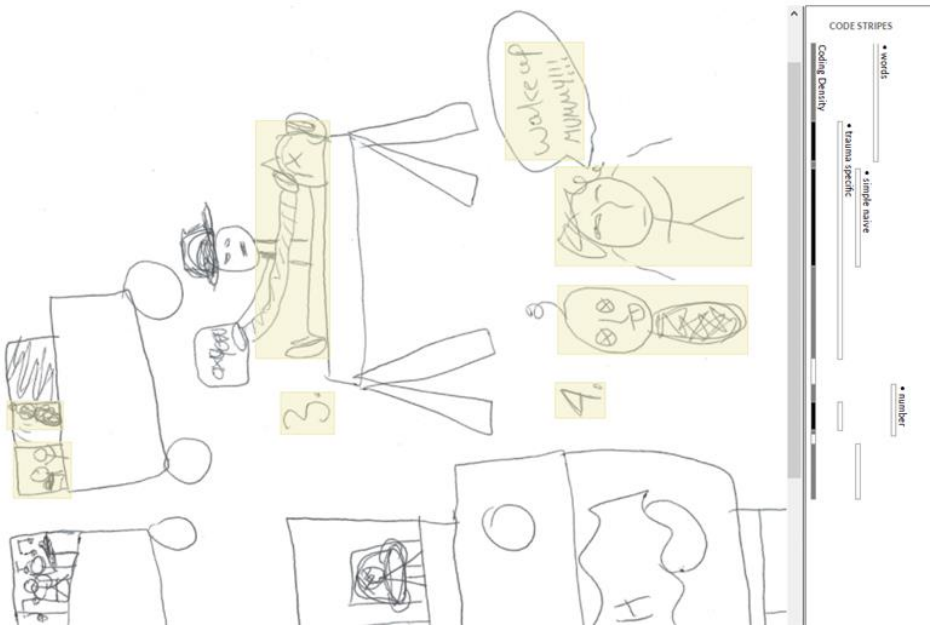
Note. The visual-perceptual drawing theme example has elements that correspond to the codes under the verbal-contextual theme (i.e., words, arrows)

Figure 5.1 depicts the final drawing analysis framework with codes. Figure 5.2 provides example drawings that represent each of the main themes. Drawings were uploaded as pdf documents to NVivo 12 and coded by selecting the regional area of coverage within each image that corresponded with a given subtheme, based on a recent qualitative drawing study (Chionas & Emvalotis, 2021). Figure 5.3 illustrates the drawing analysis. The percentage coverage of each subtheme within each image was added to reflect a main theme (e.g., verbal-contextual, visual-perceptual, graphical integrity). Blank areas of a page

contributed to the overall percentage. For our verbal-contextual and visual-perceptual themes, multiple subthemes could be selected and coded for the same drawing (e.g., a given drawing may be both emotive and portrait view). Thus, the percentage coverage could exceed 100. The drawings were examined for explicit characteristics to allow for the most reliable and replicable coding. That is, any word, number, or arrow (see Figure 5.2 for examples) were regionally selected in NVivo (see Figure 5.3 for example) and mapped onto the verbal-conceptual theme. Visual depictions that could not be clearly identified as words, arrows or numbers and had an emotive context (e.g., tears, shattered glass, blood) were regionally selected as details to be mapped onto the visual perceptual theme.

Figure 5.3

An Example of Regional Coding using NVivo 12 Software



Note. The shaded areas represent the region of coding. The side bar illustrates the percentage coverage for each code. For example, "*wake up mummy*" has been coded as *words,* "3" and "4" coded as *numbers*, under the verbal-contextual theme. The person on the stretcher and the baby with crossed out eyes coded as *trauma specific*, a code under the visual-perceptual theme (refer to Figure 5.1).

We used the representational quality coding procedure reported in previous studies (Barlow et al., 2011; Butler et al., 1995; Gross & Hayne, 1999; Wesson & Salmon, 2001). Five coders, including the first and third authors, coded all 51 drawings. Coders were blind to the participants' voluntary and involuntary memory scores. Coders first watched the trauma film; they then rated the representational quality of each drawing (1 = *very poor; not recognisable*, 20 = *extremely good, clearly recognisable*), as per Barlow et al. (2011). The 5 ratings for each drawing were then averaged. Interrater reliability was poor (α = .36), as per Cronbach's Alpha analysis (Taber, 2018), indicating coder judgements of drawing quality varied greatly.

The same 5 coders counted the number of traumatic elements within each drawing. One point was given for each traumatic element (e.g., *'girl in the stretcher'* = 1 point, '*girl in the stretcher'* and *'baby in the back car seat'* = 2 points). The 5 scores for each drawing were then averaged. Here, interrater reliability was acceptable (α = .72).

Results

The correlation coefficients, means and standard deviations are presented in Table 5.1. The effect size used for all correlation analyses 0.1 = small, 0.3 = medium, 0.5 = large (Cohen, 1988). As shown in Table 5.1, there was a large and significant positive correlation between each of the verbal-contextual and visual-perceptual themes and memory accuracy. Significant positive correlations were also observed between the verbal-contextual theme and word count (large effect) and between the visual-perceptual themes and word count (medium effect). A significant negative correlation emerged between the verbal-contextual theme and both intrusion distress and intrusion frequency (medium effects). No significant relationship was observed between the visual-perceptual theme and any of our involuntary memory outcomes. Regarding graphical integrity, no significant correlations were observed between the detailed-realistic or simple-naïve theme and any of the memory outcomes.

Table 5.1

Pearson Correlation Analysis Between Independent and Dependent Variables

Variables	*M*	*SD*	1 [LL, UL]	2 [LL, UL]	3 [LL, UL]	4 [LL, UL]	5 [LL, UL]	6 [LL, UL]	7 [LL, UL]	8 [LL, UL]
1. Accuracy	71.24	29.33	-							
2. Word Count	345.47	167.06	.586** [.369, .741]	-						
3. Errors	1.55	1.90	-.028 [-.302, .249]	.170 [-.111, .426]	-					
4. Intrusion Frequency	1.73	1.51	-.114 [-.378, .167]	-.119 [-.382, .161]	.033 [-.245, .305]	-				
5. Intrusion Distress	42.20	56.76	-.158 [-.421, .129]	.020 [-.263, .300]	-.001 [-.282, .280]	.567** [.340, .731]	-			
6. Verbal-Contextual	169.20	170.99	.700** [.526, .818]	.540** [.311, .710]	-.052 [-.323, .226]	-.294* [-.527, -.020]	-.302* [-.538, -.023]	-		
7. Visual-Perceptual	44.65	37.51	.642** [.445, .779]	.381** [.117, .594]	-.105 [-.370, .175]	-.148 [-.407, .133]	-.203 [-.458, .083]	.773** [.632, .864]	-	
8. Detailed-Realistic	25.46	33.44	.022 [-.255, .296]	.120 [-.161, .383]	.127 [-.154, .389]	-.226 [-.472, .053]	-.263 [-.507, .019]	.545** [.317, .714]	.394** [.133, .604]	-
9. Simple-Naive	12.24	18.95	.096 [-.184, .362]	.009 [-.357, .190]	.196 [-.085, .447]	.146 [-.135, .405]	.049 [-.236, .325]	.214 [-.065, .462]	.209 [-.071, .458]	.441** [.188, .639]

Note. *M* indicates mean and *SD* indicates standard deviation. $n = 51$. (*) indicates $p < .05$. (**) indicates $p < .01$. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval, respectively.

Multiple Regression Analyses

The relationships between the main themes in our drawing analyses framework (see Figure 5.1) and the memory measures were examined using simultaneous multiple regression. All main drawing themes simultaneously were entered as predictor variables to examine their effect on both the voluntary and involuntary memory outcomes. For all regression analyses the independent variables were 1) verbal-contextual (continuous), 2) visual-perceptual (continuous), and graphical integrity with two levels: 3) detailed-realistic (continuous) and 4) simple-naïve (continuous). The outcome variables were voluntary memory: 1) accuracy, 2) word count, and 3) errors, and involuntary memory outcomes 4) intrusion frequency and 5) intrusion distress. The effect size measure used for all regression analyses was R^2 = 0.02 = small, 0.13 = medium, 0.26 = large (Cohen, 1988).

Voluntary Memory Outcomes

Accuracy. Substantial variance in subsequent voluntary memory accuracy was explained by the combination of all themes, R^2 = .740, $F(4, 46) = 13.92$, $p < .001$. The strongest predictor of subsequent memory accuracy was the inclusion of verbal contextual drawing details ($\beta = .636$, $p < .001$). In isolation, none of the remaining main drawing theme were significant unique predictors of accuracy: visual-perceptual ($\beta = 0.24$, $p = .142$); detailed- realistic ($\beta = -0.22$, $p = .098$), or simple-naïve graphical integrity ($\beta = 0.01$, $p = .947$).

Word Count. Significant variance in the amount of information reported was explained by the combination of all themes, R^2 = .362, $F(4, 46) = 6.525$, $p < .001$, but none of the main drawing themes in isolation were significant unique predictors: verbal-contextual ($\beta = 0.39$, $p = .109$); visual-perceptual ($\beta = 0.32$, $p = .177$); detailed- realistic ($\beta = -0.23$, $p = .137$), or simple-naïve graphical integrity ($\beta = -0.06$, $p = .654$).

Errors. Subsequent memory errors were not explained by the combination of our main themes, $R^2 = .068$, $F(4, 46) = 0.83$, $p = .508$.

Involuntary Memory Outcomes

Intrusion Frequency. Intrusion frequency was predicted by the combination of all themes, $R^2 = .222$, $F(4, 46) = 3.27$, $p = .019$. However, only the inclusion of verbal-contextual drawing details predicted subsequent (reduced) intrusion frequency ($\beta = -0.64$, $p = .022$). Visual-perceptual drawing details trended toward predicting increases in intrusion frequency ($\beta = 0.48$) but failed to reach significance ($p = .071$). Graphical integrity did not explain unique variance in intrusion frequency, whether detailed-realistic ($p = .185$), or simple-naive ($p = .087$).

Intrusion Distress. Intrusion distress ratings were not predicted by any of our main themes, $R^2 = .149$, $F(4, 46) = 1.92$, $p = .124$.

Task Difficulty & Task Distress

We also conducted a correlational analysis to examine the relationship between the main themes, task difficulty and task distress. The correlation coefficients, means and standard deviations are presented in Table 5.2. As shown in Table 5.2, when task difficulty increased, so too did task distress, as indicated by a positive medium size effect. No further significant relationships between our main themes and task difficulty were uncovered. However, participant distress may have been influenced by the drawing task, such that higher levels of task distress reduced the extensiveness of drawing irrespective of theme or graphical representation. For task distress, the strongest relationship was that an increase in task distress ratings was related to a decrease in the detailed-realistic theme in their drawings, $r = -.426$, 95% CI [-.628, -.170], $p < .01$. This same pattern also occurred for the simple-naïve drawing theme, $r = -.359$, 95% [-.578, -.093], $p < .01$. Further, greater task distress was

associated with less verbal-contextual or visual-perceptual themes in the drawings (Figure 5.2).

Representational Quality Ratings

Another correlational analysis examined the relationship between memory outcomes and representational quality ratings. The correlation coefficients, means and standard deviations are presented in Table 5.3. No significant correlations between representational quality ratings and memory outcomes were observed.

Number of Traumatic Elements Drawn

Finally, we also examined the relationship between voluntary memory outcomes and the mean number of traumatic elements in participants' drawings (Table 5.3). As shown in Table 3, the number of traumatic elements drawn was significantly correlated with both the amount of information reported, $r = .334$, $p = .017$, 95% CI [.064, .558], and its accuracy, $r = .285$, $p = .042$, 95% CI [.010, .520]. The correlations between the number of traumatic elements drawn and our involuntary memory outcomes were not significant.

Table 5.2

Pearson Correlation Analysis Between Main Drawing Themes, Task Distress, and Task Difficulty

Variables	*M*	*SD*	1 [LL, UL]	2 [LL, UL]	3 [LL, UL]	4 [LL, UL]	5 [LL, UL]
1. Verbal-Contextual	169.20	170.99	-				
2. Visual-Perceptual	44.65	37.51	.773** [.632, .864]	-			
3. Detailed-Realistic	25.46	33.44	.545** [.317, .714]	.170 [-.111, .426]	-		
4. Simple-Naive	12.24	18.95	.214 [-.065, .462]	-.119 [-.382, .161]	.441** [.188, .639]	-	
5. Task Difficulty	46.63	27.23	.028 [-.249, .302]	-.225 [-.471, .054]	-.097 [-.363, .184]	-.156 [-.414, .125]	-
6. Task Distress	32.16	26.02	-.393** [-.603, -.131]	-.431** [-.632, -.177]	-.426** [-.628, -.170]	-.359** [-.578, -.093]	.330** [.060, .555]

Note. *M* indicates mean and *SD* indicates standard deviation. $n = 51$. (*) indicates $p < .05$. (**) indicates $p < .01$. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval, respectively.

Table 5.3

Pearson's Correlation Analysis Between Memory Outcomes, Representational Quality, and Number of Traumatic Elements Drawn

Variables	*M*	*SD*	1 [LL, UL]	2 [LL, UL]	3 [LL, UL]	4 [LL, UL]	5 [LL, UL]	6 [LL, UL]
1. Accuracy	71.24	29.33	-					
2. Word Count	345.47	167.06	.586** [.369, .741]	-				
3. Errors	1.55	1.90	-.028 [-.302, .249]	.170 [-.111, .426]	-			
4. Intrusion Frequency	1.73	1.51	-.114 [-.378, .167]	-.119 [-.382, .161]	.033 [-.245, .305]	-		
5. Intrusion Distress	42.20	56.76	-.158 [-.421, .129]	.020 [-.263, .300]	-.001 [-.282, .280]	.567** [.340, .731]	-	
6. Representational Quality Ratings	8.28	1.97	-.086 [-.353, .194]	-.012 [-.286, .265]	0.24 [-.253, 298]	.115 [-.165, 379]	.234 [-.050, 484]	-
7. Number of Traumatic Elements Drawn	3.63	1.50	.285* [.010, .520]	.334** [.064, 558]	.054 [-.225, .325]	.141 [-.140, .401]	.097 [-.190, 368]	.272 [-.003, .510]

Note. *M* indicates mean and *SD* indicates standard deviation. $n = 51$. (*) indicates $p < .05$. (**) indicates $p < .01$. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval, respectively.

Discussion

Previous findings have been mixed with respect to whether the quality of drawings predict memory recall (Barlow et al., 2011; Butler et al., 1995; Gross & Hayne, 1999; Wesson & Salmon, 2001). We theorised that more detailed-realistic drawings and those that depict traumatic elements may be positively related to the amount and accuracy of information recalled, as found by Butler et al. (1995) and Gross and Hayne (1999). Instead, in line with Barlow et al. (2011) and Wesson and Salmon (2001), we did not find a significant relationship between the representational quality of drawings and our voluntary memory measures. However, our representational quality measure had poor interrater reliability, even though our coders watched the trauma film. In contrast, in previous studies coders were only given a very brief description of the events or emotions drawn (see Wesson & Salmon, 2001). Further, our detailed-realistic theme (which also spoke to drawing quality) failed to predict any of our voluntary memory outcomes. Our inability to find positive relationships between representational drawing quality and *voluntary* event recall might reflect our use of a traumatic event rather than a neutral event.

A surprising finding was the significant positive relationship between the number of traumatic elements drawn and both the amount and accuracy of information reported. The more traumatic content depicted in a drawing, the greater the voluntary memory by both measures. This significant relationship between drawn traumatic elements and later memory performance may be due to the willingness of some participants to engage (rather than avoid) the more distressing elements of the trauma-film. In turn, by engaging rather than dodging these emotive elements of the film, participants were better able to accurately and in sufficient detail answer more questions about the event.

On an exploratory basis, we also examined the relationship between drawing themes and later involuntary memory intrusions. Specifically, we examined whether the drawing task

would compete for the visual-perceptual cognitive resources required for involuntary memory consolidation resulting in negative correlations with intrusion frequency. We did not obtain much support for this theory. Instead, surprisingly, the inclusion of verbal-contextual drawing details predicted *reduced* intrusion frequency.

We also hypothesised that drawing the traumatic film scene might 'tip the balance' *towards* visual and away from verbal memory processing (Holmes & Bourne, 2008; Maddox et al., 2023). Consistent with this possibility, a positive correlation emerged between visual-perceptual drawing and intrusion frequency. However, it did not reach significance (p = .071). Relatedly, the number of traumatic elements drawn was not found to be related to involuntary memory intrusions. These results suggest it is the *quality* of trauma-related elements drawn, and not their *quantity*, that impacts subsequent intrusion development. We also found some evidence that feeling distressed by the drawing task led participants to be less likely to produce drawings containing any of our main themes. This correlation could indicate that the more distressed participants were by the drawing task, the less likely they were to draw. This pattern held irrespective of theme or graphical representation, though the relationship was strongest for the detailed-realistic drawing details, followed by simple-naïve details.

Conclusion

Systematically examining the relationships between drawing and memory is becoming simpler thanks to innovative new research tools (e.g., NVivo 12; QSR International PTY Ltd, 2020). Our study contributes to the growing body of evidence that drawings can offer valuable insights into memory (Barlow et al., 2011; Butler et al., 1995; Gross & Hayne, 1999; Wesson & Salmon, 2001). Importantly, our study offers unique perspectives on the relationship between *trauma-focused* event drawing and involuntary memory *intrusions*—an area of research with few empirical studies. This is an important line of future research given

that traumatic events can lead to *trauma-related intrusions*—a contributing factor in the development and maintenance PTSD (APA, 2013). Such intrusions may be retrieved in visual, vivid, and perceptual ways that may make drawing a unique memory retrieval aid (Katz & Hamama; 2012). Although drawing may provide an inexpensive means of reducing intrusions, our study highlights the need for more research into the underlying mechanisms of change. Importantly, there remains a possibility that drawing might also have detrimental effects on memory such as increasing intrusions or distress. Among the few studies that have assessed the relationship between qualitative aspects of drawings and memory, the results have been mixed, thus highlighting the value of adopting mixed method approaches in future work.

Chapter 6: The effects of drawing on memory and wellbeing in an interview context: A feasibility study

Author contributions. I conceptualised and ran the study, including design, method, participant recruitment, coding, analyses, and pre-registration. Glen E. Bodner was my principal supervisor at the time the study was conceptualised, while Ryan Balzan was my principal supervisor during the final study stages. As such both supervisors provided critical revisions on my drafts, prior to submission, during their time as my principal.

Author Note. The authors report no conflict of interest. No funding was provided. The project was preregistered at Open Science Framework.

Abstract

Given the growing popularity of arts-based interventions in the treatment of trauma, our study aimed to ascertain the feasibility of measuring and analysing the effects of drawing interventions on voluntary and involuntary autobiographical memory. Participants were randomly allocated to either an event-focused draw+talk (n = 6), non-event focused draw+talk (n = 6) or talk-only interview condition (n = 5) in which they shared a negative and/or stressful experience. Given the small sample sizes, group differences were non-significant. Directionally, non-event focused drawing increased the amount of information reported in interview, relative to the other conditions. However, again directionally, non-event focused drawing also increased the likelihood of experiencing unwanted intrusions post-interview. Our study suggests that a full-scale study examining the effects of drawing on autobiographical voluntary and involuntary memory is feasible—and would inform best practice for the use of arts-based interventions in applied settings (e.g., eye-witness testimony, arts therapy, psychological assessment).

Keywords**:** drawing, art therapy, posttraumatic stress, memory, intrusions

Introduction

Drawing can help individuals explore and express personal experiences that are often difficult to articulate in words alone (ANZACATA, n.d.; Interactive Drawing Therapy, n.d.). Indeed, research has shown that verbal memory is often impaired following negative and/or stressful lived experiences (Brewin, 2014) and that memories of such events are largely comprised of visual-mental images (Johnsen & Asbjornsen, 2008; Strange & Takarangi, 2015). Consequently, arts-based interventions (e.g., drawing) have been widely used during interviews in various mental health settings to facilitate communication and event recall (e.g., eyewitness interviews, arts therapy, psychological assessment; see Matsuo & Miura, 2017; Mattison et al., 2016; see also Katz & Hamama, 2012).

Drawing involves several known memory enhancers (e.g., mental imagery, elaboration, motor skills; see Wammes et al., 2019). Drawing can enhance the amount of information reported about experienced events relative to more traditional *talk-only* interviews (i.e., eyewitness interviews, counselling; for review see, Driessnack, 2005; see also Maddox et al., under review). However, few studies have examined the effects of drawing on memory for autobiographical events, whether they be trauma focused (cf. Katz & Hamama, 2012; Katz & Hershkowitz, 2010) or other emotionally laden events (cf. Gross & Hayne, 1998; Salmon et al., 2003; Wesson & Salmon, 2001). Most studies have focused on examining the effects of drawing on memory for neutral live/staged, or videoed events in a controlled laboratory setting, where the accuracy of event recall can be measured (Dando et al., 2009; Krackow, 2012; Matsuo & Miura, 2017). A recent meta-analytic review uncovered only 5 previous RCTs examining the effectiveness of drawing on autobiographical memory (Maddox et al., 2023).

In a seminal study, Gross and Hayne (1998) randomly assigned children (age 3-4 or 5-6) to either draw while talking about a time when they were happy, sad, scared, or angry, or

to talk-only. Because *accuracy* cannot be ascertained when using personal experiences (rather than live staged, or videoed events) the *amount of information reported* is often used to gauge autobiographical memory outcomes. Consequently, using the interview transcripts, Gross and Hayne determined how many sentences contained a verb 'clause'. Each 'clause' was then assigned to a category (object, place, person, action, or description). They found that children given the opportunity to draw while talking during their interview reported twice as much information than those in the talk-only condition.

The effectiveness of drawing during interview was also studied by Wesson and Salmon (2001). Here, drawing and talking about a personal happy, sad, or neutral event was compared to talking while re-enacting, or talking-only in children aged 5-8yrs. Verbal interviews were transcribed and coded as per Gross and Hayne (1998). Children in the draw-and-talk and re-enact-and-talk conditions both reported twice as much information as those in the talk-only condition. Further, drawing elicited more information about *objects* than the talk-only condition. Wesson and Salmon also compared interview durations. Interviews with children who were asked to draw, and talk lasted more than twice as long as those only afforded the opportunity to talk (25 vs. 10 min).

Salmon et al. (2003) randomly allocated children (age 5-7) into one of three interview conditions: draw and talk, re-enact and talk, or talk-only. Here, children either talked about a time when they felt either happy or sad. Using the same interview and memory coding procedures, Salmon et al. replicated both previous studies in finding that the children who were asked to draw during their interview reported more information than the other two interview conditions.

Katz and Hershkowitz (2010) reported an early RCT examining the effects of event-focused drawing on memory for personal *traumatic* experiences. They randomly allocated children (age 4-14) with experiences of alleged sexual abuse to be interviewed either *with* or

without event-focused drawing. The researchers transcribed and categorised responses as per the previous studies. In addition, they coded whether the details disclosed were ‘central’ to the sexual abuse events, or ‘peripheral’ in that they addressed the context of the event, not the abuse per se. Children *with* an event-focused drawing task during interview reported more information about their alleged sexual abuse than those without. Further, children given the opportunity to draw while sharing their traumatic experiences were more likely to provide information on specific people, action, locations, and times when the abuse occurred. The researchers concluded that drawing was a useful tool for helping to elicit children’s statements in forensic interviews.

Deeb et al. (2021) examined the effects of drawing on autobiographical memory in adults. Drawing while talking during an interview was found to be more effective for eliciting information relative to talking-only. This finding held whether the participant was describing an event they had experienced or not (i.e., *truth telling* vs. lying).

Despite the promising effects of drawing on memory for enhancing autobiographical event recall and the potential practical implications (e.g., more complete, and accurate recall in forensic interviews), studies to date have only measured *voluntary* memory. The effects of drawing on *involuntary memories* (i.e., intrusions) colloquially known as "flashbacks” have yet to be carefully studied. Unlike voluntary memories that are retrieved purposefully, intrusions are unintentional and often vivid, visual, sensory, and distressing (Brewin, 2014; Mace, 2005). Drawing may offer an inexpensive tool for facilitating event recall about stressful and/or negative experiences while potentially also decreasing unwanted memory intrusions. Indeed, recent research has found that visual-motor tasks are more effective than verbal-only tasks for reducing intrusions (James et al., 2015). However, a recent study by Maddox et al. (2023) found that drawing (as a visual-motor task) not only failed to decrease subsequent intrusions but increased intrusion reports over time. However, as acknowledged

by the researchers, their study may have lacked ecological validity because an analogue trauma (the trauma-film paradigm) was used, rather than participants' personal experiences. To the best of our knowledge, the effects of *event-focused* drawing on autobiographical memory has not been tested in a randomised control trial (RCT). In addition, tasks that have been effective in reducing unwanted memories using RCTs have been *non-event focused*. That is, the tasks participants are asked to perform are unrelated to the experienced event (e.g., shaping plasticine, for review see Brewin, 2013). Consequently, the effects of drawing on intrusion reduction following the sharing of negative/stressful personal experiences may be moderated by whether the task is event-focused, or non-event focused.

Although drawing is often used for comfort in interview settings, only a few studies have examined the effects of non-event focused drawing during interviews (Maddox et al., 2023; MacLeod et al., 2016; Poole & Dickson, 2014). Event-focused drawing has been shown to enhance accurate event recall (for review see Driessnack, 2005; see also Maddox et al., 2023), but little is known about the effects of non-event focused drawing on memory. A recent meta-analytic review (Maddox et al., 2023) uncovered only 2 RCTs examining the effects of non-event focused drawing on memory in an interview setting (MacLeod et al., 2016; Poole & Dickinson, 2014).

Thus, it remains possible that non-event focused drawing might distract and thus inhibit event recall during interviews. Indeed, drawing is sometimes used during interviews to distract individuals from the emotional difficulty of discussing negative/stressful or traumatic experiences (i.e., *comfort drawing*). On the one hand, there is a risk that drawing may deplete the cognitive resources required for complete and accurate recall (Macleod et al., 2016; Poole & Dickson, 2014). On the other hand, drawing may reduce stress, a known memory inhibiter, which in turn may help to elicit more information about negative, stressful, or traumatic events (Poole & Dickson, 2014). MacLeod et al. (2016) found that children *not* directed to

specifically draw the target event of a memory interview made more inaccurate statements (i.e., errors and confabulations) than those directed to draw the target event (for a similar finding, see Maddox et al., 2023). They concluded that best practice for the use of drawing as an interview aid may require the interviewee to be explicitly instructed to draw the event. Nonetheless, non-event focused drawing performed during interviews may enhance subjective wellbeing measures, such as enjoyment, relaxation, and feelings of support (Poole & Dickson, 2014).

The Present Study

The present study was designed to establish the feasibility of our methodological design by measuring the effects of an event-focused vs. non-event focused drawing task relative to talking-only following a negative/stressful autobiographical memory interview. The first aim was to ascertain whether differences could be obtained between an event-focused draw+talk, non-event focused draw+talk, and talk-only interview for voluntary and involuntary autobiographical memories outcomes following a negative/stressful life event. Specifically, we examined whether the amount of information shared in interview could be meaningfully measured. The second aim was to examine whether an involuntary memory task completed after sharing a negative/stressful event could meaningfully measure post-event intrusions. And the third aim was to measure additional post-interview outcomes beyond memory, such as whether drawing while talking is a more enjoyable, supportive, and less distressing experience for participants than only talking through negative/stressful experiences in an interview context.

Method

Participants

The sample consisted of 17 students (6 event-focused draw+talk, 6 non-event focused draw+talk, 5 talking-only; 11 female, 6 male; $M = 26.53$, $SD = 11.39$) who each received course credit for their undergraduate psychology studies.

Measures

The Impact of Events Scale-Revised questionnaire (IES-R). The IES-R (Weiss & Marmar, 1997) contains 22 questions about how difficult things have been for the participant over the past 7 days with respect to a stressful life event, and how bothered and/or distressed they have been by these difficulties. Participants rate each item using a 5-point scale (0 = *not at all*, 4 = *extremely*). Eight items correspond to symptoms of intrusions, 8 items correspond to symptoms of avoidance, and 6 items correspond to symptoms of hyperarousal. Scoring provides a total raw score as well as subscale scores for intrusions, avoidance, and hyperarousal symptoms. The mean rating for each subscale score can be interpreted according to symptoms of post-traumatic stress (PTS), where 0 = no symptoms, 1 = few symptoms, 2 = moderate symptoms, 3 = a high level of symptoms, 4 = an *extremely* high level of symptoms.

The Depression, Anxiety and Stress Scale (DASS-21). The DASS-21 Lovibond & Lovibond, 1995) was used to measure aspects of participants' mental health. The DASS-21 is a structured self-report questionnaire consisting of a total 21 items, with 7 items per subscale: depression, anxiety, and stress. Participants were asked to complete every item on the 4-point scale (0 = *did not apply to me at all*, 3 = *applied to me very much*). Sum scores were computed by adding up the scores on all the items and multiplying by a factor of 2. Total sum scores range from 0-120 and subscale scores range from 0-42.

Voluntary Memory

Word Count. The total word count from the transcribed audio interview recordings was used as the measure of the amount of information reported.

Statement Categories. Interviews were transcribed by a researcher blind to participant interview conditions. Verbal interview transcripts were then coded for 'clauses' pertaining to each of the following statements categories: Objects, people, actions, locations, times, or affective statements (as per Gross & Hayne, 1998; Katz & Hershowitz, 2010; Salmon et al., 2003; Wesson & Salmon, 2001). A score of 1 was given for each cluse relating to a particular statement category (e.g., "I was at the park" = 1 point for location).

Involuntary Memory Coding and Measures

Intrusion Frequency. In the intrusions task, participants were asked to press the "X" on the keyboard each time they experienced an intrusion while reading a 1002-word article about bread (as per Takarangi et al., 2014). The total number of "X" key presses was recording using Java script in the Qualtrics survey software. The total number of key presses was used as the measure of intrusion frequency.

Intrusion Qualities. Participants were asked to rate overall qualities of their intrusions on a 7-point scale (0 = *not at all*, 7 = *extremely*). Single item questions corresponded to qualities of distress, intensity, positive/negative emotion, and vividness.

Additional Interview Measures

Pre and post intervention distress and task difficulty were measured on a sliding scale (0 = *not at all*, 100 = *extremely*). Task enjoyment and interviewer support were measured on a task on a 7-point scale (0 = *not at all*, 7 = *extremely*). Interview duration was recorded in minutes. Interviewer Support was measured by asking participants to rate how supported they felt by the interviewer while sharing their experience on a 7-point scale (0 = *not at all*, 7 = *extremely*). Interview Interruptions were coded by the two independent researchers blind to

interview conditions. All transcripts were checked for words spoken by the interviewer. Such occurrences were recorded as *interruptions* and were included as covariates in all subsequent analyses. For example, the interviewer interjecting with "ah, I see…" would be a 3-word interruption.

Procedure

Figure 6.1 outlines the study procedure. Participants completed the study in person via Qualtrics survey software. Participants first read the information sheet and were given an opportunity to ask questions prior to providing informed consent. After providing consent they answered two demographic questions (age, gender) and then completed the IES-R (Weiss & Marmar, 1997) and the DASS-21 (Lovibond & Lovibond, 1995). Participants then selected a previous negative and/or stressful life experience that they were comfortable sharing with the researcher. They were reminded that their sharing of the experience would be audio recorded for later transcription and coding, and that they were free to request the interview be stopped at any time without consequence. Participants were told that they had up to 30 minutes to provide as much detail as possible about their experience with the researcher. Prior to the interview commencing, participants were asked to indicate their pre-interview distress.

Participants were then randomly allocated to one of three conditions: 1) an *event-focused draw+talk condition* in which participants were asked to draw their experience while talking about their chosen experience with the researcher; 2) a *non-event focused draw+talk condition* in which participants were asked to draw something unrelated to the event (i.e., a vase of *dry* flowers arranged in the room) while talking about their experience with the researcher, or 3) a *talk-only condition* in which they were asked to only verbally share their experience with the researcher. Participants in the drawing conditions were supplied with pen and paper. Participants were informed that the researcher was not interested in the quality of

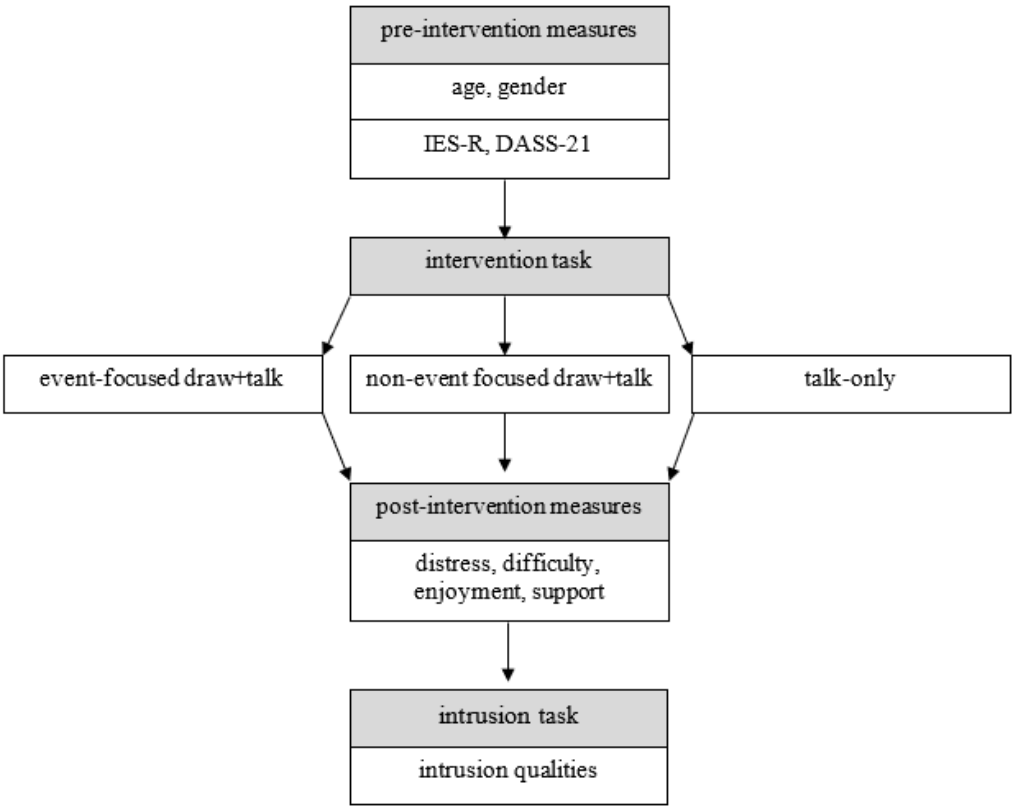
their drawings, nor were they judging or making any inferences about the content/meaning of their drawings. Researchers provided minimal encouragers during interview (e.g., “ah”, “mmm”) and refrained from asking questions.

After participants had shared their experience, drawings were collected by the researcher (where applicable), and they were asked to again indicate their current levels of distress (post-interview distress measure) and to then rate how *difficult* and how *enjoyable* they found the task. Participants were also asked to indicate how *supported* they felt by the interviewer.

Participants then received instructions on how to complete the intrusions task. In the intrusions task, participants read a 1002-word neutral article about bread (see Takarangi et al., 2014) and pressed the “X” on the keyboard each time they experienced an intrusion while reading it. After reading the article, participants were asked to complete the questions relating to intrusion qualities. At the conclusion of the study all participants were verbally debriefed and received a debriefing sheet which included information about the study’s aims, purpose, justification, and contact information for support services.

Figure 6.1

Study Procedure



Note. All participants in the non-event focused drawing task were instructed to draw the same vase of dry flowers.

Results

Descriptive and inferential statistics are presented even though the final sample size goal of 10 per condition was not achieved. Given the small sample sizes, the results are presented and discussed in terms of directional trends, with a focus on effect sizes rather than significance (i.e., *p* values). The effect size benchmarks used for all subsequent analyses were Cohen's *d*, 0.1 = small, 0.3 = medium, 0.5 = large (Cohen, 1988) and Eta squared (η^2), 0.01 = small, 0.06 = medium, 0.14 = large.

The means and standard deviations for the DASS-21and IES-R scores are presented in Table 6.1. There were no significant group differences on the DASS-21 scales or IES-R

scores. Nonetheless, directionally, the non-event focused draw+talk group had higher stress and intrusions scores than the other 2 conditions prior to the interview taking place. Therefore, the DASS-21 and IES-R scores were entered as covariates in all subsequent analyses.

Table 6.1

DASS-21; depression, anxiety, stress, and IES-R subscales; intrusions, avoidance, hyperarousal by Task Condition

Measures	**EF draw+talk (n = 6)**	**NEF draw+talk (n = 6)**	**talk-only (n = 5)**			
	M (SD)	*M (SD)*	*M (SD)*	*F*(2, 16)	*p*	η^2
Depression (DASS-21)	3.66 (3.07)	9.16 (4.30)	7.00 (5.19)	2.59	.110	.270
Anxiety (DASS-21)	4.00 (3.40)	5.16 (2.85)	4.20 (3.42)	0.22	.804	.031
Stress (DASS-21)	6.83 (3.18)	10.33 (4.27)	8.40 (4.72)	1.11	.355	.137
Intrusions (IES-R)	6.50 (5.08)	14.50 (6.97)	7.20 (6.45)	2.98	.083	.299
Avoidance (IES-R)	8.50 (5.64)	9.83 (4.71)	9.40 (6.42)	0.09	.916	.013
Hyperarousal (IES-R)	2.33 (1.03)	6.50 (3.93)	5.20 (5.31)	1.94	.180	.217

Note. NEF = non-event focused. EF = event focused.

Voluntary Memory

Figure S6.2 illustrates the means and standard deviations for the total word count per task condition. Interrater reliability was acceptable (α = .89; see Taber, 2018), as per Cronbach's Alpha analysis. Word count and voluntary memory statement categories were analysed using ANCOVA. Covariates in the model for each analysis were DASS-21 and IES-R scores (see Table 6.1).

Word Count. As can be seen in Figure S6.2, there was a trend toward the non-event focused draw+talk task group reporting more information than the event-focused draw+talk, or talk-only task conditions, $F(2, 16) = 0.29$, $p = .754$. This was a medium effect, $\eta^2 = .069$.

Statement Categories. Table 6.2 presents the results for the statement categories by task condition. The event focused draw+talk group reported more objects and affective statements than the other conditions, with large to medium effects respectively. The non-event focused draw+talk group reported more "times" relative to the other conditions. This was a small effect. Finally, the talk-only group were more likely to report actions. This was also a small effect. None of the differences between groups for any statement category were significant.

Table 6.2

Voluntary Memory Statement Categories by Task Condition

Statement Category	**EF draw+talk (n = 6)**	**NEF draw+talk (n = 6)**	**talk-only (n = 5)**			
	M (SD)	*M (SD)*	*M (SD)*	*F*(2, 16)	*p*	η^2
Objects	4.58 (4.12)	2.00 (1.09)	0.80 (0.83)	3.04	.104	.308
People	4.00 (3.80)	5.08 (3.00)	6.00 (2.57)	0.53	.734	.071
Actions	10.16 (7.84)	13.00 (7.00)	14.00 (8.58)	0.37	.749	.050
Locations	5.00 (4.65)	4.75 (3.95)	3.40 (2.21)	0.27	.769	.064
Times	4.16 (3.32)	6.08 (3.51)	5.20 (3.17)	0.49	.950	.066
Affective	5.25 (5.06)	4.66 (3.01)	3.10 (2.43)	0.47	.713	.063

Note. NEF = non-event focused. EF = event focused.

Involuntary Memory Measures

Intrusion Frequency. Figure S6.2 provides the total number of intrusions reported per task condition. Intrusion frequency was analysed using an ANCOVA. Covariates in the model for each analysis were DASS-21 and IES-R scores (see Table 6.1). As can be seen in Figure 6.2, there was a trend toward the non-event focused draw+talk task group reporting a

greater amount of intrusions than the event-focused draw+talk, or talk-only task conditions, $F(2, 16) = 0.14$, $p = .686$. This was a medium effect, $\eta^2 = .018$.

Intrusion Qualities. Table 6.3 provides the intrusion qualities (distress, intensity, positive/negative emotion, and vividness by condition. Intrusion qualities were analysed using an ANCOVA. Covariates in the model for each analysis were DASS-21 and IES-R scores (see Table 6.1). As can be seen in Table 6.3, the non-event focused draw+talk group experienced more intrusion distress than the other conditions but were less likely to report their intrusions as strong positive or negative in emotion. This was a large effect and medium effect respectively. None of the other intrusion qualities had meaningful effects and none of the of the differences between groups for any of the intrusion qualities measured were significant.

Table 6.3

Involuntary Memory Intrusion Qualities by Task Condition

Intrusion Quality	**EF draw+talk (n = 6)**	**NEF draw+talk (n = 6)**	**talk-only (n = 5)**			
	M (SD)	*M (SD)*	*M (SD)*	*F*(2, 16)	*p*	η^2
Distress	3.50 (2.58)	6.33 (2.87)	3.60 (2.60	1.13	.369	.228
Intensity	2.33 (1.51)	3.33 (1.86)	3.20 (2.68)	0.01	1.00	.057
Positive/Negative Emotion	3.16 (0.98)	2.83 (1.16)	3.60 (1.51)	1.27	.332	.071
Vividness	3.50 (1.22)	4.00 (1.26)	3.20 (1.92)	0.07	.929	.057

Note. NEF = non-event focused. EF = event focused.

Additional Interview Measures

Table 6.4 provides the additional interview measure means. The event-focused draw+talk group found the task more difficult than the other conditions. This was a large effect. The non-event focused group was rated as more enjoyable than the other conditions.

This was a medium to small effect. None of the other additional interview measures had meaningful effects and none of the of the differences between groups were significant.

Table 6.4

Pre and post Intervention Distress, Task Difficulty, Task Enjoyment, Interviewer Support, Interview Duration, and Interruptions by Task Condition

Measures	**EF draw+talk (n = 6)**	**NEF draw+talk (n = 6)**	**talk-only (n = 5)**			
	M (SD)	*M (SD)*	*M (SD)*	*F*(2, 16)	*p*	η^2
Pre-intervention Distress	32.16 (30.01)	32.66 (16.46)	24.60 (38.71)	0.13	.881	.018
Post-intervention Distress	49.50 (38.28)	35.66 (21.44)	30.60 (26.95)	0.60	.560	.079
Task Difficulty	58.16 (31.30)	29.33 (25.28)	37.40 (22.19)	1.83	.196	.208
Task Enjoyment	3.66 (2.33)	4.50 (2.16)	1.66 (1.15)	.383	.691	.297
Interviewer Support	5.83 (0.98)	5.50 (1.51)	6.66 (0.57)	0.97	.409	.139
Interview Duration	3.97 (2.38)	3.49 (2.03)	3.22 (2.90)	0.13	.915	.019
Interview Interruptions	21.58 (22.92)	23.66 (23.21)	27.40 (22.37)	.089	.875	.013

Note. NEF = non-event focused. EF = event focused.

Discussion

To the best of our knowledge, the present study was the first to explore the effects of drawing on both voluntary and involuntary memory in an interview context. The primary aim was to ascertain the feasibility of measuring both autobiographical event recall and intrusions following the sharing of a negative/stressful experience. A secondary aim was to examine the effects of an event-focused drawing vs. non-event focused drawing following a memory interview, relative to talking-only. A third aim was to examine any effects the drawing interventions may have on other subjective wellbeing measures, such as enjoyment, and feelings of support, relative to only talking during an interview.

Contrary to previous studies (cf. Gross & Hayne, 1998; Katz & Hershkowitz, 2010; Salmon et al., 2003; Wesson & Salmon, 2001), our event-focused draw+talk interview condition did not report even directionally more information than our talk-only condition. Instead, our non-event focused draw+talk condition used the largest number of words in interview (i.e., amount of information reported). However, in line with Wesson and Salmon (2001), we found that those afforded the opportunity to draw the events in question while talking (i.e., event-focused draw+talk) provided more statements on *objects* than the other interview conditions. Unlike Katz and Hershkowitz (2010), our event-focused draw+talk condition did not provide more information about *people*, *actions*, *locations*, and *times*. In fact, our talk-only condition was most likely to produce clauses containing references to people and actions, while our non-event focused draw+talk group made more references to *time*. Unlike previous studies (see Wesson & Salmon, 2001) the duration of the interview was similar across conditions. However, we did not have interviewers ask follow-up questions. Rather, we attempted to control for interviewer interference by instructing our researchers to mostly just listen to the experiences being shared. Thus, we recommend that future studies design and implement a standardised interview questionnaire and protocol (e.g., Cognitive Interview; Matsuo & Miura, 2016) and/or measure the amount of interviewer interruptions and control for them statistically (as per our analysis).

For involuntary memory we found numerically more intrusions were reported by our non-event focused draw+talk group than the other conditions. This result was unexpected, as non-event focused visual motor tasks (akin to drawing) are typically found to decrease intrusions (for review see Brewin, 2013). Nonetheless, an aim of our study was to ascertain the feasibility of our intrusion task for measuring subsequent involuntary memories. Across conditions, participants recorded relatively high numbers of intrusions relative to previous studies (M = 8.65, SD = 7.70; cf. Maddox et al., 2023). In addition, although the non-event

focused draw+talk task was rated as most enjoyable, participants in this group went on to report higher rates of subsequent intrusion distress relative to the other conditions. Perhaps the non-event focused task led to attempts at thought suppression, which has been shown to be an ineffective strategy for removing unwanted, negative thoughts. That is, suppressing negative, unwanted thoughts often has the paradoxical effect of increasing subsequent intrusions (Magee et al., 2012; Wenzlaff et al., 1991).

Finally, we also examined a few other post-interview outcomes examined. We found those asked to draw while sharing their negative/stressful experience rated the task as most difficult. The non-event focused draw condition instructed to "*draw a vase of flowers*" rated the task as most enjoyable relative to the other conditions. The talk-only group had the highest ratings of interviewer support, which may reflect the perceived level of engagement the interviewee felt when not occupied with another task. That is, drawing during interview may have interfered with known therapeutic techniques that build rapport, such as making eye contact or other non-verbal encouragers (e.g., nodding).

Conclusion

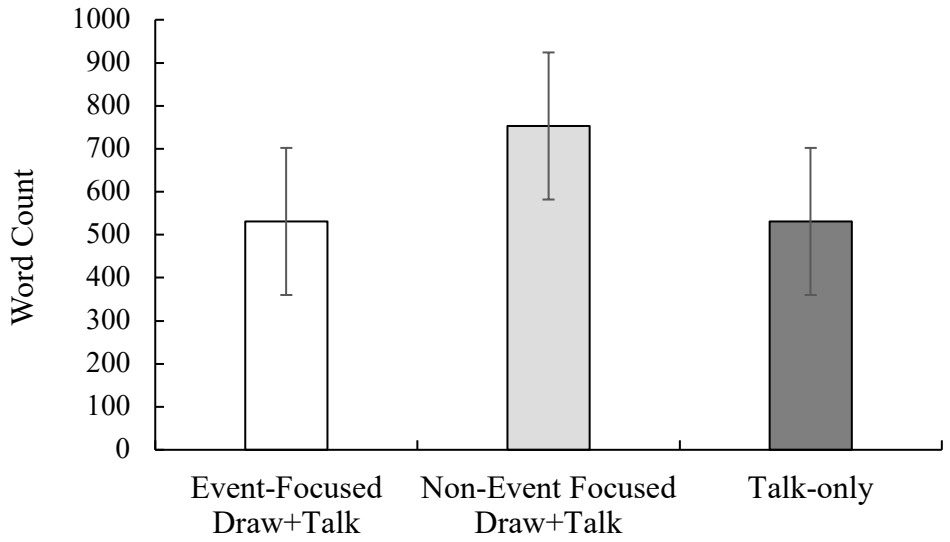
Trends in the data from our feasibility study warrant a full-scale study examining the effects of drawing on autobiographical voluntary and involuntary memory. Previous studies have shown that drawing can enhance the amount of information reported about experienced events relative to more traditional talk-only interviews (e.g., eyewitness interviews, counselling). And yet, few of these studies examined these effects following trauma-specific events (for a review see Maddox et al., 2023). The present study was the first to examine drawings effects on unwanted, negative, and intrusive memories post-interview. Thus, the perceived wisdom of using drawing during interviews in applied settings rests on shaky grounds. Whether drawing interventions increase or decrease or have no effect on post-interview intrusions following trauma-specific experiences remains to be seen.

Supplementary Material

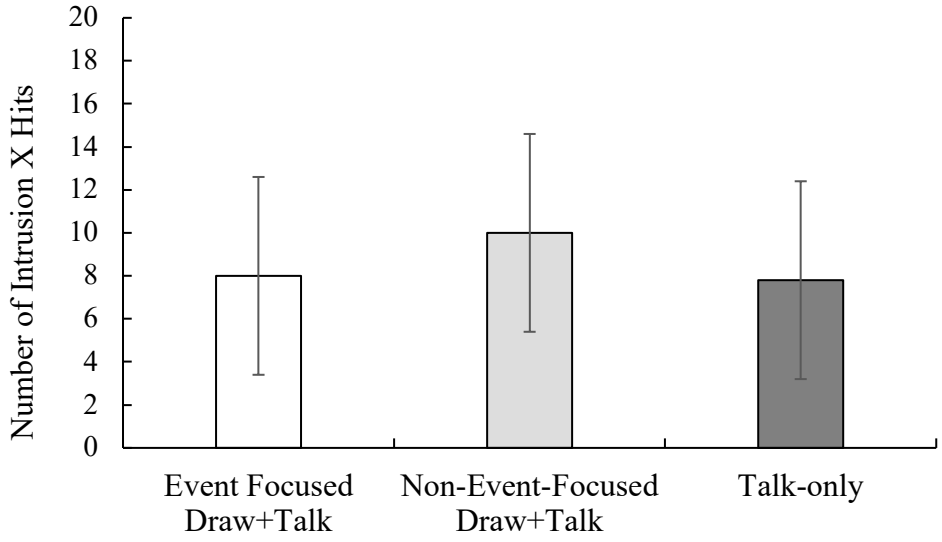
Figure S6.1

Voluntary Memory: Word Count and Involuntary Memory: Number of Intrusion X Hits

(i) Word Count



(j) Number of Intrusion X Hits



Note. Error bars represent 95% CI.

Chapter 7: General Discussion

The overarching aim of my thesis was to study the effects of post-event drawing on voluntary event recall and involuntary intrusions, and in so doing, to examine the possible underlying mechanisms of change for arts-based interventions in the treatment of trauma. To this end, I conducted two systematic and meta-analytic reviews. The first review and meta-analysis focussed on the popular and growing field of arts therapy. I examined the efficacy of visual arts-based interventions following trauma. Specifically, I evaluated the proposition that visual-image creation alleviates PTSD symptoms (e.g., Hass-Cohen-Findlay, 2019; Spiegal et al., 2006; Talwar, 2007). However, my meta-analysis did not uncover much support for this proposition, as overall visual arts-based interventions did not influence *PTSD-specific* outcomes (e.g., intrusions, avoidance, hyperarousal).

In my second review and meta-analysis, I evaluated the effects *drawing* on memory. Many studies have shown that drawing is an effective *voluntary* memory enhancer (e.g., Fernandes et al., 2018; Wammes et al., 2019). I had hoped my review might unearth some studies measuring the effect of drawing on *involuntary* memory (i.e., intrusions), given the claim that visual-image creation can reduce trauma-related intrusions (Talwar, 2007). According to clinical theories of PTSD (for review see Brewin, 2014; see also Brewin et al., 1996), visual-motor tasks (akin to drawing) can prevent the development of intrusions after a traumatic event. Specifically, performing a visual-motor task is said to interfere with the visual-perceptual cognitive pathway required to consolidate such memories. Contrary to this possibility, my review and meta-analysis did not unearth studies measuring involuntary memory; thus, the *intrusion reduction* hypothesis could not be evaluated. Further, this meta-analysis showed a clear need for more studies of the effects of drawing on intrusion development following *trauma-specific* events. I next reported a series of experiments

designed to fill these important gaps in the literature. Namely, measuring intrusion outcomes using trauma-specific stimuli.

My experimental studies examined whether a drawing task, when applied during the period of memory consolidation, could reduce subsequent intrusions while leaving voluntary event recall intact, as predicted by clinical models of PTSD (Brewin et al., 1996). I also examined the impact of drawing performed after memory for an event has been consolidated (i.e., *delayed* task), as is the case in most applied settings (e.g., clinical, therapeutic, forensic interviews). Importantly, unlike the studies captured by my reviews, I examined these effects using trauma-specific stimuli (i.e., trauma-film paradigm; see Arnaudova & Hagenaars, 2017). This paradigm enabled me to examine the effects of drawing on memory in a controlled fashion and while also allowing me to measure memory *accuracy*.

In my experiments, drawing did not have consistent positive effects on voluntary or involuntary memory. In Experiment 1, after tracking the effects of a draw (versus verbal) task on both memory types over 3 days, *event-focused* drawing failed to enhance memory accuracy, and it also led to significantly *more* intrusions 24-hrs after the trauma film (Day 2). *Non-event focused* drawing reduced accuracy, but not intrusions. In Experiment 2, no differences between either memory type were uncovered after delaying the performance of the event focused tasks (i.e., on Day 2).

Using the trauma-film paradigm allowed me to conduct a subsequent thematic analysis to examine whether the qualities of participants' drawings were predictive of their later memory performance. No evidence was obtained that the representational quality of participants drawings related to their later event memory. However, the number of traumatic elements drawn was positively correlated with later event recall, both the amount and accuracy of information reported.

Using an analogue trauma was not without its limitations as it can always be argued to lack full ecological validity (Poole & Dickson, 2014). As such, I also reported a feasibility experiment in which I measured both event recall (i.e., amount of information reported) and intrusions for autobiographical events using a memory interview procedure. In this feasibility study, participants were randomly allocated into one of three groups: event focused draw+talk, non-event focused draw+talk, or a talk-only control group. Group differences were non-significant due to small sample sizes. Nonetheless, directionally, non-event focused drawing increased the amount of information reported in interview, and also increased the likelihood of experiencing unwanted intrusions post-interview, relative to the other conditions.

Below, I review and synthesise these findings in more detail. First, I discuss my meta-analytic reviews. Second, I address the experimental studies with research designs that were driven by theoretical models of PTSD (see Brewin et al., 1996). Third, I review the studies that were designed to address several practical considerations of how drawing is applied in various professional settings (e.g., after long delays). Lastly, I address the limitations of my thesis and recommend directions for the future study of arts-based interventions in the treatment of trauma.

Arts-based Interventions Following Trauma: What did my Reviews Show?

The systematic reviews and meta-analyses reported in **Chapters 2** and **3** confirm that many studies have examined the effects of drawing following traumatic experiences. And yet, both reviews failed to reveal enough studies to firmly answer the question of whether visual-image creation (i.e., drawing) successfully reduces trauma-related intrusions (a key diagnostic criterion of PTSD; APA, 2013).

The meta-analysis in **Chapter 2** revealed that visual-image creation in arts-based interventions was effective (relative to control) for enhancing *non-PTSD* specific outcomes,

such as quality of life, relaxation, and enjoyment in group-based arts therapy. In addition, unwanted symptoms, such as depression, appeared to decline for those who had experienced acute traumas (e.g., combat related trauma, sexual abuse). Arts-based interventions were effective for reducing PTSD-*specific* outcomes in children but not in adults (e.g., intrusions, avoidance, hyperarousal). Importantly, no studies evaluated whether intrusion reduction might serve as a potential underlying mechanism of change. Although 6 studies measured PSTD-specific symptoms such as intrusion/reexperiencing subscales, only 2 analysed them in the published articles (Erickson, 2008; Gul & Irshad, 2018; these subscale data were provided upon follow-up by Campbell et al., 2016). Given this small set of studies, meaningful inferences could not be made regarding the effectiveness of arts-based interventions for reducing trauma-related intrusions. Therefore, although artmaking may help individuals access traumatic memories (see Hass-Cohen-Findlay, 2019; Spiegal et al., 2006; Schnitzer et al., 2021), the evidence base for why and how this may be effective in the treatment of trauma is lacking. Indeed, none of the studies included in the **Chapter 2** meta-analysis focussed specifically on the effects of arts-based interventions on memory.

The second review and meta-analysis reported in **Chapter 3** aimed to unearth studies examining the effects of drawing on *both* voluntary (i.e., event recall) and involuntary memory (i.e., intrusions). This review indicated that drawing was a valuable facilitator of event recall relative to more traditional methods of communication (e.g., talk-only interviews). Specifically, drawing enhanced the *amount* and *accuracy* of information reported post-event, without increasing *errors* or *confabulations*. In addition, these memory benefits held irrespective of age (children vs. adults), event type (autobiographical vs. live/staged vs. video), or task timing (immediate vs. delay). However, as per the **Chapter 2** review, none of the included studies examined the effects of drawing on trauma-related *intrusions*. Indeed, much like the first review, drawing was found to be useful for enhancing memory following

trauma-specific experiences, but there were too few studies available in the literature for examining these effects using trauma-specific stimuli.

Arts-based interventions (e.g., drawing) are often used to facilitate communication and event recall following traumatic experiences, but in other situations individuals are directed to draw something *unrelated* to the traumatic event. When used this way, *non-event focused* drawing is can divert attention away from the difficulty of re-experiencing an event (Poole & Dickson, 2014) and to *comfort* individuals following a trauma. Surprisingly, the review presented in **Chapter 3** found only 2 studies that have examined whether non-event focused drawing inhibits event recall (Macleod et al., 2016; see also Poole & Dickson, 2014). Neither study found that performing non-event focused drawing tasks, during memory interviews, enhanced event memory. Instead, MacLeod et al., found that non-event-focussed drawing made event memory less accurate. Thus, further examination of the influence of non-event focused drawing on memory was warranted—a critical gap in the literature later addressed by my subsequent experimental studies. This was particularly important given voluntary memory enhancement had only previously been established following an event-focused drawing task.

The reviews reported in **Chapter 2** and **Chapter 3** revealed several other gaps in the literature on arts-based interventions (e.g., drawing) on memory following trauma. First, more studies need to examine the use of arts-based interventions in the treatment of trauma, including studies testing the potential underlying mechanisms of change. Second, there is a lack of research examining the effects of drawing on *both* voluntary and involuntary memory. Third, research in the arts therapy space lacks rigour (e.g., a scarcity of RCTs) and research in clinical/forensic fields lacks validity (e.g., a scarcity of trauma-specific stimuli).

To address these gaps, I designed a series of experiments to examine the potential underlying mechanisms of change for the efficacy of arts-based interventions following

trauma. As discussed below, these experiments tested the dual-representation model of PTSD (Brewin et al., 1996) and evaluated the potential effects of drawing when used as it is typically applied in professional settings.

Gauging the Effects of Drawing on Memory: What did my Theory Driven Studies Show?

The dual-representation theory of PTSD posits that when individuals are exposed to a traumatic event, memories are encoded and retrieved via two distinct memory systems (Brewin et al., 1996); involuntary memories via a *visual-perceptual* cognitive pathway, and voluntary memories via a *verbal-contextual* cognitive pathway. Voluntary memories are consciously recalled, and as such are not likely to be distressing or to cause psychological harm. Involuntary memories, in contrast, are often characterised as vivid, visual, sensory, repetitive, spontaneous, unwanted, and distressing. Involuntary memories of a traumatic experience are one of the key diagnostic criteria of PTSD (i.e., trauma-related intrusions, APA, 2013). Research has suggested that performing simple visual-motor tasks (akin to drawing) can reduce trauma-related intrusions (see Deeprose et al., 2012; Hagenaars & Antz, 2012; Holmes et al., 2010). However, the visual-motor task needs to be performed *during* the period of memory consolidation to compete with the cognitive resources required for involuntary memory processing (for review see Brewin, 2014; see also James et al., 2015). That is, it is only *during* this consolidation period—while memories are still able to be altered, disrupted, and/or modified—that the visual-motor task can interfere with the visual-perceptual cognitive pathway.

In **Chapter 4** (Experiment 1 & 3) I tested this claim using drawing as the visual motor task: participants performed a drawing task *immediately* after watching a trauma film and thus before memory consolidation (see Deeprose et al., 2012; Hagenaars et al., 2017; Holmes et al., 2010; see also Brewin, 2014 for review). Specifically, **Chapter 4**, Experiment 1

examined whether immediately drawing a traumatic event increased the accuracy and amount of information voluntarily recalled, while decreasing the frequency and distress of subsequent intrusions (relative to a verbal control), over 3 consecutive days. Contrary to expectations, drawing the target event did not enhance the accuracy or amount of information voluntarily recalled following the invention on Day 1, Day 2, or Day 3. These results ran contrary to previous studies that found drawing enhanced event recall (for review see Driessnack, 2005). Importantly, however, these prior studies used *non-traumatic* stimuli before testing memory. Thus, our failure to replicate the beneficial effects of drawing on event recall, may be due to our use of *trauma-specific* stimuli. Another possibility is that participants were informed about the drawing portion of the study *prior* to viewing the trauma film. As such, participants may have asked themselves "how could I draw these events?" while watching the trauma film (irrespective of later assigned task condition), and thus engaged in strategies such as mental imagery, generation, and/or elaboration that are known to enhance later recall (see Fernandes et al., 2018).

Drawing the target event, relative to verbal debriefing, also did not result in fewer subsequent intrusions, contrary to expectations. Based on Brewin et al.'s (1996) dual-representation theory of PTSD, visual-image creation was expected to compete for the visual-perceptual cognitive resources required to consolidate involuntary memories. Drawing not only failed to reduce post-task intrusion frequency, it actually led to *more* intrusions 24-hrs post-event. In fact, drawing the target event appeared to lead to more persistent intrusions in some cases. For instance, 62% of intrusions reported on the second day of the study matched the descriptions of intrusions also experienced-on Day 1 (see **Chapter 4**). These intrusions were not more distressing for those asked to draw the traumatic event than for those asked to verbally describe the event. However, the verbal group also showed a significant decline in intrusions after Day 1.

An important difference between our visual-motor task and those that successfully reduced intrusions in previous studies (e.g., Tetris; see Brewin, 2014 for review) is that the latter typically *did not focus on the target event*. Therefore, **Chapter 4**, Experiment 3 examined whether immediately drawing something unrelated to the traumatic event (i.e., a vase of flowers) would increase the accuracy and amount of information voluntarily recalled, while decreasing the frequency and distress of subsequent intrusions (relative to verbal control) over 3 consecutive days. Although I was not able to collect a full sample, the data suggested that non-event-focused drawing showed no sign of reducing intrusion frequency relative to verbal debriefing. Moreover, the non-event-focused drawing group's intrusion distress ratings remained high across timepoints (see **Chapter 4**, Figure 4.2.1). This experiment suggested that non-event-focused drawing has the potential to *decrease memory accuracy* and *increase memory errors*. Thus, in line with the findings of MacLeod et al. (2016) drawing the target event (i.e., event-focused drawing) may be required to enhance voluntary event recall. However, event-focused drawing may sponsor persistent intrusions. Experiments 1 and 3 in **Chapter 4** failed to demonstrate that post-trauma event drawing (whether event-focused or non-event focused) protects against subsequent intrusions, contrary to the dual-representation theory of PTSD (Brewin et al., 1996). Nonetheless, this result was in keeping with other visuospatial tasks that have failed to reduce subsequent intrusions in previous studies (see Brewin, 2014).

Gauging the Effects of Drawing on Memory: What did Drawings reveal about later Event Recall and Intrusions?

Participants' drawings are typically not analysed even though they may provide a rich source of information that can provide insight into cognitive processes and memory (Bainbridge, 2022). Many cognitive processes are used when drawing, including mental imagery, motoric, elaborative, and generative functions (Fernandes et al., 2018; Wammes et

al., 2019). In **Chapter 5**, I examined whether the *qualitative* characteristics of participants' drawings predicted their subsequent *quantitative* memory outcomes (i.e., event recall and intrusions). A coding framework was developed using an inductive research approach. Informed by the dual-representation theory of PTSD (Brewin et al., 1996) we unearthed themes characteristic of the theory's verbal-contextual and visual-perceptual cognitive pathways (see **Chapter 5**, Figure 5.1, & Figure 5.2). Inclusion of emotive elements (e.g., tears, sadness, grief) and trauma-specific elements (e.g., blood, dead bodies) were characteristics of the visual-perceptual drawing theme, whereas inclusion of words, numbers and arrows were characteristics of the verbal-contextual theme. Inclusion of verbal-contextual details, rather than visual-perceptual details, was found to be associated with *lower* rates of intrusions. This finding is at odds with the dual-representation theory of PTSD (see Brewin et al., 1996) by which drawings with *more* visual-perceptual details should have led to fewer intrusions. Our findings did not support the idea that the visual-perceptual cognitive resources required to draw these elements interfered with the visual-perceptual cognitive resources required to consolidate involuntary memories.

Another surprising finding from the thematic analysis in **Chapter 5** was the significant positive relationship between the number of traumatic elements drawn and voluntary memory outcomes. We speculated that enhanced voluntary memory following the drawing of trauma-specific elements may have been due to the *willingness* of some participants to engage with (rather than to avoid) the distressing elements of the film.

Further, in **Chapter 4,** Experiment 3, drawing something *unrelated* to the traumatic event (i.e., a vase of flowers) led to decreased memory *accuracy*. Taken together, the results of **Chapter 4** and **5** suggest that *supressing* negative/unwanted thoughts of a trauma (i.e., *thought suppression*; see Wenzlaff et al., 1991; see also Magee et al., 2012) via explicit instruction (i.e., non-event focused drawing), or by one's own choice (i.e., avoidance of

depicting traumatic elements) may inhibit voluntary memory, while increasing intrusion distress. We suggested thought suppression as a possible mechanism through which intrusion distress increased following the non-event focused drawing task in **Chapter 4,** Experiment 3. Purposefully drawing (rather than avoiding) trauma-specific elements may have the paradoxical effect of enhancing voluntary event recall, while protecting against enhanced intrusions distress (albeit not intrusion frequency; cf. **Chapter 4**, Experiment 1), consistent with our observations based on the thematic analysis in **Chapter 5**.

Gauging the Effects of Drawing after Trauma: Reflecting on the Application of Drawing Interventions

The effects of a delayed drawing task on involuntary memory outcomes had not been studied previously (see **Chapter 1**, Figure 2). And yet, in forensic, clinical, and therapeutic settings, drawing is likely to be used to facilitate communication and event recall long after traumatic events have been experienced, and therefore, long after memories are consolidated (see Derksen & Connolly, 2022; see also **Chapter 2** & **Chapter 3** for review). In **Chapter 4** Experiment 2 we examined the effects of drawing on both voluntary and involuntary memory when the task was performed after a *delay* (i.e., after memories were consolidated), as is often the case in real-world applications involving drawing.

The **Chapter 3** review indicated that drawing can be a powerful memory retrieval aid irrespective of when it is performed. That is, relative to talk-only interviews drawing should (in theory) enhance voluntary memory whether performed immediately or after a long delay (see **Chapter 1**, Figure 2). However, according to the dual-coding theory of PTSD (Brewin et al., 1996) intrusions should only be reduced if the visual-motor task is performed *during* the memory consolidation phase (a proposition tested in our **Chapter 4**, Experiment 1). It was possible that delayed drawing might lead to enhanced intrusions over time, as per our **Chapter 4**, Experiment 1. As postulated in some studies included in our **Chapter 2** review,

visual image-creation might help individuals access involuntary memories due to the connection between the visual experience inherent in both artmaking and trauma-related memories (Hass-Cohen & Findlay, 2019; Schnitzer et al., 2021; Schouten et al., 2015). However, when we tested the effects of a delayed drawing task on voluntary and involuntary memory in **Chapter 4**, Experiment 2, it failed to affect either memory type on any of our measures (i.e., accuracy, amount of information, intrusion frequency and distress), relative to verbally debriefing. Our failure to see a reduction in intrusion frequency was perhaps unsurprising given the performance of visual-motor tasks is only theorised to reduce involuntary memory when performed after the memory consolidation phase (e.g., Nader & Hardt, 2009).

The **Chapter 4** Experiment 2 results suggest that arts-based interventions such as drawing do not have clear drawbacks, but they also do not yield robust benefits, when applied *long after* initial exposure to traumatic events (i.e., delayed intervention). **Chapter 4** Experiment 1, in contrast, indicated there might be potential harms of *immediate* post-event drawing such as an increase in the persistence of intrusions over time. Our **Chapter 4**, Experiment 2 results suggest that such concerns may apply only to immediate drawing tasks.

Gauging the Effects of Drawing for Autobiographical Memory: Is it Feasible?

An easy criticism of the **Chapter 4** experiments is that we used an analogue trauma event rather than more ecologically valid autobiographical events (see Poole & Dickson, 2014). Our **Chapter 3** review did not produce studies examining the effects of drawing on both event recall and intrusions following an autobiographical memory interview. To address this gap, **Chapter 6** reported a feasibility study that used a negative/stressful autobiographical experience, rather than a controlled analogue trauma. **Chapter 6** also provided a second opportunity to examine the potential moderating effect of task focus on intrusion reduction (i.e., event-focused vs. non-event focused drawing).

Non-event-focused drawing is often used during memory interviews to comfort, reassure, and retain the attention of interviewees when discussing traumatic events (Bekhit et al., 2005; Malchiodi, 1998, cited in MacLeod et al., 2016). It may be especially useful with children and when the events being discussed are difficult to talk about (e.g., child sexual abuse; Katz & Hershkowitz, 2010). And yet, our **Chapter 3** systematic and meta-analytic review revealed only 2 prior studies examining the effects of *non-event focused* drawing on memory, and neither used trauma-specific events and measured intrusions.

Drawing might exhaust the cognitive resources needed to remember one's traumatic experience, thus leading to diminished voluntary memory outcomes (i.e., amount of information reported; as per Macleod et al., 2016; Poole & Dickson, 2014; **Chapter 4**, Experiment 3). Alternatively, drawing might reduce stress and in turn help to elicit more information during memory interviews (Poole & Dickson, 2014). In our **Chapter 6** feasibility study, we randomly allocated participants to either an event-focused draw+talk, non-event focused draw+talk, or talk-only memory interview condition. In all conditions, participants shared a negative and/or stressful autobiographical event.

Group differences in **Chapter 6** were non-significant, perhaps due to small sample sizes. Nonetheless, directional trends in our data suggested that non-event focused drawing increased the amount of information reported relative to the other conditions. Specifically, participants who drew a vase of flowers while sharing their negative/stressful experience reported more information during the interview (i.e., word counts) relative to the other two conditions. In **Chapter 4** Experiment 3, non-event-focussed drawing increased reporting in terms of word count, but this increased output did not lead to more accurate reports. Using autobiographical events in the **Chapter 6** feasibility study meant that we could not measure memory *accuracy*. However, MacLeod et al. (2016) found that children *not* directed to specifically draw the target event during memory interview made more inaccurate statements

(i.e., increased errors and confabulations) than those directed to draw the target event—and we obtained a parallel finding in **Chapter 4** Experiment 3.

Given these issues, future studies could focus on measuring the *consistency* of autobiographical reports, rather than on measuring memory *accuracy*, *errors*, and *confabulations* using the trauma-film paradigm. Trends in our **Chapter 6** data suggest that non-event focused drawing may increase the likelihood of experiencing unwanted intrusions post-interview. Regardless, a full study of the effects of drawing (specifically non-event focused "*comfort*" drawing) on voluntary and involuntary memory for autobiographical appears to be feasible based on our **Chapter 6** experiment. A full study is also essential, given that the feasibility study hinted that there may be some negative consequences of using drawing interventions during memory interviews.

Future Research: The Need for a No-Task Condition

Several limitations of the studies in my thesis were addressed in detail in previous chapters, as well as in the above discussion, and do not bear repeating here. Nonetheless, one methodological limitation of my experimental studies warrants discussion: The lack of a *no-task* comparison condition. The results of **Chapter 4**, Experiment 1 suggested that verbally debriefing, rather than drawing, may be a safer and more effective way to facilitate communication and elicit information following traumatic events. However, single session verbal psychological debriefing following traumatic events can be harmful (see Rose at al., 2002 for systematic review). Though some authors continue to advocate for the use of verbal psychological debriefing as a supporting approach to manage stressful events (see Delany et al., 2021), current evidence suggests that it may not prevent the development or maintenance of PTSD. In fact, in some instances, it may strengthen adverse symptoms (e.g., PTSD, anxiety, depression, stress; see Rose et al., 2002).

In this regard, a limitation of my experiments was the lack of a *no-task* comparison condition for gauging the relative effects of drawing versus verbal debriefing on memory following trauma—whether for an analogue trauma (as per **Chapter 4**, Experiment 1, 2 & 3), or a negative/stressful autobiographical experience (as per **Chapter 6**). If drawing relative to a no-task control led to enhanced recall and decreased intrusions, support for the use of arts-based interventions following trauma would be gained. On the other hand, if drawing led to decreased event recall and enhanced intrusions relative to a no-task control, then engaging in no task might be preferable, as is the current recommendation for verbal debriefing (Rose et al., 2002). Nonetheless, in applied settings, collecting information about a trauma event is often required (e.g., eyewitness testimony). Not debriefing *at all* (akin to a no-task condition) may not always be feasible, such as during forensic interviews. Thus, even though a no-task condition would have been informative, the studies in my thesis still provide a useful evidence base for benchmarking the effects of drawing versus verbalising on voluntary memory, involuntary memory, and PTSD symptomology following trauma-specific events. It is also important to consider that there may be conceptual differences between drawing as a form of remembering (i.e., as a memory retrieval aid) and drawing as a sensory, visual process that may assist individuals in the often-complex task of trauma recovery. Such distinctions are valuable as we begin to examine the efficacy of arts-based interventions in the treatment of trauma and uncover the underlying mechanisms of change. The relationship and interaction between visual arts-based interventions, memory and trauma have important implications for not only the application of theoretical models of PTSD (Brewin et al., 1996), but also for the way researchers study such interventions in the future.

Conclusion

My thesis makes important progress in evaluating and examining the effects and possible underlying mechanisms of change for arts-based interventions in the treatment of

trauma. The evidence-base regarding the effects of drawing on both voluntary and involuntary memory following a traumatic event requires further investigation. Arts-based interventions continue to be a popular form of treatment for trauma sufferers, and more research is needed to determine their efficacy and the underlying mechanisms of change (see **Chapter 2** & **3**). Indeed, researchers in the arts therapy space have called for more RCTs (see Schnitzer et al., 2021). In addition, while theories such as the dual-representation theory of PTSD (Brewin et al., 1996) hold promise for explaining the underlying mechanisms of change for arts-based interventions in the treatment of trauma, further evaluation of their claims is needed. My studies suggest that both event-focused and non-event focused drawing might have potential drawbacks for memory when performed immediately after exposure to a traumatic event (i.e., **Chapter 4** Experiment 1 & 3) or potentially after long delays (i.e., **Chapter 6**). Such results, if replicable, have important implications for professional practices that use drawing with vulnerable individuals following traumatic experiences, such as in forensic, clinical, and therapeutic settings.

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Appendix A

Voluntary Memory Questionnaire

Please answer the following questions regarding the film you watched to the best of your ability and in as much detail as possible. If you are unsure of an answer, please guess.

1. Can you describe the vehicles involved in the accident? For example, the colour, make and model of the cars involved? How many cars were involved? Please describe in as much detail as possible.

2. Can you describe the location where the accident took place? For example, what was the weather and visibility like? Were there any landmarks or street names?

3. Can you describe the people responsible for the accident? For example, what they were wearing; colour; length of hair; male/ female, age, or any other distinguishing features? And how the accident occurred? If multiple people, please describe who and in what ways.

4. Can you describe the people NOT directly involved in the accident? For example, how many people arrived on scene to help the victim(s)? How many people were witnesses to the accident? How long after the accident did it take for help to arrive? Who called for help to arrive? Who was the first person(s) to arrive at the scene? What type of help did people receive? Please describe in as much detail as possible

5. Can you describe any victim(s) of the accident? For example, what they were wearing; colour; length of hair; male/ female, age, or any other distinguishing features? Who and how were they injured? If multiple, please describe who and in what ways.

6. Is there anything else you remember about the event that you haven't already mentioned? If yes, please describe in as much detail as possible. If no, please type NA.