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Research Article

The art therapy relational neuroscience and memory reconsolidation four drawing protocol

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ABSTRACT

Novel and rewarding experiences can reconsolidate people's memories and recalibrate their reactions to past events. Memory reconsolidation (MR) is a positive process whereby as autobiographical memories are recalled, they return to a labile state, and can be either reinforced or updated before reconsolidation. Thus, updating fear-based memories with non-fearful information may lead to permanent reduction in automatic responses and lasting changes to distressing memories. During recall, both implicit and explicit memories may be updated. The arts therapies offer rewarding and creative access to nonverbal autobiographical memories, as well as mitigate habitual reactions. When informed by the neuroscience of MR, art therapy relational neuroscience (ATR-N) practices support therapeutic MR dynamics. In support of these theoretical claims, the relevant literature is reviewed and then illustrated by a MR-ATR-N trauma-based protocol.

Introduction

This article provides an overview of the theoretical and practical implications of autobiographical memory reconsolidation for the field of art therapy. Autobiographical memories are formed by the consolidation of personal memory and recall and comparison of past to current experiences (Waters, 2014). During recall, memory reconsolidation (MR) allows for previously consolidated autobiographical memories to be strengthened or modified (Tronson & Taylor, 2007) by the destabilization and re-synthesis of proteins in the memory and fear centers of the brain (Nader, Schafe, & LeDoux, 2000). MR is a critical psychotherapy change factor for treatment of disturbing memories (Agren, 2014; Dunbar & Taylor, 2017; Hass-Cohen, 2016). Arts psychotherapy research has indirectly addressed some MR concepts through its focus on memory integration, progressive exposure, externalization, reduction in negative arousal, and increased positive emotions, emotional self-efficacy and self-esteem (Spiegel, Malchiodi, Backos, & Collie, 2006). Smith (2016) highlighted explicit symbolic expression, containment, and artistic pleasure and also identified the need for conceptual clarification of memory terms while Gerge and Pedersen (2017) called for conceptual clarification of pictorial interventions. Naff (2014) also explored the potential of the arts for the development and enhancement of resources and resiliency. Sensory and visual art-making and processing, as well as imagination and creativity may be advantageous for MR (Hass-Cohen, Bokoch, Clyde Findlay, & Witting, 2018; Lahad, Farhi, Leykin, & Kaplansky, 2010). Furthermore, nonverbal art therapy-based interventions likely support the modification of both implicit and explicit autobiographical memory (Hass-Cohen, 2016). The art therapy relational neuroscience (ATRN), which is illustrated in this article, has been designed to meet specific MR change conditions. This four-drawing protocol has several variations and demonstrated some efficacy in reducing depression, anxiety (Hass-Cohen et al., 2018; Hass-Cohen & Clyde Findlay, 2016; Hass-Cohen & Clyde Findlay, 2019; Hass-Cohen, Clyde Findlay, Carr, & Vanderlan, 2014), and pain (Hass-Cohen & Clyde Findlay, 2009).

Memory reconsolidation

Episodic, personal memories are first consolidated as short-term memories in the memory center of the brain, the hippocampus, and then through systems consolidation, they distribute in the cortex as autobiographical and relational long-term memories (Dudai, 2004) (Fig. 1).

Over time, episodic memories represent a dynamic and changing representation of a person's sense of self. Moreover, distressing and fear-based vivid personal memories, which continue to depend on subcortical areas of the brain, frequently disrupt this autobiographical sense of self and consequently, a person's daily life, relationships, and

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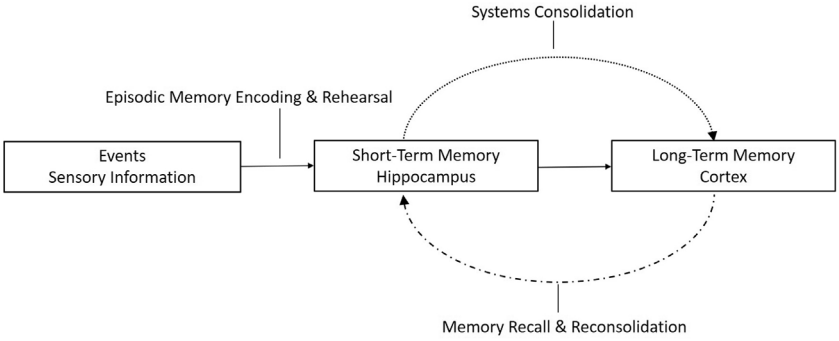

Fig. 1. Memory consolidation and reconsolidation.

outlook on the future (Brewin, 2018). However, MR research has suggested that retrieved autobiographical memories can be modulated and updated with new information, potentially changing their impact (Elsey, Van Ast, & Kindt, 2018).

During MR, the destabilization and re-synthesis of proteins in the brain's memory and fear centers continuously modifies memories for up to 6 h after recall (Nader et al., 2000; Hardt, Einarsson, & Nader, 2010). As memories are updated with new information, synaptic potentiation thickens existing dendritic connections and new retrieval pathways and neuronal growth are established (Aimone et al., 2014). Memory recall and MR protein changes are chemically different than initial memory consolidation (Tronson & Taylor, 2007). Over time, the novel reconsolidated memories are recalled instead of the initial memory trace (Lane, Ryan, Nadel, & Greenberg, 2015). From an evolutionary perspective, MR facilitates effective threat responses as new learning and forgetting transforms old schemas and supports alternate courses of action. While this dynamic occurs naturally over the lifetime, it can be encouraged as an effective therapeutic aid.

MR studies of procedural-implicit and declarative-explicit memories have included: behavioral interventions (Schiller et al., 2010), episodic, spatial, and relational-based learning (Hupbach, Gomez, Hardt, & Nadel, 2007), object recognition (Balderas, Rodriguez-Ortiz, & Bermudez-Rattoni, 2015), addiction as reviewed by Lee, Nader, and Schiller (2017), art therapy trauma and relational protocol (Hass-Cohen et al., 2018), and recommendation for clinical practices (Brewin, 2018; Ecker, Ticic, & Hulley, 2015; Hass-Cohen, 2016). A review of pharmacological research further assists in understanding MR mechanisms and ethics. Administration of propranolol, a beta blocker medication for blood pressure, commonly used in MR research, prevented the reconsolidation of negative and PTSD-related fearful memories (Lonergan, Olivera-Figueroa, Pitman, & Brunet, 2013). Due to the propranolol effects on the fear center of the brain, the amygdala, fearful memories were reduced (Kindt, Soeter, & Vervliet, 2009) while the factual and neutral memories of the same event stored in the memory center of the brain, the hippocampus, were maintained (Schwabe, Nader, & Pruessner, 2014) (Fig. 2).

More recently, the administration of cannabidiols before and after a traumatic event has shown to interfere with fear conditioning while increasing cognitive self and memory functions (Bitencourt & Takahashi, 2018). These findings, that fear is reduced, yet the memory related facts, neutral reactions and cognition remain intact, suggested an ethical foundation for MR psychotherapy strategies.

Memory reconsolidation and art therapy relational neuroscience theory

Memory system

Autobiographical memory processing of episodic memories involves the interconnectivity of the amygdala and hippocampus functions (Kandel et al., 2014) as well as visual system pathways, which converge

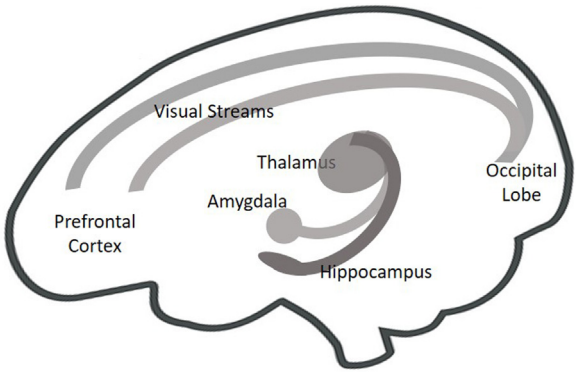

Fig. 2. Hippocampus and amygdala.

and overlap in temporal and pre-frontal brain areas (Brewin, 2018). These structures contribute to optimal short-term memory processing and consolidation within hippocampal areas and support the transfer of short-term memories from hippocampal and temporal areas to the cortex for long-term storage and eventually retrieval and reconsolidation (Kandel et al., 2014).

MR of long-term recalled memories may be constrained by their vague yet stable characteristics which make them less susceptible to change whereas recently consolidated short-term memories are vivid and vulnerable to forgetting (Wang, 2018) and can be retraumatizing (Brewin, 2018). Yet regardless of age, episodic memories continue to rely on the subcortical hippocampal areas for context (Smith & Bulkin, 2014). Hippocampal areas are very sensitive to the spatial-visual-temporal dimensions of events and to implicit MR processing (Eichenbaum, 2017; Wang, 2018). Enriched sensory and playful environments further support the therapeutic formation and forgetting of memories within the hippocampus (Aimone et al., 2014). It is likely that the non-verbal, visual-spatial, and contextual cues used in art therapy practices have the potential to directly contribute to MR (Hass-Cohen et al., 2018). Hence, creating patterned-based art may support the vivid and contextual recall of long-term vague memories. In this context, art therapy's nonverbal and vivid sensorial practices may support MR.

Fear center

Nonverbal, fear-based memories, especially of perceived inescapable situations, are likely resistant to MR as they trigger fear and avoidance areas within the amygdala and tend to remain stable and vivid over time (Ledoux, 2000). The lateral area of the amygdala is highly vulnerable to reoccurring conditioning of avoidance and negativity and contributes to the continuous modulation and reinforcement of fearful memories within the amygdala central (Nader et al., 2000). While the right amygdala stores fear and sadness-based memories in the basal areas, the left amygdala connects to the reward system of the brain and is associated with coping-based memories and pleasurable

emotions (Sergerie, Chochol, & Armony, 2008). For example, when recalling perceived escapable situations, the amygdala basal coping areas are activated (Hartley, Gorun, Reddan, Ramirez, & Phelps, 2014). Tangible and pleasurable art-making can be symbolically experienced and provide an escape route potentially stimulating the amygdala coping-response basal areas as well as the left amygdala response (Hass-Cohen & Clyde Findlay, 2015).

Reward system

The reward system's neurochemicals norepinephrine, dopamine, and serotonin are secreted in response to stressful and pleasurable events. The response to stressful and traumatic events which releases norepinephrine, impairs cognitive functions of the self-center, the medial prefrontal cortex (Hayes, Hayes, & Mikedis, 2012). In contrast, dopamine, which is likely triggered by motivational efforts, may help to consolidate memories by rebalancing cortisol- and norepinephrine-based stress responses and may enhance resistance to traumatic stress (Gerlicher, Tüscher, & Kalisch, 2018). Furthermore, it is likely associated with creativity (Mayseless, Uzefovsky, Shalev, Ebstein, & Shamay-Tsoory, 2013). Serotonin, excreted in the dorsal raphe nucleus of the reward center, can also modulate amygdala fear-based memories and regulate the ventral medial prefrontal impaired responses (Lee et al., 2017). Both serotonin and dopamine may be stimulated by creativity (Zaidel, 2014). Furthermore, brain imaging has demonstrated that art making activates the reward circuitry and positive emotions (Kaimal et al., 2017), suggesting the potential advantage of art therapy and MR practices for managing high arousal. MR may not occur if the fear reminder is too high, as high arousal prevents protein destabilization and synthesis (Wang, 2018).

Stress neurocircuitry

The directionality of the effects of stress response on MR are complex (Schwabe et al., 2014). The severity of the stressor and the characteristics of the reactivated emotive memory likely determine whether stress effectively disables or enhances MR. During the direct experiencing of severe stressors, excessive cortisol aided forgetting by shutting down the function of hippocampus while during recall, cortisol enhanced fearful memories in men (Meir Drexler & Wolf, 2018; Zohar et al., 2011). In contrast, experiences or recall of milder stressors supported MR (Bos, Schuijer, Lodestijn, Beckers, & Kindt, 2014). The regulating effects of art making, a sense of internal control as well as mastery of art media can potentially mitigate chronic stress responses and support MR when initiated after memory recall (Hass-Cohen, 2016).

Memory storage

Pre-existing negative self-schemas and experiences can proactively or retroactively interfere with MR updates or storage (Lane et al., 2015). Proactive interferences may prevent the triggering and storage of MR, whereas retroactive interferences happen within the 4-to-6-h post-MR time frame. Examples include, verbally dismissing any potential of self-growth or any other conditioned negativity. Verbally expressed proactive or retroactive MR interferences might be sidestepped through sensory processing (Hass-Cohen, 2018). This is because sensory memory storage of visual, iconic, and auditory memories is modality-dependent, contributing to increased capacity for new memories and learning (Fougnie & Marois, 2011). According to the later, processing of visual information immediately following verbal information will then not compete with the storage of the verbal learning. In another example, visual spatial motor activities such as playing the computer game, Tetris, following the reactivation of a traumatic memory of a film, reduced intrusive memories suggesting that the game competed with storage of visual-only information (James et al., 2015). Visual memory processing has also strongly correlated with cognitive ability (Luck & Vogel, 2013). For example, St. Jacques and Schacter (2013) showed the modification of visual memories following a museum visit. Thus, sensory art therapy MR interventions may mitigate limitations in storage capacity of verbal learning (Hass-Cohen, 2016).

Memory reconsolidation and psychotherapy

The focus of therapeutic MR is helping people contextualize distressing episodic memories as past events, which can then be explicitly expressed and reconsolidated. The goal is to facilitate the development of a coherent sense of self and autobiography by softening and eventually allowing distressing memories to be forgotten (Ecker et al., 2015; Lane et al., 2015; van den Berg, Awh, & Ma, 2014).

Memory reconsolidation sequencing

In therapy an understanding of a distressing problem is first collaboratively generated, followed by a therapeutic establishment of a brief working reminder of the problem, and then the generation of new information which can modify, supplement, or erase the original memory. During the necessary MR reminder, disturbing, fragmented, conditioned and implicit memories may easily and frighteningly surface (Brewin, 2018). These implicit memories may compete with reparative MR, or conversely, neutral memories may be modified with threatening updates (Lee et al., 2017). In other words, both implicit unexpressed and explicit expressed memories can be reactivated by brief reminders, become vulnerable to potential change, and then reconsolidated (Barreiro, Suárez, Lynch, Molina, & Delorenzi, 2013). Therefore, it is important that the established working reminder of the problem should not re-traumatize, as a strong stress-based arousal may further fragment, decontextualize, and strengthen traumatic memories (Soeter & Kindt, 2013). Strategies, such as contextual processing, which focus on “how” the narrative is processed, rather than on ascertaining the truth of the traumatic facts (Brewin, 2018; Hupbach, Hardt, Gomez, & Nadel, 2008) minimized the reliving of perceived inescapable traumatic situations (Hartley et al., 2014). Descriptive questions, “What?”, “where?”, and “when?” rather than causative “why” questions also anchor events in the past. Explicitly focusing on the event in a safe situation, adding safe elements to a threatening memory, and focusing on creating a contingent, coherent, and organized narrative further contextualize the memory. These cognitive, and emotive efforts successfully compete for the same pathways that maintain the distressing memory (Hass-Cohen, 2016).

For MR to occur, the exposure to the reminder must also be brief, meaning less than an hour, and followed by new information (Lane et al., 2015). Longer reminders triggered extinction, which posed retraumatization and spontaneous relapse risks (Kindt et al., 2009; Pedreira, Pérez-Cuesta, & Maldonado, 2004).

Following the reminder, the memory must be disrupted by a prediction error, meaning new and engaging information or meaning-making, otherwise the original memory is merely reinforced (Lane et al., 2015). Prediction errors trigger an interaction between old memory and new experiences which destabilize the memory (Lee et al., 2017). To create a prediction error, memory related cognitions and emotions should be paired with unexpected alternatives (Schiller et al., 2010), or disconfirming information (Ecker et al., 2015). Examples include the therapist's supportive inquiry or questioning of the validity of negative self-bias, or the necessity of maintenance of the problem. This experiential process, which provides new information, may need to occur or be presented repeatedly (Wichert, Wolf, & Schwabe, 2013) and in a short period of time (Lee et al., 2017). Other examples of prediction triggers include retrieval of positive or neutral implicit or non-expressed memories, such as recalling the joy of creation, or neutral procedural skill-based memories, such as knowing how to mix colors.

For example, the vividness of positive future imagery was significantly associated with optimism, (Blackwell et al., 2013). Accessing such positive implicit memories is critical for providing new information as well as mitigating implicit fear-based memories which, without awareness, can be reactivated, reconsolidated, and strengthened (Barreiro et al., 2013). Therapeutically, a familiar relationship, such as that of the therapist and office space, may also support positive MR (Hupbach et al., 2008). These strategies contribute to MR, growth, and integrated thriving.

New information, which is provided immediately after the reminder, must command cortical attention (Wichert et al., 2013). It must generate new meaning (Hupbach, 2011) and compete with old negative belief systems (Agren, 2014), implicit negative or traumatic appraisals, and bias (Brewin, 2018). Within the MR time frame (4–6 h), retroactive interferences, such as habitual negative reactions, may result in a rejection of the memory update or the new information. As described earlier, retroactive interference is less likely to occur when the reminder and novel information are cued by dissimilar and nonverbal modalities, such as sensory, visual, and spatial interventions (Fougnie & Marois, 2011). It is also to be expected that people who have experienced significant losses will likely oscillate between recovery-oriented and loss-oriented responses to trauma (Stroebe & Schut, 2010). The loss orientation focuses on mourning, while the restoration orientation involves dealing with secondary losses, meaning making and acceptance of this process (Neimeyer, Burke, Mackay, & van Dyke Stringer, 2010).

The MR-ATR-N protocol

The four-drawings protocol was designed so that new and old information was sequenced, paired, and contextualized. The prompts were: (1) “Draw a picture of the problem,” (2) “Draw yourself”, (3) “Draw the internal and external resources that helped you with the problem,” and (4) “Draw yourself, as you see yourself now.” Media choices included colorful and white paper, oil pastels, and markers. A title and narrative were elicited after drawing. The first and second drawing were not discussed and were turned over and placed to the side. A contextualized-based discussion was initiated after drawing the resource drawing: (a) which of the represented resources are external or internal? (b) what is the order in which the resources are drawn? (c) which resource is the most important? The onset, frequency, intensity, duration and meaning of each resource was explored. Then, the fourth prompt was provided with the third drawing of resources in full view. Upon protocol completion a full discussion of the drawings and comparison of the two self-drawings as they are laid out in sequence was encouraged (Fig. 3).

The following protocol example is from a participant in a multi-methods study (Hass-Cohen et al., 2018). It was selected as it illustrated the ATR-N MR protocol theoretical constructs. Pre- and post-protocol (at five weeks) were conducted. IRB consents were obtained.

ATR-N MR protocol example

Draw the problem: “Scarred”

Lisa is a female veteran with a history of combat trauma, unexpected familial loss, depression, anxiety and panic. She is a fitness instructor and graduate student. A couple of years ago, she gave a late-night ride home to her intoxicated neighbor. He asked for her to stop on the way and then proceeded to violently pull her into the bushes and attempted to strangle as well as sexually assault her. She fought back, and another neighbor came to her help. She thought that she was going to die, a thought which continues to haunt her. While she credited herself with saving her life, she continues to suffer from depression and anxiety. Eventually, she moved away from living in the same community as her attacker.

“Scarred” shows a bird's eye representation of a small female stick figure lying amid bushes with three towering sharp triangles which represent mountains. There is a gap between the circle that represents the head and the triangle shape of the female body. Two triangle shapes represent the figure of her attacker and perhaps his hand or other parts of his body. Lisa said that the red paper represented blood and the black crayon marked her fear. Later, she said that when she drew “Scarred” she responded automatically and immediately felt tense as if relieving the memory: “I wanted to make him [the monster] like the whole page, um but at the same time as much as I wanted to make him the whole page, I felt that I was giving him too much credit because even though he was bigger than me physically, and in that moment, I still won.” Notably, the sharp menacing triangular sharp shapes of the landscape and attacker merge and fill the page. The bird's-eye perspective, which is commonly seen with survivors, reflects a distancing depersonalized stance that is intended to protect the victim. The lack of connection between the head and body may be an implicit strangulation memory. Lisa's vivid depiction of a life-threatening memory included a focus on her survival then and now. It seemed that from the first drawing she updated her traumatic memory as a tale of courage, thus mitigating traumatization of the MR reminder and creating the potential for MR (Fig. 4).

Draw yourself: “Incongruent”

Lisa said that bright colors and a smile represent that she showed herself to the outside world as brave and happy whereas the teardrop, angry eyes and thin mouth represented internalized sad and feelings and her continued fear for her life. “Incongruent” also has a tiny black

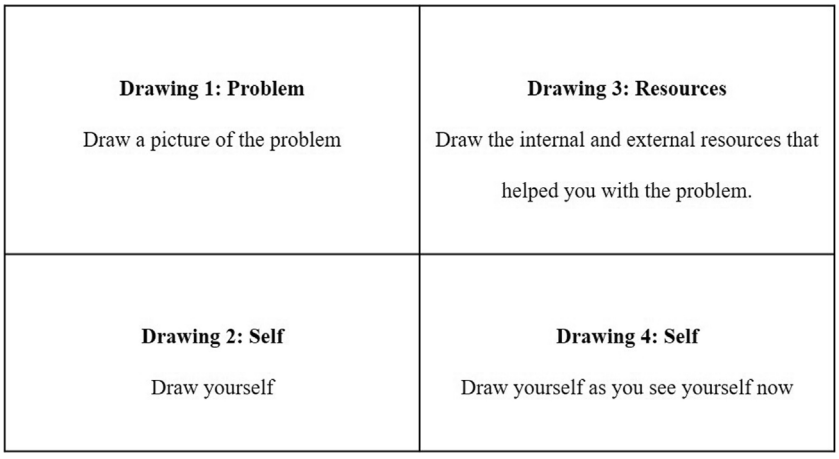

Fig. 3. Post protocol discussion layout.

1. Represent the problem
Title. “Scarred”

2. Represent your internal & external resources that help with the problem
Title. “A list of resources ”

2. Represent yourself .
Title. ”Incongruent”

4. Represent yourself as you see yourself now.
Title. “Happy good feeling drawing”

Fig. 4. A tale of courage: ATR-N MR protocol.

dot in at the heart level. The figure fills most of the page stands alone with no grounding and no context. Protected by a cascade of yellow hair, the figure has no hands and the face is again not connected to the green body. The teardrop represented her night terrors, depression and anxiety. Upon reflection Lisa noted that she was surprised that it was harder to draw herself than to draw what happened. She realized her continued anger, embarrassment, and shame, and said she could not share what had happened with her friends, thus in her mind letting them and herself down. She said that until now she had never acknowledged this internal struggle and its impact.

Draw your internal and external resources: "A List"

Lisa divided the page into four quadrants. In the top part she first drew fitness, which provided her with immediate stress relief and notes representing music, which helped with anxiety. In the bottom left she represented friends as stick figures with no facial features as they always support her. Lastly, she drew Molly, her dog, who had provided her with unconditional love for 12 years as an internal and external protective support. Lisa said she was surprised that she did not draw Molly first and then then drew a heart shape around Molly. The discussion of the resources instigated a shift in Lisa's perceptions and brought up feelings of love, comfort and connection: "I was transforming as I was going through my emotions were shifting from each, from each quadrant, … oh I love fitness, oh I love music, so these are the things that I love, I felt my emotions change when I got to this point of [drawing resources]… Looking at the image of Molly and my friends showed me how much I relied on them. They have been like family to me and made me realize just how important friendship/human connection are."

Draw an image of yourself now: "Happy Good Feeling Drawing"

Lisa, Molly and her friends are represented on a green supportive background with blue ocean waves and a sun. Lisa is holding Molly's leash, and both have a red heart. Lisa and Molly are together in the foreground. Lisa figure has a congruent facial expression, her protective layer of hair has lifted, and her hands are showing. In the second plane, there are three friend figures who now have supportive smiling facial expressions and upward arm gestures perhaps representing strong attachment (Hass-Cohen, 2008). In the third plane, there is a representation of the ocean with pointy waves that are perhaps a faded representation of the mountainous sharp ridges. Lisa said that up to this drawing, she had not fully identified as a survivor; her smile now is true and represents her gratitude for life. She added that there are so many women who lose their lives during such experiences.

Sharing and reflecting

When comparing the two self- drawings, Lisa noted how her second self-drawing was much more complete: "There, I left off a nose, I didn't draw my nose on there. I felt like I didn't draw my hands. I felt incomplete. Here, [second self-drawing] I'm complete. I have all of my limbs, I have my nose, I have a big happy, ya know, a big smile on my face and um, where, obviously looking down here I am, I just felt, here I was a victim, so being put in that role I felt like, you lose, you lose a huge part of yourself when something like that happens, you feel so violated and, and it, you are, and you're scarred for (inaudible) I was definitely left with a scar. I really see more happiness here." In her sharing, Lisa oscillated between describing her feelings of loss-of-self, as in "Incongruent" versus restoration-of self as in "Happy". Each time she verbalized additional insights: "That teardrop really represents exactly all of the pain that I had … I was just dealing with everything um, all by myself, I felt alone and that was just the biggest thing I take away from that and here I am not alone, I have everything around me, I'm happy, here before I was living in the past and so um, I was living in this horrible nightmare."

Lisa shared that drawing was most helpful to her: "Drawing myself gave me a better understanding of how tough I really am…In the first drawing, I created the image based on pure emotion. I didn't give it a lot of thought because it's what I felt during the time I was with my attacker. In drawing two, I created myself as incomplete … it was meaningful for me to discuss my resources. It kinda helped me to see everything and go wow, look how I changed, look at how my emotions shifted, I think that if somebody … was to experience an event like this or something traumatic it would be very helpful to be able to just kind of take your emotions and let your hand just go because that's what I felt like in this, is that my hand just went, and it was, you see what I'm saying?" Five weeks later, Lisa scores showed a reduction in depression and no anxiety.

Discussion

Sequencing

A sequenced administration of the ATR-N-MR protocol can be completed in one or two meetings. For two meetings, the first three prompts, drawing the problem reminder, self and drawing resources may be administered in one meeting and the last, redrawing the self is then provided in the next meeting. Revisiting and drawing the self allows for MR updating to occur three times: in the resource drawing, the self-redrawing and the discussion of all the sequence. Thus, exploring temporal dimensions such as when the event happened, and the sequence of events will further facilitate MR processing (Hass-Cohen, 2016). Sole administration of the first prompt, the problematic memory reminder, without any new information such as resources, additional novel media or other clinically appropriate interventions is discouraged as it may only reinforce the problem (Lane et al., 2015). As the identified problem may be linked to or trigger other related problems, it may be necessary to repeat the protocol several times.

The distressing memory reminder

In psychotherapy, details of problematic events are identified and discussed prior to the start of MR (Ecker et al., 2015). Therefore, the first prompt, "represent the problem" serves as the reminder. The event is not specifically labeled, but rather, called "the problem," or "what had happened." Such non-specificity allows for reduced arousal, as well as for unrecognized aspects of the problem to inform MR processing and the art making. To meet MR conditions, the reminder must be brief, and have a low arousal level, and stimulate a prediction error. In Lisa's case, recalling her attack as a perceived escapable experience, her tale of survival and courage spontaneously emerged serving as a mismatch to her continuous experience of her depression and anxiety symptoms. Thus, therapeutic art making practices may be helpful as they can simultaneously make older memories vivid and available for change while at the same time contain traumatizing memories (Gerge & Pedersen, 2017) by reducing the fear center responses.

As seen in Lisa's bird's eye representation of the event, it is possible that making a tangible and creative representation of the problem creates distancing and relief. For example, clients with PTSD experienced a reduction in symptoms when they shared a reminder of their trauma story and then imagined a movie theater where their traumatic event was projected at a distance in black and white from different vantage points (Gray & Liotta, 2012). There are several techniques to contain the potential of the MR reminder to retraumatize the client. Sometimes it is necessary to immediately turn the page over, at other times the clinician can inform the client that drawing the problem would not take too much time and the amount and type of media can also be controlled. When clients narrate the drawing, it is also important to ask how their coped with it and admire their strengths.

The reminder of reaction to trauma: the first self drawing

The second prompt asked for a self-portrait, eliciting the representation of the person's mental self-image in the context of the adverse event. Asking for a drawing of the self after drawing the problem, reveals how the impact of the trauma on one's sense of self maintains a distressed response. Lisa's surprise at how the attack has continued to implicitly impact her sense of self is such an example. Her image and the story represent an internal conflict that emerged as a secondary threat to her sense as a survivor, thus constraining MR memory updating. One reason that such implicit reactions tend to linger is that negative emotional memories were found to be resistant to change and preferentially encoded (Schwabe et al., 2014).

Pairing and disconfirming

The third prompt, "represent the internal and external resources that help with the problem," asks for the representation of resources that helped in the past and in the present. This prompt's purpose is to update the autobiographical memory by pairing the problem reminder with unexpected mismatched or disconfirming information. Art making is thought to be particularly conducive to attending to a difficult reminder, while experiencing the pleasure of creativity (Zaidel, 2014). This pairing of negative and positive experience, a therapeutic factor of art therapy, may help mitigate the strength of the trauma reminder and reduce emotive arousal, cognitive distortions and re-traumatization (Hass-Cohen, 2016). As in Lisa's case, the discussion of the art reinforces the newly contextualized resource-based memory. The therapist and client discuss the representation of the resources and if needed, changes are initiated to ensure a good enough fit and pairing of the resources with the problem. Lisa's listing of her resources cognitively shifted her attention to coping, resiliency and post traumatic growth. Due to memory center sensitivity to visuo-spatial patterned cues, her organization of her resources into quadrants likely supported further affective and contextualized non-verbal change. The contextualized questions about discussion of the resources described earlier, support memory updating as they are recovery oriented. Lisa described cognitive, emotive and behavioral shifts. Her recalling of a felt sensation of loving her resources reconsolidated her memories of being loved which is frequently threatened by trauma. The sensory reminder of Molly's unconditional love, which did not require a sharing of the details of what had happened, helped resolve her internal conflicts and ignite some self-compassion. Assisting clients in mindfully oscillating between recognizing their hurt and loss while at the same time accepting their universal need for support and restoration has the potential to support MR.

Consolidating updated memories

For the fourth prompt, "represent yourself as you see yourself now," the image of the resources is kept in full view, reinforcing recalled or newly found resourcefulness. By emphasizing the present tense, the prompt encourages an updated self-perspective (Bridgham & Hass-Cohen, 2008) and reconsolidates a restoration orientation. Comparing the first, and second representation of self may provide an additional opportunity for pairing negative and positive reactions, as well as practicing and accepting oscillating restoration and loss orientations. Both self-drawings, the first in the context of the distressing memory and the second in the context of resourcefulness, may be considered as internal working memory representations of insecurity versus security (Hass-Cohen & Clyde Findlay, 2009). It is possible that creativity and art making contribute to affect self-regulation and security (Hass-Cohen & Clyde Findlay, 2015) which have been shown to impact internal working representations (Leyh, Heinisch, Kungl, & Spangler, 2016). In addition, the recall of significant attachment figures, in Lisa's case her friends, was shown to assist in recovery from distressing memories (Selcuk, Zayas, Günaydin, Hazan, & Kross, 2012). Lisa's last drawing includes a foreground middle and background. This depth and perspective may represent self-development, and increased capacity for complexity. Complexity of thinking is frequently constrained by trauma-oriented black and white thinking (Brewin, 2018).

One limitation is that positive changes in self-representation may not be immediately apparent and should not be expected in the second self-drawing. In this case, it would be recommended for the therapy to focus on the discussion and reminder of social, cognitive, emotional, spiritual, behavioral and physical resources (Hass-Cohen et al., 2018; Lahad et al., 2010). In Lisa's case, a somatic memory of being strangled likely continues to be implicitly embodied and represented by lack of a connection between body and head throughout her protocol. Such lingering trauma effects have been observed in other applications of the ATRN-MR protocol (Hass-Cohen & Clyde Findlay, 2009).

Five weeks after having completed the protocol, Lisa reported reductions in depression and no anxiety. The longevity impact of completing the protocol could possibly reflect how sensory art therapy MR interventions may mitigate limitations in storage capacity of verbal learning as well as and mitigate any expressed negative bias, thus nullifying any retroactive interference.

Summary

Neuroscientific research on MR is promising for the theory and practice of ATR-N. The illustrated protocol demonstrated specific MR conditions including sequencing, media, problem reminder, and importantly, how novel and mismatched updating of the memory can assist in mitigating or eliminating its effects. The MR-ATR-N protocol likely promotes MR by reiteratively targeting explicit and implicit memories (Hass-Cohen, 2016). When compared to verbal discussion of the drawings, it is the drawing activity that was most positively associated with positive change and the development of resiliency (Hass-Cohen et al., 2018). Specifically, it is likely that in imagery driven protocols, in which the trauma activation is followed by novel information, contribute to mismatched perception of the disturbing memory and will continue to show positive results (Hass-Cohen, 2018). The degree to which such new episodic memories interfere with old memories after reactivation depends on how strongly the new episodic memories encode (Wichert et al., 2013).

The ATRN-MR protocol is designed to visually and vividly compete with old memories. Visual memory processing involved in the planning and making of artwork contributes to the ability to maintain attention and motivation despite the emotional demands of recalling and consolidating distressing accounts. The vivid qualities of the art may further access and modification of implicit uncontextualized sensory memories. It is likely that the therapeutic expressive arts environment facilitates an adaptive and positive emotional response, allowing for MR. When resources artwork is discussed, the purpose is to reaffirm recalled and embodied experiences of personal resources, the capacity for change, and creative expression. While general factors of optimism, hope, courage, and creativity further resiliency (Fredrickson, 2013), it is critical to identify specific, and enduring resources and personality traits for each person's responses. Thus, as novel art-based procedures are successfully expressed, they may update the memory with a successful action in the "here and now." Through ATRN based MR, it is possible to eliminate and reduce symptoms, as well as experientially practice self-growth and identity shifts. In this case, imaginative art-making, accentuated relationships and incorporated resiliency became an integral part of the autobiographical self. These constructs are aligned with our approach that that imagination and creativity provide sources of knowledge. As old memories are destabilized and then updated with new and rewarding experiences, such as art-making and new learning, resiliency and thriving can occur. Additional factors need to be empirically researched to support this claim. Clinical practice modifications may be needed, and the protocol may need to be repeated

due to influences of implicit and explicit negative biases and interferences. Hence, it is incumbent upon the therapist to draw from their experience and the specific skills of their client in order to maximize the advantages of novelty, familiarity, automaticity, and verbal versus nonverbal recall and interactions. It is necessary for further research to determine whether beneficial effects are lasting.

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