Joana Santos Pra Baldi

Autobiographical memories and mental imagery: An emotional regulation and reconsolidation study

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Abstract

Pra Baldi, Joana Santos; Mograbi, Daniel Correa (Advisor). **Autobiographical memories and mental imagery: an emotional regulation and reconsolidation study.** Rio de Janeiro, 2017. 79p. Dissertação de Mestrado - Departamento de Psicologia, Pontifícia Universidade Católica do Rio de Janeiro.

The current dissertation aims to explore the connection between autobiographical memories (AM) and mental imagery (MI) through a systematic review and an empirical study. The present review investigates the role of AM and MI as mood induction procedures (MIP). Results broadly suggest that a variety of cues to elicit AM or MI has been used. It was also found that few studies reported statistical results about the methods' efficacy, control for demand effects, or employed physiological measures of emotion. Further work investigating the implications of these methodological issues is recommended. The empirical study explored the effects of MI tasks (positive or neutral) on AM of healthy young adults. In Session 1, participants remembered a sad life event. Depending on their group, they should imagine either a positive or a neutral alternative scenario to the memory. Two weeks later, in Session 2, they had to complete the same memory task. Results indicate that MIPs were effective, with increases in negative mood after the sad AM and improvements in mood in both groups after imagery regardless of its emotional content. Memory report revealed that groups had a similar profile of memory intrusion. This suggests that mental imagery may be used as an effective emotional regulation strategy for negative autobiographical material, and that the emotional content of imagery may not have a crucial impact in this process. Further studies are needed to evaluate the use of imagery as emotional regulation, explore different types of emotional memory and extend this paradigm to clinical populations.

Keywords

Autobiographical memories; mental imagery; mood induction procedures; emotion; mood; imagination

Resumo

Pra Baldi, Joana Santos; Mograbi, Daniel Correa (Orientador). **Memórias autobiográficas e imaginação: Um estudo de regulação emocional e reconsolidação.** Rio de Janeiro, 2017. 79p. Dissertação de Mestrado - Departamento de Psicologia, Pontifícia Universidade Católica do Rio de Janeiro.

A presente dissertação tem como objetivo explorar a conexão entre memórias autobiográficas (MA) e imagética mental (IM) através de uma revisão sistemática e um estudo empírico. A presente revisão investiga o papel da AM e MI como procedimentos de indução de humor (PIH). Os resultados em geral sugerem que uma variedade de pistas tem sido usada para evocar MA ou IM. Verificou-se também que poucos estudos relataram resultados estatísticos sobre a eficácia dos métodos, controle dos efeitos de demanda ou empregaram medidas fisiológicas da emoção. Recomenda-se um trabalho adicional para investigar as implicações dessas questões metodológicas. O estudo empírico explorou os efeitos das tarefas IM (positivo ou neutro) sobre a MA de adultos jovens saudáveis. Na Sessão 1, os participantes se lembraram de um evento triste. Dependendo do grupo, eles deveriam imaginar um cenário alternativo positivo ou neutro para a memória. Duas semanas mais tarde, na Sessão 2, eles tiveram que completar a mesma tarefa de memória. Os resultados indicam que os PIHs foram eficazes, com aumentos no humor negativo após a MA triste e melhorias no humor em ambos os grupos após IM, independentemente do seu conteúdo emocional. Isso sugere que as IMs podem ser usadas como uma estratégia eficaz de regulação emocional para o material autobiográfico negativo, e que o conteúdo emocional das imagens pode não ter um impacto crucial nesse processo, porém são necessários mais estudos para realizar esta avaliação, explorar diferentes tipos de memória emocional e estender esse paradigma para populações clínicas.

Palavras-chave

Memória autobiográfica; imaginação; imagem mental; imagética; emoção; procedimento de indução de humor

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1

Introduction

One of the greatest advantages of science is its ability to observe natural phenomena and transform it into accessible material to be studied, discussed, and reformulated. Science is also responsible for gathering sufficient evidence to guide practice in various research fields. A difficult phenomenon to define is the way in which we access past experiences, which has implications for memory retrieval and inherent emotional processing. This dissertation seeks to contribute to answers to these questions by exploring the relationship between autobiographical memory (AM) and mental imagery (MI).

According to Baddeley, Anderson, and Eysenck (2011), AM can be defined as a combination of semantic and episodic memory categories, based on established knowledge about both environmental and specific life events. However, AMs are more than a collection of episodes and facts when considering that they offer a complete view of the life cycle. Autobiographical memory involves the retrieval of spatial and temporal information to permit the reconstruction of vivid imagery (SPRENG; MAR; KIM, 2008). Autobiographical memory plays many roles, such as directing practical everyday activities, sharing experiences socially, creating self-representations, and helping with problem solving based on past success or failure (BADDELEY, ANDERSON, EYSENCK, 2011). Patients with anterograde amnesia, such as H.M. and K.C., who have episodic memory deficits that are caused by brain injury need to adapt their routine and be assisted with organization and self-representation by their families, indicating the relevance of this memory function (ROSENBAUM *et al.*, 2005).

The flexibility of memory has been noted for nearly a century (BARTLETT, 1932). The mnemonic process is composed of a cycle of learning, storage, retrieval, and reconsolidation. During the retrieval period new information may be added to the consolidated material (SCHWABE; NADER; PRUESSNER, 2014). Experimenters have investigated the possibility of creating false memories through conjunction errors, in which participants rate the realness of situations that are created based on their own AMs (DEVITT *et al.*, 2016). In a similar context, imagination inflation theory suggests that imagined actions may

be mistaken for memories because of *source error monitoring* (GARRY *et al.*, 1996; HEAPS; NASH, 2001; LIBBY *et al.*, 2007; MARSH; PEZDEK; LAM, 2014). These studies have contributed to the notion that situations that are frequently imagined, especially if they are related to childhood memories, are more likely to be considered real. Another link between imagination and memory is related to the neural correlates of remembering past events and imagining future events (prospection), which activate similar brain networks, such as the medial temporal lobe, posterior cingulate, retrosplenial cortex, inferior parietal lobe, medial prefrontal cortex, and lateral temporal cortex (DE BRIGARD *et al.*, 2013; SPRENG; MAR; KIM, 2008).

In the field of clinical psychology, advancing knowledge about memory and imagery is crucially important when considering that patients often need to deal with past experiences, trauma, and grief. Emotional memories are more likely to be recalled accurately than ordinary events (BADDELEY, ANDERSON, EYSENCK, 2011) and carry distinctive details, especially unique events, such as the death of a relative or a car accident. One of the roles of the psychotherapist is to assist patients with reinterpreting these emotional memories (reappraisal) despite not being able to change what occurred, changing patterns of thoughts and actions, and consequently offering relief and a chance to cope with such events.

Despite existing anecdotal evidence, clinical knowledge may not necessarily be generalized because each experience with a patient is unique, and diverse approaches and treatments are needed. This leads to the need to study this topic experimentally. This is not a simple task because studying emotions outside their natural occurrence may induce biased results and low applicability. Therefore, demand characteristics must be controlled (e.g., avoiding external factors that may disrupt the interpretation of results, such as the compliance of participants with the experimenter's presumed desired behavior and biased answers). The impact of these factors can be mitigated, for example, by not fully disclosing the purpose of the experiment to participants and assessing emotional variables outside volitional control (e.g., autonomic responses; KENEALY, 1986; MARTIN, 1990).

Mood induction procedures (MIPs) are an empirical method to study emotions in a laboratory setting. Mood induction procedures experimentally elicit emotions through various trigger mechanisms, such as music, films, pictures,

social interaction, facial expressions, feedback, receiving gifts, and scripts (WESTERMANN; STAHL; HESSE, 1996). Autobiographical memory recall and MI are also used as tools to induce emotional states. Many studies have employed these two MIPs to investigate they ways in which emotions impact and are impacted by other variables, such as persistence (KAVANAGH, 1987), the vantage point of the narrator (HOLMES, E. A; COUGHTREY; CONNOR, 2008; SEEBAUER *et al.*, 2016), optimism (MEEVISSEN; PETERS; ALBERTS, 2011), imagery colorfulness (RITCHIE; BATTESON, 2013), persuasion (BRIÑOL; PETTY; BARDEN, 2007), and mental processing style (NELIS *et al.*, 2015).

In this dissertation, we performed a systematic review to provide an overview of recent scientific publications on this subject by reviewing studies that elicited emotion through AM and MI. Several reviews of MIPs have been published, but diverse procedures were used, thus preventing direct comparisons among them. One of the first reviews analyzed only four MIPs (i.e., self-referent mood statement, AM, script, and feedback) that were related to depressive mood (GOODWIN; WILLIAMS, 1982). A methodological review that focused exclusively on the Velten procedure (VELTEN, 1968)also contributed to other issues regarding emotion research, such as the indispensability of manipulation checks as a confirmation of the efficacy of the tested procedure (KENEALY, 1986). Martin (1990) organized MIPs according to different cognitive models (i.e., self-schema theory, semantic network, and fragmentation theory). Gerrards-Hesse et al. (1994) published a wider systematic review by considering combinations of MIPs. This study was extended to a meta-analysis that compared effect sizes of many procedures and concluded that films or stories were the best MIPs to induce either positive or negative mood (WESTERMANN; STAHL; HESSE, 1996). A review of music mood induction summarized the main musical pieces that are employed to elicit various emotional states (VÄSTFJÄLL, 2002). Films, priming, pictures, music, the Velten procedure, imagination, real-life manipulations, reading texts, and behavioral and autobiographical memories were evaluated in a meta-analysis that included solely discrete emotions. Greater effect sizes were found for pictures that elicited contrasting happy and negative emotions (LENCH; FLORES; BENCH, 2011). Within the last six years, no other systematic reviews or meta-analyses on this theme have been published.

The systematic review that is reported in this dissertation explored the details of AM and MI mood induction techniques, the types of assessments that are employed by experimenters (e.g., self-report scales and physiological measures), the emotional paradigm of each study (e.g., discrete emotions and valence), and the procedures that were utilized to induce a particular mood in the participants (eliciting cues). The particularities of these MIPs were not thoroughly explored in past reviews, in which solely the effectiveness of the techniques was explored. Methodological discussions of the importance of these cue elicitors are still necessary when considering that they might be confounded by combinations of MIPs.

With regard to emotional experience assessment, the role of physiology in emotion processing has been markedly defined since Aristotle, despite controversies regarding whether autonomic activation causes or is caused by emotion (JAMES, 1884). Recently, in addition to autonomic responses (e.g., heart rate, respiratory rate, skin conductance response, and blood pressure), neuroimaging (e.g., functional magnetic resonance imaging and electroencephalography) has been employed in various experimental studies of emotion(KIMBRELL *et al.*, 1999; KOHN *et al.*, 2013; PHILIPPOT; SCHAEFER; HERBETTE, 2003). The adopted emotional paradigm is equally relevant for discussion when considering the distinction between valence (i.e., positive-negative range) and discrete models (e.g., the six basic emotions that were proposed by Ekman [1992]). A recent meta-analysis included only discrete emotions in its investigation. The hypothesis of the meta-analysis was that the contrast between these emotions would be more evident in self-reports and physiological responses (LENCH; FLORES; BENCH, 2011).

Based on the information that was collected in the systematic review, we developed an empirical study in which the effects of mental imagery (i.e., positive or neutral) on sad AM were tested. The main hypotheses involved effects on emotional regulation and the reconsolidation of memory content, suggesting that the negative mood that is elicited by the memory would decrease and the memory report would also be less negative. Using this model, we sought to experimentally simulate the use of imagery in a clinical setting. We tested the potential impact of imagery on emotions, although it is already an established technique in cognitive therapy (HIRSCH; HOLMES, 2007; HOLMES, E. A.; ARNTZ; SMUCKER,

2007; MOUNTFORD; WALLER, 2006). We also evaluated the effects of imagination inflation, although we did not employ the same methodology as in the Life Events Inventory paradigm (MARSH; PEZDEK; LAM, 2014).Instead, we analyzed the intrusion of emotional information that is generated during an imagery task in subsequent memory reports. Memory reconsolidation models were also adapted because memory conjunction errors did not use emotional memories to test such paradigm (DEVITT *et al.*, 2016; MCLELLAND *et al.*, 2015). These adapted methods were used to create a more ecologically valid paradigm by simulating the clinical use of imagery to cope with sad past events.

2

Article 1 - Autobiographical memory and mental imagery as mood induction procedures: A systematic review

Abstract

Reviews on mood induction procedures (MIPs) have been published over the last 30 years, but only a few have separately summarized the findings of studies that used autobiographical memory (AM) or mental imagery (MI). To fill this gap, 57 experimental studies that used AM and/or MI were reviewed herein. The main methodological questions that are discussed include the paradigms that were used to elicit mood states and type of assessment of emotion. The results broadly suggest that various cues that elicit AM or MI have been used, thus preventing direct comparisons between methods. Additionally, few studies statistically tested whether the MIP was effective. Less than half of the studies reported methods to control for demand effects. Only a fifth of the studies used physiological measures as a method to assess emotional change. Half of the studies induced discrete emotions, and the other half induced positive/negative mood states (valence induction). Further work that investigates the efficacy of eliciting cues, uses improved measures of emotional reactivity (e.g., physiological measures), and carefully controls demand effects is recommended.

2.1.
Introduction

A large increase in the number of empirical studies that investigate emotion has been seen in the past decades (GILET, 2008). Consequently, researchers have been refining established methods and creating new procedures to elicit emotion experimentally. Mood induction procedures (MIPs) have undergone substantial development since the publication of the Velten paradigm (VELTEN, 1968). With the growing use of MIPs, work that summarizes the existing evidence and experimental rigor of research that is conducted in this field has become necessary. Two traditional techniques that have been increasingly used as MIPs are autobiographical memory (AM) and mental imagery (MI; JALLAIS; GILET, 2010).

One of the first experimental studies that mentioned the use of AM as a MIP induced a sad emotional state by instructing participants to remember a past event that is related to loneliness, rejection, defeat, or hurt (BREWER; DOUGHTIE, 1980). In an early review, AM mood induction was described as a method where by subjects are instructed to remember a situation that made them feel a certain emotion (GOODWIN; WILLIAMS, 1982). Martin (1990) categorized three types of memory mood induction: solitary recollection (recalling and writing an emotional event), social recollection (recalling, writing, and verbally reporting an emotional event), and AM (described similarly to Goodwin & Williams, 1982). In a recent review, AM was characterized as effective for mood induction because it relies on real personal events and lacks cognitive content, resulting in fewer priming effects that are caused by eliciting cues (LENCH; FLORES; BENCH, 2011).

Imagination and imagery are terms that are used to designate the mental visualization of scenarios in experimental research. However, imagery is also used to refer to MIPs that rely on exposure to pictures or images. Considering the aim of the present review to discuss the mental visualization of both past events and imaginary situations, the term “mental imagery” is employed. This technique has been used since early studies in this field. For example, the Velten procedure partially relies on MI because it asks participants to experience written statements and situations as if they were currently occurring (VELTEN, 1968). A review by Kenealy (1986) indicated the efficacy of this procedure and discussed such issues as demand characteristics and manipulation checks. However, further reviews have conflated MI with memory MIPs. For example, Martin (1990) categorized mentally visualized hypothetical situations and recollected memories together. Similarly, Gerrards-Hesse (1994) defined MI as the free mental generation of emotional states and included in the description of this technique both imagined and reexperienced (AM) events. The same was found in a meta-analysis that was published by the same group of authors, in which the mental process of visualizing events was described ambiguously and included both imagined and reexperienced events (WESTERMANN; STAHL; HESSE, 1996).

This highlights how AM and MI have often been investigated together because they both rely on the mental visualization of events, thus conflating concepts that can be confusing when standardized laboratory methods are used.

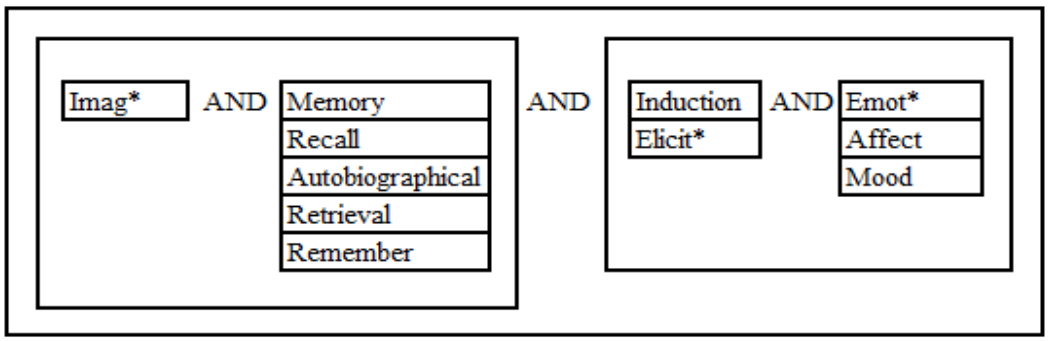
Labeling the procedure as AM or MI depends solely on the nature of the inducing event. In some studies, researchers allow participants to choose which type of situation is going to be visualized mentally. Considering the absence of recentre views that summarize evidence for these MIPs, the main purpose of the present review is to discuss the use of both methods (AM and MI) and identify, whenever possible, whether the procedure relied more on the former or the latter. Special attention is given to the nature of the cues that are used to elicit mood states because these can define the nature of the event that is elicited and lead to potential demand effects.

2.2. Methods

2.2.1. Literature search

Literature searches were performed up to January 2017 using three databases: ISI/Web of Knowledge, PUBMED/MEDLINE, and PsycINFO. The following terms and truncations were used: imag* (to include, imagery, imagination, and so on), memory, mood, induction and procedure, recall, autobiographical, retrieval, remember, elicit*, emot*, and affect. Figure 1 indicates the combinations of terms employed. To avoid inaccurate exclusions, the fields that were searched were as inclusive as possible: ISI/Web of Knowledge ("TS [topic]"), PubMed ("All Fields"), PsycINFO ("Any Field"). No other fields were employed, and no filters that are provided by the databases were used.

Figure 1. Combinations of terms and truncations for literature search.



2.2.2.
Inclusion/exclusion criteria

The main inclusion criteria were experimental studies that investigated the induction of emotional states using MI or AM in healthy subjects. The exclusion criteria were articles not published in English, reviews, theses, dissertations, case reports, book chapters, articles not published in peer-reviewed journals, studies with clinical groups or children, and studies that used methods other than AM and MI to induce emotions. Studies that did not assess emotion through self-report questionnaires or that investigated only characteristics of emotional memories were also excluded. Figure 2 shows the screening process that was used in this review, adapted from the PRISMA model (MOHER, et al., 2009).

After removing duplicate articles, the exclusion criteria were first applied by considering the titles and abstracts of the articles. Two reviewers independently double-checked the exclusion process, with the intervention of a third reviewer when no consensus was reached about inclusion of the article. If no exclusion criteria were found in the title or abstract, then the full text was checked for the inclusion criteria (LIBERATI et al., 2009).

2.3.
Results

A total of 44 articles that comprised 57 studies were analyzed. Table 1 summarizes each study. Table 2 summarizes the eliciting cues, physiological measures, and emotional paradigms of each study.

2.3.1. Sample characteristics

Consistent with the exclusion of clinical samples, the participants were mostly undergraduate students and healthy adults who were recruited through advertisements. The number of participants varied from 10 to 337 (M = 76.71, SD = 67.5).

2.3.2.
Type of MIP

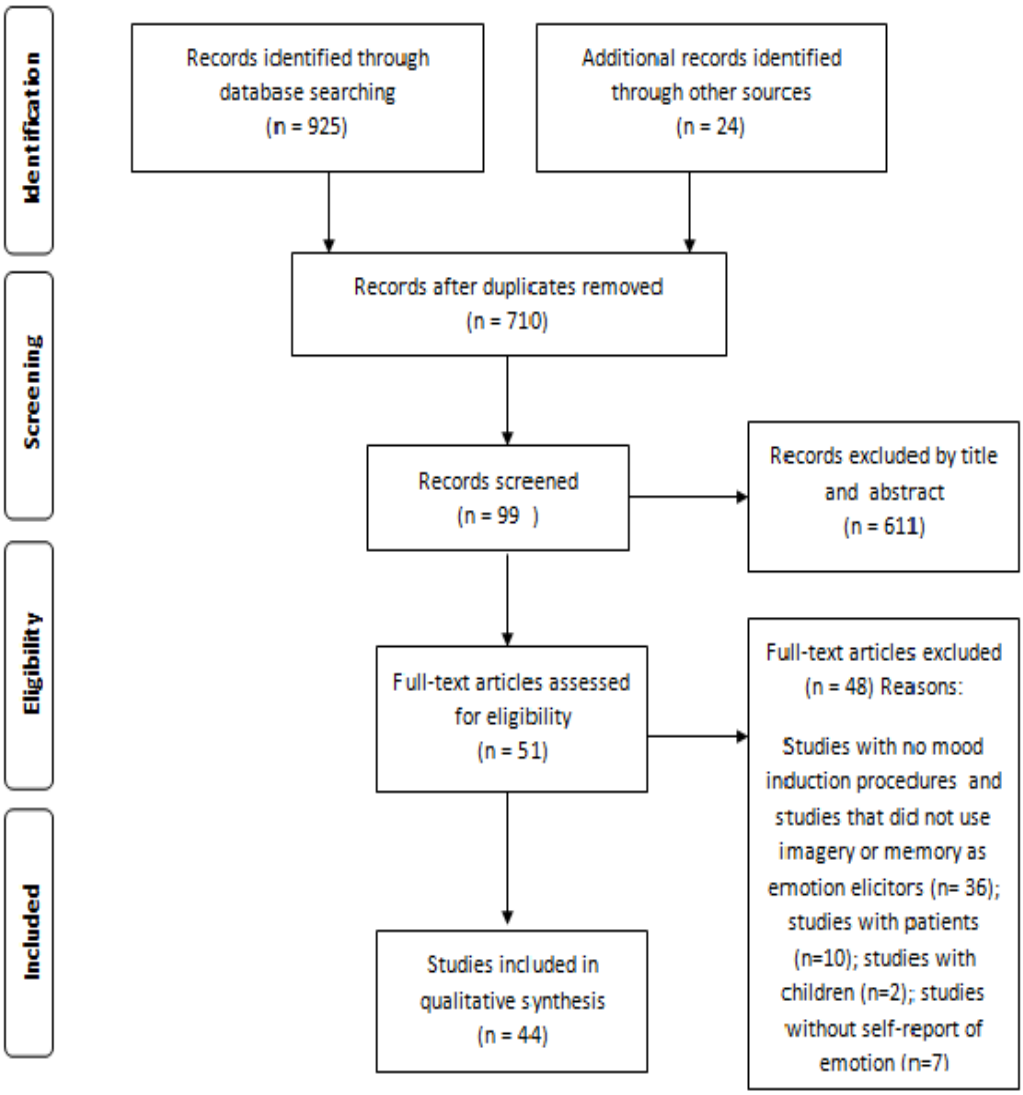
2.3.2.1.

Autobiographical memory

With regard toAM as a MIP, 41 studies were analyzed in this review, of which 18 used uncued AM. This was usually an instruction to remember a personal situation that was experienced with the emotion that the researcher sought to elicit. The other 23 studies investigated AM using eliciting cues, such as music (5), scripts (4), films (2), pictures (3), sentences (6), and words (3). Cued and uncued studies cannot be directly compared in terms of efficacy because the presentation of such elements as music, films, and sentences can potentially manipulate the emotional state of the individual.

All of the studies that used AM mood induction with pictures as eliciting cues also used neuroimaging to record variations in emotional states (FITZGERALD ET AL., 2004; KIMBRELL ET AL., 1999; KOHN ET AL., 2013). Kohn et al. (2013) and Kimbrell et al. (1999) used pictures of facial expressions. Fitzgerald et al. (2004) used pictures of faces or a selection of disgust pictures from the International Affective Picture System (LANG et al., 1997). However, these authors mentioned the confounding effects of picture presentation as a limitation in functional magnetic resonance imaging (fMRI) studies because the pictures can activate brain areas themselves, potentially interfering with activation that is caused by AM. Sentences that described emotional situations that were similar to the events that the participants should remember were explored in six studies. Two of these studies were based on Velten statements, and the other four studies used original material (ENGEBRETSON, SIROTA, NIAURA, EDWARDS, & BROWN, 1999; RICHARDSON & TAYLOR, 1982; RUSTING & DEHART, 2000[studies 1 and 4]). Memories were also elicited by cue words in three studies (MARKOWITSCH *et al.*, 2003; RAES *et al.*, 2003; RICHARDSON; TAYLOR, 1982), with a varying number of words (36, 10, and four, respectively). Music that was played during the recall of personal events to either improve AM mood induction or sustain the mood that was already induced by personal recall was applied by several studies (KAVANAGH, 2006; KRACKOW; KANIA; TRAVERS, 2013; MARZILLIER; DAVEY, 2005; RENNER *et al.*, 2014; ZHANG; YU; BARRETT, 2014). The musical pieces that were chosen in each study were not always reported by the authors. Film clips were used in two different manners. Lane et al. (1997) used film clips as an

Figure 2. Summary of literature search



eliciting cue for AM mood induction. Philippot et al. (2003, study 2) first introduced film themes to generate priming cues for AM mood induction to re-elicit the same emotion in a subsequent session when the film clips were finally watched. Scripts to elicit memories were also applied, which were read or listened to by the participants (CERQUEIRA *et al.*, 2008; KAVANAGH, 1987; NELIS, HOLMES, PALMIERI, BELLELLI, & RAES, 2015; PHILIPPOT, SCHAEFER, & HERBETTE, 2003[STUDY 1]). The difference of scripts and sentences rely on the type of description. Scripts are more directional and suggestive, and sentences describe general situations that are emotionally congruent with the desired MIP.

Some studies used AM to investigate the impact of emotion on such variables as confidence (BRIÑOL; PETTY; BARDEN, 2007), the accuracy of

recall (KRACKOW; KANIA; TRAVERS, 2013), the processing style of thought (NELIS *et al.*, 2015), priming (PHILIPPOT; SCHAEFER; HERBETTE, 2003), appraisal (RUSTING; DEHART, 2000), success (KAVANAGH, 2006), and metacognitive evaluation (KEALY; KUIPER; KLEIN, 2006). The procedures usually consisted of an emotional baseline assessment prior to the AM task, the experimental assignment of participants to conditions, and the reassessment of emotional state. One exception was Briñol et al. (2007), in which a sentence reading task was applied before AM because these authors sought to evaluate the ways in which the emotional nature of AMs (positive or negative) influences the participants' attitude toward these sentences. Furthermore, Briñol et al. (2007) and Kealy et al. (2006) did not assess baseline emotion prior to the experiment because the analysis of emotional variation was performed with between-subjects factors (pleasant-unpleasant/negative-positive) and not as a temporal variation of emotions within participants (before-after interventions). With the exception of Krackow (2013), all of these studies reported that emotion influenced the investigated variables.

2.3.2.2. Mental imagery

With regard to MI as a MIP, 24 studies were analyzed in this review, of which 16 used only MI and eight employed both AM and MI. Most of the studies used eliciting cues to trigger the MI process, such as music (4), scripts (11), pictures (1), and sentences (2). Scripts were employed that were either listened to or read by the participants. In a few studies, the presentation of scripts was followed by instructions to imagine them with various processing styles (e.g., field or observer perspective, imagery or verbal meaning, concrete or abstract and schematic or propositional) to investigate their effects on emotional states. For example, positive affect increased more in field perspective processing than in observer perspective or verbal meaning processing (HOLMES, E. A; COUGHTREY; CONNOR, 2008; HOLMES, E.; MATHEWS, 2005), increased more in imagery processing than in verbal meaning processing (HOLMES, E. A. *et al.*, 2006), and decreased in concrete processing (MOBERLY; WATKINS, 2006). Affect intensity was greater in schematic imagery processing (SCHAEFER *et al.*, 2003). Other script-cued MI studies investigated the effects of MI on such

variables as cognition (CHEPENIK; CORNEW; FARAH, 2007), interpretive biases of ambiguous scenarios (CLARKE *et al.*, 2014), correlations between emotions (anxiety-disgust; MARZILLIER & DAVEY (2005), and self-reported emotion (vicarious shame; WELTEN, ZEELENBERG, & BREUGELMANS (2012). Mental imagery was also compared with other MIPs, such as recall with music, images with music, and embodiment of affective behaviors, and no significant differences were found (ZHANG; YU; BARRETT, 2014).

Other eliciting cues were explored. Fitzgerald et al. (2004) used pictures to elicit MI similarly to the way they prompted AM. Music was combined with other techniques, such as scripts (CHEPENIK, CORNEW, & FARAH, 2007; KAVANAGH, 1987, MARZILLIER & DAVEY, 2005) and sentences (JALLAIS & GILET, 2010). Sentences were also used by Berna et al. (2011) in a study of the interpretive bias of MI, in which a negative correlation was found between depressive mood state and the pleasantness of imagined scenarios.

In the studies that did not use any eliciting cue, the participants were usually instructed to imagine an event in which they would experience a certain mood state. In studies that used a MI technique called *best possible self*(BPS), the participants were asked to imagine a better version of themselves, and affect was measured to investigate possible improvements in mood, optimism, future expectations, life satisfaction, and gratitude (MEEVISSEN; PETERS; ALBERTS, 2011; PETERS *et al.*, 2010; RENNER *et al.*, 2014; SHELDON; LYUBOMIRSKY, 2006). These studies found an increase in positive affect using this technique.

2.3.2.3.

Combined MIPs

Only a few studies that used AM as an emotional elicitor also analyzed the effects of MI. Most of these studies compared emotional variations between both induction procedures, in which the participants either remembered or imagined the emotional events (FITZGERALD *et al.*, 2004; FOSTER; SMITH; WEBSTER, 1998; JALLAIS; GILET, 2010; KAVANAGH, 2006; KEALY; KUIPER; KLEIN, 2006; VELLA; MOULDS, 2014; ZHANG; YU; BARRETT, 2014). These studies indicated that AMs and MI were equally effective, with no statistically significant

difference between them (JALLAIS; GILET, 2010; KEALY; KUIPER; KLEIN, 2006; ZHANG; YU; BARRETT, 2014).

Table 1. Complete list of studies organized chronologically.

Author/year	Sample	MIP (cue)	Emotions	Manipulation check	Physiological Measures
Richardson, Taylor, 1982	44 students	AM (sentences and words)	Positive, negative	Before and after	
Kavanagh, 1987	85 students	AM (script and music), MI (script and music)	Happy, sad (memory)/ neutral (mental imagery)	After	
Lane, Reiman, Ahern, Schwartz, Davidson, 1997	12 students	AM (film)	Happiness, sadness, disgust, neutral	After	PET
De Pascalis, Ray, Tranquillo, D'Amico, 1998	20 students	AM	Happy, sad, neutral	After	EEG, HR
Engebretson, Sirota, Niaura, Edwards, Brown, 1999	81 students	AM (sentences)	Anger, depression	Before and after	
Foster, Smith, Webster, 1999	36 participants	AM, MI	Anger	After	SCR, HR
Kimbrell, George, Parekh, Ketter, Podell, Danielson, Repella, Benson, Willis, Herscovitch, Post, 1999	16 participants	AM (picture - faces)	Anger, anxiety, neutral	After	PET
Rusting and DeHart, 2000	117 students	AM (sentences)	Positive, negative	Before and after	
	59 students	AM (sentences)	Negative	Before and after	
	60 students	AM (sentences)	Negative	Before and after	
	60 students	AM (sentences)	Negative	Before and after	
Foster, Webster, 2001	10 students	AM	Anger, mirth	After	HR,SCR
Kavanagh, Freese, and Andrade, May, 2001	18 students	AM	Happy, distressed	Before and after	
Van den Hout, Muris, Salemink, Kindt, 2001	60 participants	AM	Sad, happy	After	
Markowitsch, Vanderkerckhove, Lanfermann, Russ, 2003	13 participants	AM (words)	Sad, pleasant	After	fMRI
Philippot, Schaefer, Herbette, 2003	Study 1: 45 students	AM (script)	Negative	Before and after	
	Study 2: 60 students	AM (film)	Anger, sadness, fear, happiness	After	
Raes, Hermans, Decker, Eelen, Williams, 2003	294 participants	AM (words)	Negative	Before and after	
Schaefer, Collette, Philippot, Van der Linden, Laureys, Delfiore, Degueldre,Maquet, Luxen,	19 participants	MI (script)	Happy, angry, sad, "affection," neutral	After	fMRI, HR

Salmon, 2003					
Barrowcliff, Gray, Freeman MacCulloch, 2004	80 participants (20 community and 60 students)	AM	Positive, negative		SCR
Fitzgerald, Posse, Moore, Tancer, Nathan, Phan, 2004	12 participants	AM (picture), MI (picture)	Disgust	After	fMRI
Holmes and Mathews, 2005	Study 1: 24 participants	MI (script)	Negative	After	
	Study 2: 43 participants	MI (script)	Negative, benign	After	
Marzillier and Davey, 2005	Study 1: 60 participants	MI (music)	Anxiety, disgust, neutral	Before and after	
	Study 3: 60 participants	AM (music)	Anxiety, disgust, neutral	Before and after	
Schaefer and Philippot, 2005	84 participants	AM	Positive, negative	After	IBI, SCR
Holmes, Mathews, Dalgleish, Mackintosh, 2006	26 participants	MI (script)	Positive	Before and after	
Kealy, Kuiper, Klein, 2006	Study 1: 139 participants	AM, MI	Pleasant, unpleasant	After	
Moberly and Watkins, 2006	61 participants	MI (script)	Positive, negative	After	
Sheldon and Lyubomirsky, 2006	67 students	MI	Positive	Before and after	
Briñol, Petty, Barden, 2007	Study 1: 92 students	AM	Happy, sad	After	
	Study 2: 89 students	AM	Happy, sad	After	
	Study 4: 78 students	AM	Happy, sad	After	
Chepnik, Cornew, Farah, 2007	33 participants	MI (script and music)	Sadness	After	
Cerqueira, Almeida, Gorenstein, Gentil, Leite, Sato, Amaro, Busatto, 2008	11 participants	AM (script)	Happiness, irritability, neutral	After	fMRI, SCR
Holmes, Coughtrey, Connor, 2008	78 students	MI (script)	Positive	Before and after	
Walker, Skowronski, Gibbons, Vogl, Ritchie, 2009	337 participants (from 3 different samples)	AM	Positive, negative	After	
Jallais, Gilet, 2010	160 students	AM, MI (music and sentences)	Happiness, serenity, anger, sadness	Before and after	
Peters, Flink, Boersma, Linton, 2010	82 students	MI	Positive	Before and after	
Berna, Lang, Goodwin, Holmes, 2011	Study 1: 208 participants (web)	MI (sentences)	Unpleasant, pleasant	After	
	Study 2: 41 participants	MI (sentences)	Unpleasant, pleasant	After	
Meevissen, Peters, Alberts,	54 participants	MI	Positive	Before and	

2011				after	
Philips, Samson, 2012	55 participants	MI	Anxiety, depression	After	
Welten, Zeelenberg, Breugelmans, 2012	Study1: 139 students	AM	Shame	After	
	Study 2: 300 students	AM	Vicarious shame, embarrassment, anger, compassion	After	
	Study 3: 164 students	MI (script)	Vicarious shame, embarrassment, anger, compassion	After	
Krackow, Kania, Travers, 2013	42 students	AM (music)	Positive, negative	Before and after	
Ritchie, Bateson, 2013	26 students	AM	Positive, negative	After	
Vella, Moulds, 2013	80 students	AM, MI	Positive	After	
Clarke, Nanthakumar, Notebaert, Holmes, Blackwell, MacLeod, 2014	80 students	MI scripts)	Positive, negative	After	
Kohn, Falkenberg, Kellermann, Eickhoff, Gur, Habel, 2014	54 participants	AM (pictures - faces)	Happiness	Before and after	fMRI
Renner, Schwarz, Peters, Huibers, 2014	40 students	MI, AM (music)	Sadness, optimism	Before and after	
Zhang, Yu, Barrett, 2014	37 students	AM (music), MI (script)	Pleasant or unpleasant	Before and after	
Nelis, Holmes, Palmieri, Bellelli, Raes, 2015	Study 1: 70 participants	AM	Positive	Before and after	
	Study 2: 159 students	AM (script)	Positive	Before and after	
Seebauer, Arthen, Austermann, Falch, Koch, Moulds, Jacob, 2015	Study 1: 87 participants	AM	Sad, positive	Before and after	
	Study 2: 57 participants	AM	Sad, positive	Before and after	

Aside from being used as cues, such elements as films have been used in combination with AM to regulate emotion. For example, Seebauer et al. (2016) first induced sadness using a film MIP and elicited happiness using AM. Two processing styles were explored (concrete and abstract). The authors concluded that the former regulated mood better than the latter. Similarly, Renner et al. (2014) first elicited sadness using AM and then applied a second emotion induction of positive or neutral MI, depending on experimental condition, hypothesizing a mood regulation process**.** The results indicated that the participants who had to write about their best possible self presented increases in mood levels and less cognitive dysfunction compared with baseline levels.

2.3.3.
Type of assessment

2.3.3.1.
Self-report

A large variety of self-assessment questionnaires that measure emotions was applied in the studies that are presented in this review. They can be categorized into self-constructed scales (Likert or Visual Analogue Scale [VAS]) and validated scales. Forty studies used only Likert scales, whereas 11 used validated instruments. Six studies used both types of instruments. The most commonly used standardized scales were the Positive and Negative Affect Scale (PANAS) and Differential Emotional Scale (DES). A few studies used other validated scales, such as the Emotional Experiences Questionnaire (EEQ), Brief Mood Introspection Scale (BMIS), Spielberg's Anxiety and Anger scales, and an adapted version of the Profile of Mood States (POMS). Many studies rated memory characteristics, such as vividness, emotional intensity, and colorfulness (RITCHIE; BATTESON, 2013).

To determine the effectiveness of the MIP, half of the studies performed before-and-after manipulation checks, with a baseline measure compared with a post-induction mood state, thus permitting within-group statistical analyses. The other half of the studies measured the effects of the intervention only after mood induction and statistically compared between-group conditions. Although the latter represents an important limitation, in some cases the intervention had been validated in a previous study, such that checking its efficacy was not the main purpose of the study.

The instruments also varied in terms of the type of emotional assessment. Scales were used to measure emotional valence or discrete emotions. Most of the studies chose to measure discrete emotions, specifying in more detail the effects of the MIPs while directly investigating whether the target-emotion was elicited by the participants. Valence aspects of emotion were also investigated, which were categorized in dualities, such as positive/negative, mood improvement/decline, and pleasant/unpleasant. For example, the participants could recall a memory and rehearse it privately or publically and then rate the pleasantness they felt toward it (WALKER *et al.*, 2009). Another type of

emotional measurement focused on general aspects of emotions, without describing specific emotional labels but assessing general characteristics, such as emotional strength (Foster & Webster, 2001) and intensity (FITZGERALD *et al.*, 2004; MARKOWITSCH *et al.*, 2003; NELIS *et al.*, 2015; RITCHIE; BATTESON, 2013; SCHAEFER *et al.*, 2003; SCHAEFER; PHILIPPOT, 2005). Most of the AM studies elicited discrete emotions and assessed the participants' emotional state using Likert discrete emotion questionnaires. The majority of MI studies elicited emotions using a valence paradigm and assessed emotional states using the PANAS and a Likert scale or VAS.

2.3.3.2.

Physiological measures

The use of physiological variables is still uncommon in this field, which limits the scope of hypothesis testing. For example, two studies searched for associations between eye movements and emotions that were elicited by positive and negative AMs, suggesting that eye movement reduces the vividness and associated emotional valence compared with stationary eyes (BARROWCLIFF *et al.*, 2004) and finger tap or no-task (VAN DEN HOUT, MURIS, SALEMINK, & KINDT, 2001) conditions. Nevertheless, the absence of eye-tracking data is an important limitation of both studies and restricts the authors' conclusions.

Only 20% of the reviewed studies employed physiological measures, such as neuroimaging (Functional Magnetic Resonance Imaging [fMRI], Positron Emission Tomography [PET], and electroencephalography [EEG]) and autonomic nervous system measures (heart rate [HR] and skin conductance response [SCR]). These are more recent studies that were conducted between 1997 and 2014 (10 studies).

2.3.3.2.1.

Neuroimaging

In the pool of studies of physiological measures of emotion, neuroimaging studies are the most recent (from 2003 to 2014). Neuroimaging was used in eight studies, five of which used fMRI (CERQUEIRA *et al.*, 2008; FITZGERALD *et al.*, 2004; KOHN *et al.*, 2013; MARKOWITSCH *et al.*, 2003; SCHAEFER *et al.*,

2003). Electroencephalography was used by De Pascalis et al. (1998), and PET was used by Kimbrell et al. (1999) and Lane et al. (1997).

All of the fMRI studies reported alterations in the activation of specific neural circuits by mood induction procedures, either AM or MI. Blood oxygen level dependent (BOLD) signals were analyzed by Cerqueira et al. (2008) while the participants listened to scripts that were generated from their own AMs. In this study, happiness, irritability, and neutral content were explored (three scripts for each condition), and BOLD signals were measured. The results indicated different brain activation patterns for each condition. Fitzgerald et al. (2004) confirmed that the neurocircuitry that was activated by disgust during MI was the same as the neurocircuitry that was activated by the actual experience of disgust. Markowitsch et al. (2003) compared neural networks that were activated by sadness and happiness that were derived from personal experiences. These authors found that positive experiences were linked to more medial orbitofrontal cortex and left hemisphere activation, whereas sad memories correlated with lateral orbitofrontal cortex and right hemisphere activation. Schaefer et al. (2003) tested possible differences between two ways of processing an MI task that was elicited by scripts. These processing modes (schematic and propositional) activated the ventromedial prefrontal cortex and lateral prefrontal cortex, respectively. Kohn et al. (2014) correlated brain activity in healthy subjects with individual emotional ratings. They induced happiness through an AM mood induction procedure using pictures of facial expressions as eliciting cues, combined with instructions to feel happy or neutral as they observed the faces, depending on the experimental condition. The results suggested that an increase in positive affect correlated with greater activation of the amygdala, hippocampus, and fusiform gyrus and lower activation of the subgenual anterior cingulate cortex. In a PET study by Kimbrell et al. (1999), differences between neutral, anger, and anxiety conditions were found. The results indicated an increase in regional cerebral blood flow (rCBF) in the left inferior frontal and left temporal poles and a decrease in rCBF in the right posterior temporal/parietal and right superior frontal cortex in the anger and anxiety conditions compared with the neutral condition. When inducing happiness and sadness by films and AM recall, Lane, Reiman, Ahern, Schwartz, & Davidson (1997) found activation of the thalamus, medial prefrontal cortex, anterior and posterior temporal structures, anterior insula, and ventromedial frontal cortex.

De Pascalis, Ray, Tranquillo, and D'Amico (1998) investigated the EEG response toemotional AM during hypnotic induction. The happiness MI task increased activity in the left frontal and central regions of the cortex. The sadness MI MIP increased activity in the right central and posterior regions.

2.3.3.2.2.
Autonomic measures

Four studies measured participants' HR (DE PASCALIS *et al.*, 1998; FOSTER; SMITH; WEBSTER, 1998; FOSTER; WEBSTER, 2001; SCHAEFER *et al.*, 2003), and Schaefer & Philippot (2005) also measured the inter-beat interval (IBI). Variations were found in mean HR, depending on the MIP that was used to induce anger (Foster et al., 1999). De Pascalis et al. (1998) reported that HRwas not significantly different between high/low hypnotizable subjects. Foster and Webster (2001) found a significant increase in HR for both angry and happy AMs, although no correlation was found between memory age and HR. Foster et al. (1999) investigated anger, and their results indicated that recollected and imagined anger situations caused larger increases in HR than actual experienced anger. Schaefer et al. (2005) measured the IBI related to positive, negative, and neutral memories. To analyze these measures, the authors combined the mean IBI related to positive and negative memories compared with neutral memories. The results indicated a main effect of valence,in which the mean IBI for positive and negative emotion was significantly different from the mean IBI for neutral scales. The difference between two ways of processing MI that is elicited by scripts (schematic and propositional) was investigated by Schaefer et al. (2003).These authors found that a schematic processing mode generated greater mean HRs than a propositional mode.

Five studies evaluated electrodermal activity (BARROWCLIFF ET AL., 2004; CERQUEIRA ET AL., 2008; FOSTER ET AL. 1999; FOSTER AND WEBSTER, 2001; SCHAEFER AND PHILIPPOT, 2005). Older memories were associated with greater SCRs in the recall of AMs of anger and happiness (FOSTER AND WEBSTER, 2001). The SCR was significantly higher for happy memories in Cerqueira et al.(2008). Schaefer (2005) found that the SCR that was related to emotions (positive and negative memories) was greater compared with neutral memories. The galvanic skin response that was related to negative

memory recall was reduced during an eye movement task (BARROWCLIFF *et al.*, 2004).

2.3.4.
Emotions

With regard to the type of emotional paradigm, 29 studies used discrete emotions, and 28 used affect valence as targets for the MIP. The studies that used a discrete paradigms ought to elicit sadness (15 studies), happiness (13 studies), anger (nine studies), and disgust (four studies). Serenity, optimism, fear, pride, surprise, depression, anxiety, shame, vicarious shame, embarrassment, and compassion were induced in other studies. The studies that investigated valence labeled emotions as positive/negative or pleasant/unpleasant. This classification allows a wide range of emotions, investigating mainly the transition between the two poles of the scale.

The emotional paradigm in AM studies was equally distributed, in which 19 studies elicited changes in valence, and 22 studies elicited discrete emotions. Most of the discrete emotion studies induced happiness (12 studies), sadness (13 studies), and anger (seven studies). Of the studies that used MI without eliciting cues as a MIP, only a few used discrete emotions, such as anger, anxiety, depression, and optimism (FOSTER; SMITH; WEBSTER, 1998; PHILIPS; SAMSON, 2012; RENNER *et al.*, 2014). Philips et al. (2012) employed an imaginative rescripting technique and observed a reduction of self-reported levels of pain. Foster et al. (1999) elicited anger through MI processing and found greater physiological arousal for imagined anger compared with anger that was caused by social interaction (actual anger). Most of the studies that did not employ eliciting cues instructed the participants to imagine situations that were related to positive emotions(MEEVISSEN, PETERS, & ALBERTS, 2011, FLINK, BOERSMA, & LINTON, 2010; SHELDON & LYUBOMIRSKY, 2006; VELLA & MOULDS, 2014), of which three used the *best possible self* (BPS) technique. Renner et al. (2014) also used BPS but elicited discrete emotions.

Half of the studies that employed MI with eliciting cues used discrete emotions, and the other half assessed positive/negative or pleasant/unpleasant emotions. The studies that used scripts as cues also chose valence as the main emotional

paradigm (CLARKE ET AL., 2014; HOLMES ET AL., 2005,STUDIES 1 AND 2; HOLMES ET AL., 2006; HOLMES ET AL., 2008; MOBERLY ET AL., 2006; ZHANG ET AL., 2014). Holmes et al. (2005) compared verbal processing and the imagination of negative scripts and found an increase in anxiety levels. Holmes et al. (2006, 2008) investigated variations in positive affect. Three of four studies that used music as the cue elicitor of MI adopted the discrete paradigm for emotional induction (CHEPENIK; CORNEW; FARAH, 2007; KAVANAGH, 2006; MARZILLIER; DAVEY, 2005). Kavanagh et al. (1987) found evidence that happiness influences the increase in persistence in an Anagram solving task. Jallais et al. (2010) used music with sentences as the cue for MI and elicited happiness, serenity, anger, and sadness. The only MI study that used pictures as the cue elicitor induced disgust and analyzed fMRI data (FITZGERALD *et al.*, 2004).

2.4. Discussion

2.4.1. Procedures

This review included 57 studies, from 44 publications that investigated the effects of AM and MI mood induction using a variety of eliciting cues. This heterogeneity deserves special attention. Because of the subjectivity of MI, it is difficult to instruct subjects to recall or imagine similar situations to collect comparable data. Each individual can imagine different types of scenarios, with various emotional characteristics that may impact the experimental manipulation.

Authors should be careful when labeling the MIP being used because this can have important implications for replication of the results. The authors of previous reviews conflated both techniques, labeling imagination as an MI process that involves the evocation of past experiences (WESTERMANN; STAHL; HESSE, 1996). In contrast, Renner, Schwarz, Peters, and Huibers (2014) first elicited sadness using an AM MIP and tested affect regulation with an MI, clearly illustrating differences between both MIPs. If the procedures are not well labeled or connected with cue elicitors, then this poses a challenge to standardized experimental testing.

Table 2. Studies stratified by mood induction procedures, emotional paradigms, and physiological measures.

	Emotional Paradigm		Physiological Measures		
	Valence	*Discrete Emotions*	*Neuroimaging*	*Cardio*	*Electrodermal*
Mood Induction Procedures					
Autobiographical Memory					
No eliciting cue	BarrowclifF2004); Keaky (2006); Nelis (2015); Ritchie (2013); Schaefer (2005); Vella (2013); Walker (2009)	Briñol (2007); De Pascalis (1998); Foster (1999); Foster (2001); Jallais (2010); Kavanagh (2001); Seebauer (2015); Van den Hout (2001); Welten (2012)	De Pascalis (1998)	Schaefer (2005); De Pascalis (1998); Foster (1999); Foster (2001)	BarrowclifF2004); Foster (1999); Foster (2001); Schaefer (2005)
Music	Krackow (2013); (Zhang (2014)	Kavanagh (1987); Marzillier (2005); Renner(2014)			
Film		Lane (1997),Philippot (2003)	Lane (1997)		
Sentences	Richardson (1982); Rusting (2000)	Engebretson (1999)			
Words	Raes (2003); Richardson (1982)	Markowitsch (2003)	Markowitsch (2003)		
Pictures		Fitzgerald (2004); Kimbrell(1999); Kohn (2014)	Fitzgerald (2004); Kimbrell(1999); Kohn (2014)		
Scripts	Nelis (2015),Philippot (2003)	Cerqueira (2008); Kavanagh (1987)	Cerqueira (2008)		Cerqueira (2008)
Mental Imagery					
No eliciting cue	Vella (2013); Kealy (2006); Sheldon (2006); Meevissen (2011), Peters (2010)	Philips (2012); Foster (1999); Renner (2014)		Foster (1999)	Foster (1999)
Scripts	Clarke (2014); Holmes (2005); Holmes (2008); Holmes (2006) Moberly (2006); Zhang (2014)	Schaefer (2003); Chepnik (2007); Welten (2012); Kavanagh (1987); Marzillier (2005)	Schaefer (2003)	Schaefer (2003)	
Pictures		Fitzgerald (2004)	Fitzgerald (2004)		
Music		Chepnik (2007); Jallais (2010); Kavanagh (1987); Marzillier (2005)			
Sentences	Berna (2011)	Jallais (2010)			

An important question concerning the efficacy of the methods that are employed is the use of instruments to measure participants' mood states. In an early review, Kenealy (1986) indicated that the first step to investigate emotion is to establish the efficacy of the MIP that is used. To test the efficacy of an MIP, the ideal manipulation should determine the emotional state of the participants both before and after mood induction. Comparisons between experimental and control groups is also effective when the latter performs a similar task as the former but without emotional content. Considering the papers reviewed herein, half of them measured mood both before and after the MIP using either Likert scales or validated instruments. The other studies performed between-group analyses and compared the experimental group with a control condition (neutral task) or with another experimental condition that had different emotional content. Nevertheless, creating a perfect control condition may be challenging in studies of emotion, and comparing groups after the intervention does not address the potential bias that is caused by variations in baseline mood. Additionally, the results that are obtained in cases of contrasting conditions may only reveal relative changes in one condition relative to another, without allowing precise verification of the intervention's efficacy. The self-assessment questionnaires that were most widely used in the studies reviewed herein (e.g., PANAS and DES) differ from those that were cited in other reviews on MIP (e.g., Multiple Affect Adjective Check List [MAACL]),which prevents direct comparisons with previous studies.

2.4.2.
Eliciting cues

Cued MIPs should be distinguished from a combination of MIPs, as described by Westermann, Stahl, and Hesse (1996). The main aim of combining MIPs is to increase the procedure's effect. Cues are secondary elements that facilitate the recall/imaginative process, improve instructions, and allow participants to have similar triggers of the remembered/imagined content. It is difficult, however, to distinguish whether the emotional effects are caused by the cue or the MIP itself. The majority of authors did not adequately address this potential confounding factor. The experiments that were analyzed in this review used six types of eliciting cues, including pictures, films, music, words, sentences, and scripts, which could also be combined. This heterogeneity limits direct

comparisons between studies. Additionally, the rationale and relevance of the cues for MIP are seldom mentioned. Future research should pay particular attention to this issue.

2.4.3. Demand effects

Another issue that should be addressed concerns demand effects (i.e., elements of the laboratory setting that imply certain expected behavior of the subjects, influence genuine actions, and generate inference with the experiment's purpose; KENEALY, 1986). The instructions that are given to participants in studies that investigate emotion are particularly sensitive to demand effects because the experimenter must direct the recall/imagination (or another MIP) toward the desired emotional state. According to Gilet (2008), eliciting emotions through personal memories depends on the subjects' cooperation, which can be a demand effect itself. Of the studies analyzed in this review, 38% mentioned a concern with demand effects. Future studies should explore this issue further and disentangle demand effects from experimental manipulations of emotion (e.g., by exploring dissociations between social desirability and emotional responses).

2.4.4. Physiological measures

Neural and autonomic measures were explored by a few studies. Although this fact is understandable when considering the relatively high cost of measuring such variables, it is crucial to explore the role of biological factors to develop further emotion research. The neuroimaging data that were discussed in this review are difficult to interpret because of the heterogeneity of the investigated emotions. One exception to such difficulty is research that investigated basic adaptive emotions, such as anger and disgust, in which the neural circuits that were identified have been established in previous studies (FITZGERALD *et al.*, 2004; FOSTER; SMITH; WEBSTER, 1998; FOSTER; WEBSTER, 2001; LANE *et al.*, 1997; SCHAEFER *et al.*, 2003). The autonomic findings reported herein(DE PASCALIS *et al.*, 1998; FOSTER; SMITH; WEBSTER, 1998; FOSTER; WEBSTER, 2001; SCHAEFER *et al.*, 2003) are consistent with previously published results (for review, see Kreibig, 2010) and provide further robust evidence in this area.

2.4.5.
Target emotions

In a similar proportion, the studies chose valence and discrete emotions as the main focus of the MIP. Some of the studies used one paradigm to elicit emotion and another to assess it, with no further justification for such choices. Typically, these different paradigms regarding emotion were chosen according to the main interest of the researchers. For example, if the main purpose was to determine the way in which people react to an undesired behavior of someone else, then a discrete emotion (vicarious shame) was the chosen target (WELTEN; ZEELENBERG; BREUGELMANS, 2012). In contrast, if the interest was to determine the way in which people react upon imagining a better version of themselves, then the target was merely valence(i.e., positivity; SHELDON & LYUBOMIRSKY, 2006). There is little evidence of which emotional paradigm is the most suitable for experimental studies because no study compared both theories. Future studies that use AM and MI could provide evidence for important theoretical discussions on the ways in which emotions are processed.

2.4.6.
Limitations

Studies with patients were not included in the present review to avoid the confounding effects of clinical variables (e.g., depression) in the interpretation of outcomes. Although this limits the generalizability of the findings, it allows clearer interpretations of the presented evidence, which can then be used to support studies with clinical groups. Moreover, we made no attempt to summarize the existing evidence in the form of a meta-analysis. We did so because of the heterogeneity of paradigms/cues, which would not allow comparable effect sizes between studies.

2.4.7.
Conclusion

In summary, the present systematic review discussed the ways in which AM and MI are used for emotion induction, which is a growing field with potential for further methodological development and refinement. Authors should

pay special attention to reporting the techniques and eliciting cues that they use, which would allow more reproducible research. Physiological measures may make the development of MIP studies more robust. Future studies can make important contributions to the dimensional *vs*. discrete debate in the field of emotions.

3
Article 2 - Positive and neutral imagery equally reduces negative emotions associated with sad autobiographical memories

Abstract

The present study explored the effects of mental imagery tasks (positive or neutral) on autobiographical memories in healthy young adults. In Session 1, the participants remembered a sad life event and, depending on their group, imagined either a positive (experimental group) or neutral (control group) alternative scenario in the memory. The participants were prompted again with this alternative scenario in a phone call one week later. Two weeks later in Session 2, they had to remember again the sad life event that was previously reported. The results indicated that the mood induction procedures effectively increased negative mood after the sad memory recollection. Similar improvements in mood (measured by self-report and autonomic measures) were found in both groups after imagery, regardless of its emotional content. The analysis of the memory reports revealed that the groups had a similar profile of memory intrusion, incorporating elements of the imagery task into the memory report in Session 2. This suggests that mental imagery may be used as an effective emotional regulation strategy for negative autobiographical material and that the emotional content of imagery may not have a crucial impact on this process. Further studies are needed to evaluate the use of imagery for emotional regulation, explore different types of emotional memory, and extend this paradigm to clinical populations.

3.1.
Introduction

Whenever patients receive psychological treatment, they report what occurred and possibly reexperience it. Numerous techniques, such as desensitization, relaxation, and progressive exposure, have been applied in psychotherapy to assist patients with personal losses, stress disorders, phobias,

and traumas that are related to past experiences (KACZKURKIN; FOA, 2015).These attempts focus on changing the patterns of emotional reactions that are related to these autobiographical memories (AMs), seeking relief, closure, and a more functional life.

Autobiographical recall has been explored in many experimental studies, including studies of reconsolidation, memory conjunction error, and mood induction procedures (MIPs; DEVITT *et al.*, 2016; MARSH; PEZDEK; LAM, 2014; RENNER *et al.*, 2014). Reconsolidation theory is based on the premise that memories are flexible and susceptible to modifications after retrieval (SCHWABE; NADER; PRUESSNER, 2014).This paradigm has often been tested in animals, including the use of behavioral protocols that are related to fear conditioning in rats (NADER, 2015). However, only a few studies have tested reconsolidation in humans, and no studies of which we are aware have investigated sad memories. Most studies that sought to test reconsolidation in humans evaluated memory conjunction error, which concerns the possible misjudgment of whether a series of events really occurred or were made-up. In these studies, memory details were segmented and recombined, and the likelihood of occurrence of such combinations was assessed (DEVITT *et al.*, 2016; MCLELLAND *et al.*, 2015). The results indicated that partial re-combinations were more likely to be misjudged, especially if they were imagined briefly. This is consistent with imagination inflation theory, which suggests that imagining an event that did not occur may influence the confidence of its realness (GARRY; POLASCHEK, 2000), particularly if it was imagined several times. However, the majority of experimental studies of imagination inflation did not focus on *emotional* autobiographical memories and rather used the Life Events Inventory that contained a series of short statements related to possible childhood events (e.g., “Had to go to the emergency room late at night”; GARRY *et al.*, 1996).

Autobiographical memory has also been employed as a MIP, eliciting various emotional states (NELIS, HOLMES, PALMIERI, BELLELLI, & RAES, 2015; VAN DEN HOUT, MURIS, SALEMINK, & KINDT, 2001; VELLA & MOULDS, 2014). Autobiographical memory is considered an effective MIP (WESTERMANN; STAHL; HESSE, 1996), together with the mental imagery (MI) of new scenarios. For example, as reported by Foster, Smith, & Webster (1998), recalled and imagined events that were associated with anger generated

more physiological arousal than social interaction, indicating the potency of such procedures.

The present study examined the ways in which a positive MI task influences the emotional state of participants and the content and emotions that are associated with AM. The main hypotheses were the following: (1) the recall of a negative AM leads to more negative self-reported emotion and related physiological activity, (2) positive MI regulates emotion and increases positive emotions, (3) repeated MI leads to imagination inflation, generating intrusions of content from MI in AM, (4) MI influences AM, with more positive subjective evaluation of emotional states and congruent physiological arousal in memory recall after MI.

3.2. Methods

3.2.1. Participants

Sixty undergraduate students from PUC-Rio were recruited through social media to participate in the study (39 women, 21 men; age range = 18-34 years, M = 20.7 years, SD = 3.2 years). The study protocol was approved by the local ethics committee. All of the participants signed consent forms and received course credit for participating in the study.

3.2.2. Experimental procedure

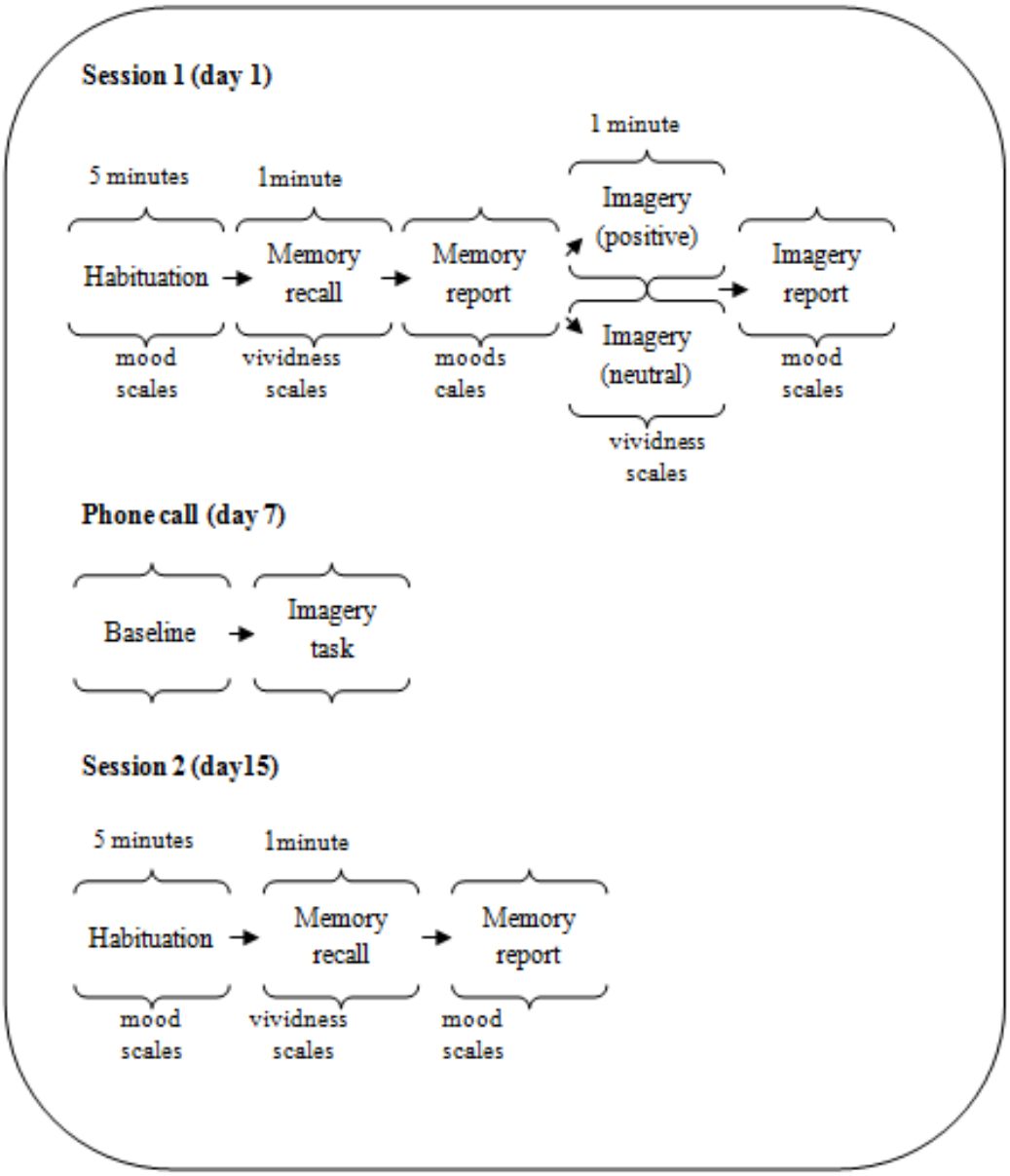
Session 1. After reading and signing the consent forms, the participants were randomly assigned to the experimental or control condition. The participants completed baseline measures and had physiological sensors attached to them. After an initial 5-minute period of habituation, baseline recordings of physiological activity were made while the participants sat in a comfortable chair alone in the experimental room, with dim lights and silence. Afterward, all of the participants underwent a sad AM mood induction procedure. The participants in both groups were instructed to recollect the saddest moment they had experienced in the past 10years. They had 1 minute to recall and relive this memory while their

eyes were closed and they focused on episodic details, such as what they saw, heard, who they were with, and how they felt at that particular moment. The participants were instructed to experience the memory as vividly as possible, despite its unpleasantness. Afterward, they described this memory, which was audio-taped, in detail. The participants then performed a MI task. They were asked to imagine alternative scenarios concerning the memory they reported, with the limitations that the cause of sadness could not be altered and the elements that were changed had to be feasible. The emotional content of the MI task varied, depending on the condition to which the participants were assigned. The experimental group was asked to imagine a positive situation, and the control group was asked to imagine a neutral situation. This task lasted 1minute and was performed with the eyes closed. The participants were asked to imagine how they would feel, which thoughts would have crossed their minds, what the scenario would be like, who would be with them, etc. After the task, the participants briefly described the imagined scenario. Vividness was assessed, followed by a brief description of the scenario. Self-reported mood was measured before and after the memory and imagery tasks. The entire session lasted approximately 1 hour.

Phone call. This session consisted of a 5-minute phone call 1 week after Session 1 at a prearranged time. The experimenter read a script that was based solely on the participant's mental imagery description that was provided in the previous session. The purpose of this phone call was to prompt the participants with the MI that was generated during Session 1.

Session 2. Two weeks after Session 1, the participants returned to the laboratory to complete the last phase of the experiment. Physiological measures were collected according to the same procedures as Session 1. The participants completed self-reported measures of emotion and again underwent sad AM mood induction, followed by assessment of the memory's vividness and a brief verbal description. Self-reported emotion was then assessed. A debriefing about the experiment ended the test session. Attempts were made to control demand effects by informing the participants that the research was about memory and imagery ability, not highlighting that emotion was a core feature of the study. The procedure is illustrated in Figure 1.

Figure1. Sequence of experimental procedure.



3.2.3.
Materials

3.2.3.1.
Background measures

Prior to the experiment, the participants completed a series of tests and questionnaires that evaluated narrative discourse (part of the MAC Battery; FONSECA, PARENTE, CÔTÉ, SKA, & JOANETTE (2008), visual memory

(Rey-Osterrieth Complex Figure [ROCF]; OLIVEIRA *et al.*, 2004), MI (Vividness of Visual Imagery Questionnaire [VVIQ]; MARKS, 1973), depression (Beck Depression Inventory [BDI-II]; BECK, AARON T.; STEER; CARBIN, 1988), and anxiety (Beck Anxiety Inventory [BAI]; (BECK, A T *et al.*, 1988). Narrative discourse and visual memory were applied to evaluate the homogeneity of memorization and reproduction of episodic events between the experimental and control groups. The VVIQ was used to evaluate the ability to create a mental visualization of guided imagery. Finally, the BAI and BDI were used to evaluate whether the participants had depression or anxiety symptoms; no significant difference were found between groups.

3.2.3.2.

Self-reported mood

The participants' current mood state was assessed using an eight-point Likert scale (0 = not at all, 7 = totally) for six discrete emotions: joy, sadness, anger, tranquility, fear, and calmness. The Likert scale was applied after habituation, after memory recall, and after the MI task (Figure 1).

3.2.3.3.

Physiological response

Heartbeats per minute (BPM), galvanic skin response (GSR), and respiratory rate (RR) were recorded in Sessions 1 and 2 using the Captiv L7000 kit. BPM was assessed using a Captiv CFM T-sens C2030 device and Polar T31 transmitter belt that was attached to the thorax at the center of the chest. The GSR was assessed using a Captiv T-sens C2034 device, with two electrodes attached to the index and ring fingers of the non-dominant hand. The RR was assessed using a Captiv T-sens C2033 device through a belt with an elastic device that was also attached to the thorax, below the Polar belt.

3.2.3.4.

Self-reported vividness scales

The vividness of mental visualization for both AM and MI was assessed using a 5-point Likert scale based on VVIQ ratings (1 = perfectly clear and as

vivid as a normal visualization, 5 = no image at all, just thoughts on the subject). The participants rated vividness after memory recall and after the MI task.

3.2.3.5.
Autobiographical interview

Memory and imagery reports were recorded, transcribed, and then analyzed using an adaptation of the Autobiographical Memory Interview (LEVINE *et al.*, 2002). In the present study, the *thought/emotion* category was privileged because of its relationship to mood state. For each participant, we recorded the number of *thought/emotion* sentences, which were then categorized as positive or negative sentences. For example, if the participant reported, "I met my family in the afternoon my grandfather died, and I was feeling very sad," then the excerpt, "I was feeling very sad," was recorded as one negative sentence. These sentences were also evaluated with regard to their *rating composite* (richness of details) using a 3-point scale (1 = lack of richness, 3 = very rich in detail). Intrusions were analyzed as the identification of sentences that were generated during the imagery task that later appeared in the memory report in Session 2. Only material that *did not appear* in the memory task in Session 1but were reported in the memory task in Session 2 was considered an intrusion. The presence of intrusions, *thought/emotion* rating composites, and the presence of positive/negative sentences were scored by two independent raters, and kappa analysis indicated good agreement between raters ($\kappa > .76$, $p < .05$).

3.2.4.
Statistical analysis

The data analysis was performed using SPSS 20.0 software . Descriptive statistics were used to illustrate the sample characteristics. Differences in sociodemographic and clinical characteristics were explored using χ^2 tests and *t*-tests. Differences in self-report data were explored with three pairs of emotions (joy/sadness, calm/anger, tranquility/fear), with reverse-coding of the negative emotion (higher scores indicated more positive emotion). For the physiological measures at each time point of the experiment (baseline, memory recall, and memory report in Sessions 1 and 2), the last minute was used for the analysis. For the effects of autobiographical recall on mood, a three-way mixed analysis of

variance (ANOVA) was used for physiological variables, with group (control or experimental) as a between-subjects factor and session (Session 1 and Session 2) and time (baseline, memory recall, and memory report) as within-subjects factors. A similar design was used for the self-reports, but the time factor had only two levels (baseline and after memory report).The vividness of mental imagery in Session 1 was compared between groups using Student's *t*-test for independent samples. For both self-reports and physiological measures, the effects of the imagery task on mood were explored using a two-way mixed ANOVA, with group (control or experimental) as the between-subjects factor and time (after memory report in Session 1 and after imagery report) as the within-subjects factor. Finally, the impact of imagery on memory characteristics was explored. The χ^2test was used to compare the frequency of intrusions between groups. Differences in the memory reports' positivity, negativity, and thought/emotion ratings were analyzed using a two-way mixed ANOVA, with group (control or experimental) as the between-subjects factor and time (memory report in Session 1, imagery report in Session 1, and memory report in Session 2) as the within-subjects factor. The same statistical analysis was applied for the self-reported vividness of the memory. Main effects and interactions were explored using *post hoc* tests, with Bonferroni correction for multiple tests.

3.3. Results

3.3.1. Sample characteristics

Descriptive statistics are shown in Table 1. No significant differences in age, gender, anxiety and depression symptoms, logical memory, visual memory, or vividness of visual imagery abilities were found between groups (all $p > .05$).

3.3.2. Autobiographical memory mood induction

3.2.2.1. Mood self-report

An interaction between time and session (F (1) = 5.29; p = .025; η_p^2 = .08) was found for joy/sadness. As shown in Figure 2, compared with baseline, more

Table 1. Background variables stratified by group.

Variable	Positive Imagination group (n=30) Mean (SD)	Neutral Imagination group (n=30) Mean (SD)	P
Age (years)	20.4(3.3)	21.1(3.1)	.382
Gender (male/female)[1]	22/8	17/13	.176
VVIQ score (eyes open)	34.8(8.8)	32.2(12.4)	.360
VVIQ score (eyes closed)	28.2(8.2)	27.9(11.1)	.884
BAI score	11.2(7.2)	9.8(7.1)	.451
BDI-II score	12.3(6.7)	11.5(7.6)	.681
Rey Figure score (copy)	35.4(0.9)	35.8(0.6)	.088
Rey Figure score (recall)	25.1(5.2)	24.2(6.2)	.591
BMAC score (essential)	15.4(2.3)	11.3(2.1)	.862
BMAC score (present)	11.7(3.6)	19.8(3.4)	.913
BMAC score (complete)	11.4(1.6)	11.5(1.4)	.800

[1] Gender (male/female); Analysis of difference for gender using Chi-square tests; other analyses using Student's *t*-test.

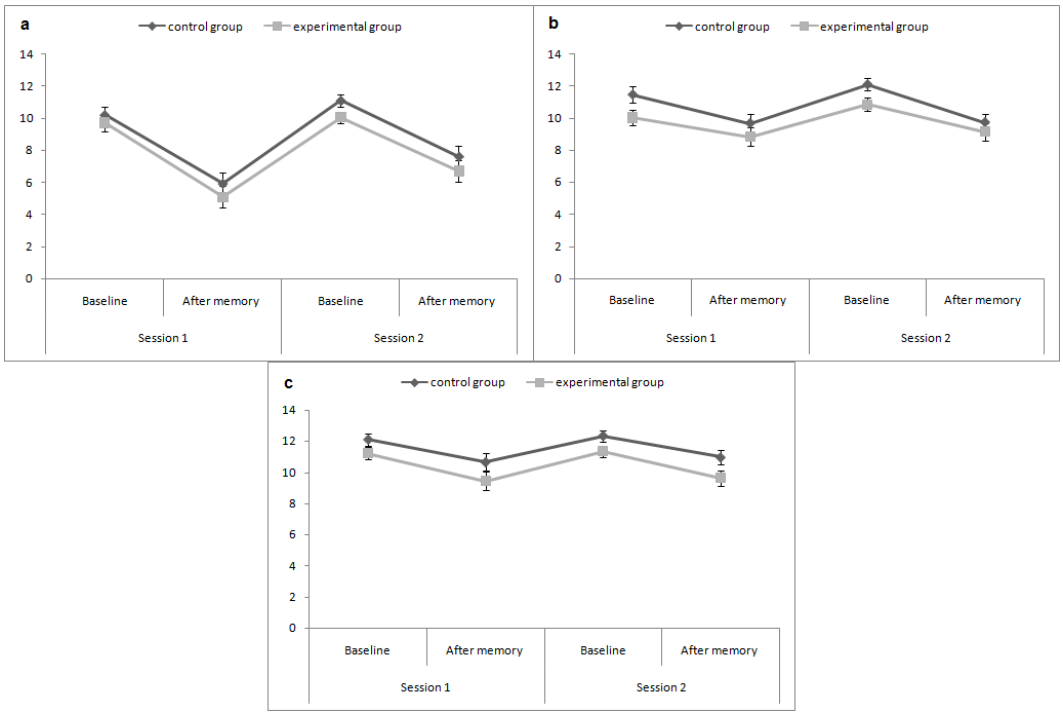
negative emotion was reported after recalling the memory in both sessions (p < .001). However, in Session 2, this increase in negative emotion was not as pronounced as in Session 1. Main effects of session (F (1) = 16.69; p < .001; η_p^2 = .22; more positive emotion in Session 2) and time (F (1) = 141.99; p < .001; η_p^2 = .71; significant decrease in positive emotion after autobiographical recall) were also found. No interaction between session, time, and group was found for joy (F (1) = 0.27; p = .606; η_p^2 = .01).

For calm/anger, a main effect of group (F (1) = 5.05; p = .028; η_p^2 = .08) was found, indicating that the control group had overall higher ratings (more positive emotion) compared with the experimental group. A main effect of time was found (F (1) = 35.38; p < .001; η_p^2 = .38), indicating that rates of calmness were lower after the sad memory induction compared with baseline ratings. Both main effects are shown in Figure2. No main effect of session was found (F (1) =

.59; = .441; η_p^2 = .01), with no interaction between session, time, and group (F (1) = 0.01; p = .999; η_p^2 = .01).

For tranquility/fear, a main effect of group was also found (F (1) = 4.04; p = .049; η_p^2 = .06), indicating that the control group had significantly higher scores for tranquility compared with the experimental group. A main effect of time (F (1) = 35.88; p < .001; η_p^2 = .38) indicated an overall decrease in tranquility after the sad memory. These results are shown in Figure 2. No significant effect of session was found (F (1) = 2.03; p = .160; η_p^2 = .03),with no interaction between session, time, and group (F (1) = 0.01; p = .943; η_p^2 = .01).

Figure 2. Self-reported emotion during Sessions 1 and 2.



(a) Joy/sadness, (b) tranquility/fear, and (c) calm/anger effects related to memory tasks in Sessions 1 and 2. Comparisons were made between the experimental and control groups.

3.2.2.2. Physiological Measures

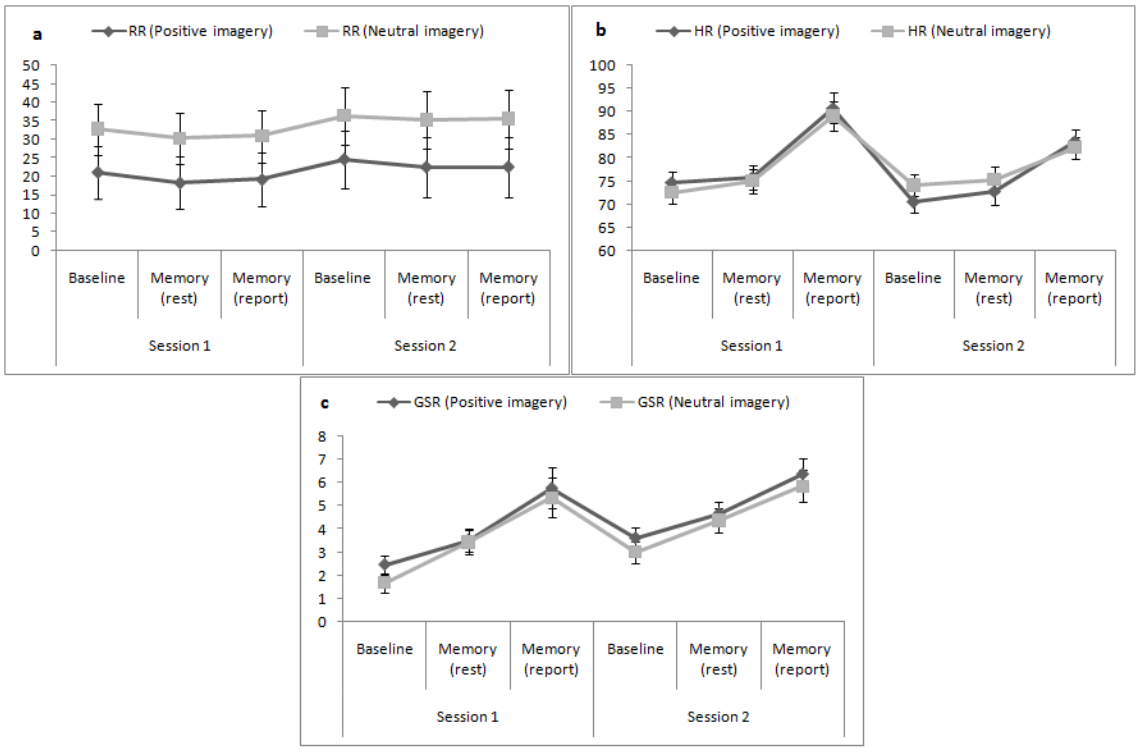
For RR, an interaction was found between time and session (F (2, 1.44) = 5.09; p = .016; η_p^2 = .08), in which differences were found between memory recall and report in Session 1 but not in Session 2 (p < .001). A main effect of

time was found (F (2, 1.51) = 58.76; p = .001; η_p^2 = .52), indicating the same time-dependent variation in RR within each session. The RR decreased during sad memory induction (recall) and increased during the memory report (p < .005). No significant main effect of session (F (1) = 1.44; p = .235; η_p^2 = .03) or group (F (1) = 1.46; p = .232; η_p^2 = .03) was found. No significant interactions were found between session and group (F (1) = 0.01; p = .922; η_p^2 = .01), time and group (F (2) = 1.54; p = .219; η_p^2 = .03), or session, time, and group (F (2) = 1.41; p = .249; η_p^2 = .02).

For HR, a significant interaction was found between time and session (F (2) = 13.26; p < .001; η_p^2 = .21), indicating that the difference between memory recall and report was larger in Session 1 than in Session 2. A significant main effect of session was found (F (1) = 5.97; p = .018; η_p^2 = .11), with lower HR in Session 2. A main effect of time was found (F (2, 1.4) = 107.04; p < .001; η_p^2 = .67), indicating the same time-dependent variation in HR within each session. Heart rate increased during memory recall, with a further increase during memory report. No main effect of group was found (F (1) = .01; p =.995; η_p^2 = .01). No significant interactions were found between session and group (F (1) = 1.41; p = .242; η_p^2 = .03), time and group (F (2) = 1.04; p = .357; η_p^2 = .02), or session, time, and group (F (2) = 2.15; p = .122; η_p^2 = .04).

For the GSR, a main effect of session was found (F (1) = 5.89; p = .018; η_p^2 = .09), with an increase in GSR in Session 2. A main effect of time was also found (F (2, 1.32) = 97.81; p < .001; η_p^2 = .63), indicating that the GSR increased after AM recall. No significant main effect of group was found (F (1) = 0.42; p = .519; η_p^2 = .01), with no significant interaction between time and session (F (2, 1.37) = 2.74; p = .09; η_p^2 = .05). No significant interactions were found between session and group (F (1) = .01; p = .946; η_p^2 = .01), time and group (F (2) = .63; p = .532; η_p^2 = .01), or session, time, and group (F (2) =.19; p = .830; η_p^2 = .01). The results for RR, HR, and GSR are shown in Figure 3.

Figure 3. Physiological responses during Sessions 1 and 2.



(a) Respiratory rate, (b) heart rate, and (c) galvanic skin response anger effects related to memory tasks in Sessions 1 and 2. Comparisons were made between the experimental and control groups.

3.3.3.

Effects of imagery on mood

Concerning the imagery task in Session 1, no significant difference in self-reported vividness scales was found between groups (t (58) = .61, p = .543), indicating that the situations that were imagined had similar vividness and richness scores in both groups.

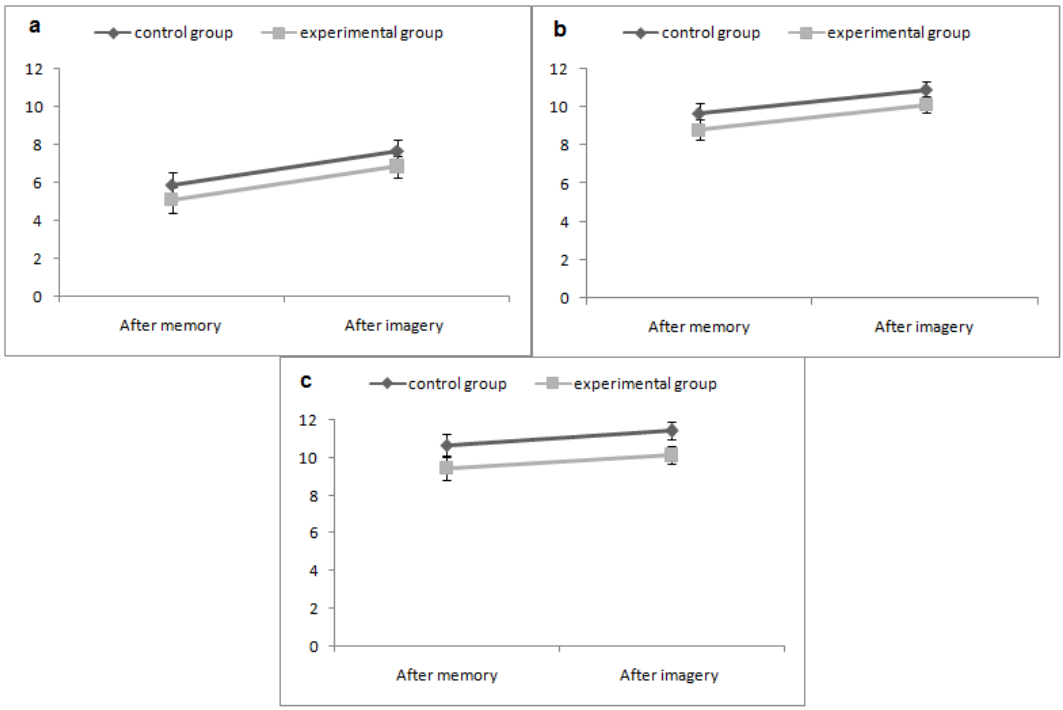
3.3.3.1.

Self-report

The comparisons of self-reports after memory in Session 1 and after imagery indicated main effects of time on joy/sadness (F (1) = 39.51; p = .001; η_p^2 = .41), calm/anger (F (1) = 6.94; p = .010; η_p^2 = .11), and tranquility/fear (F (1) = 11.88; p = .001; η_p^2 = .17), indicating an increase in positive emotions after imagery. No significant main effects of group were found (joy/sadness: (F (1) = .94; p = .335; η_p^2 = .02; tranquility/fear: (F (1) = 1.79; p = .185 ; η_p^2 = .03);

calm/anger: (F (1) = 3.39; p = .071; η_p^2 = .05), with no time × group interaction (joy/sadness: (F (1) = .01; p = .953; η_p^2 = .01; tranquility/fear: (F (1) = .01; p = .905; η_p^2 = .01; calm/anger: (F (1) = .01; p = .928; η_p^2 = .01). These results are shown in Figure 4.

Figure 4. Self-reported mood in Session 1.



(a) Joy/sadness, (b) tranquility/fear, and (c) calm/anger effects related to memory task (Session 1) and imagery task (Session 1). Comparisons were made between the experimental and control groups.

3.3.2.2

Physiological measures

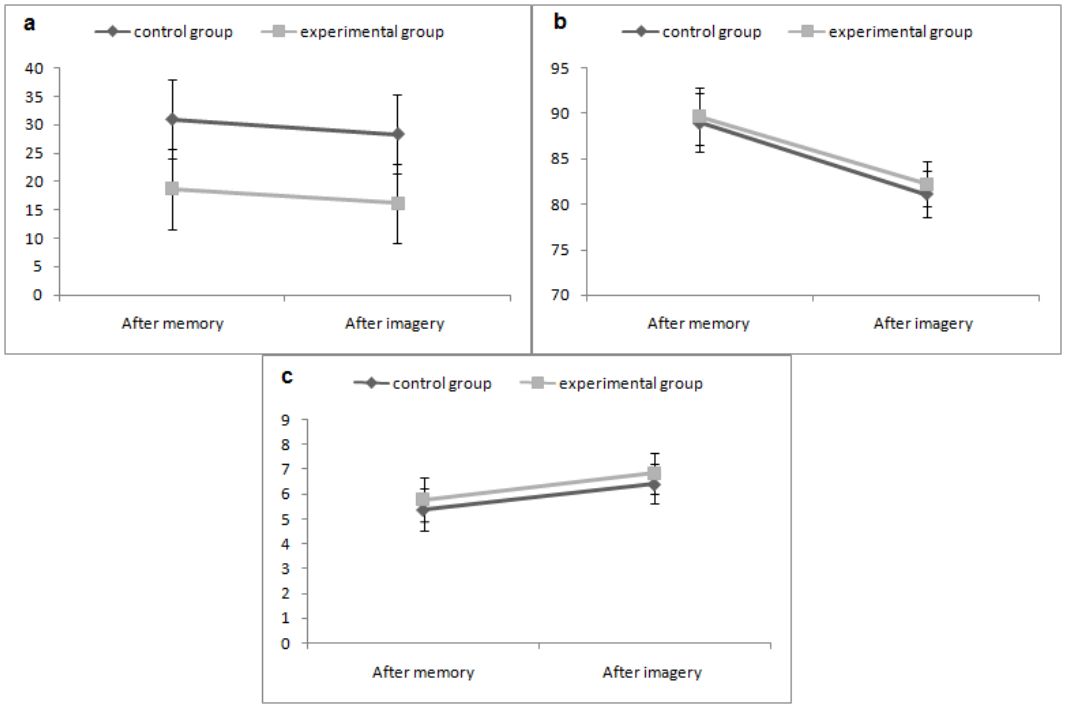
For RR, a significant main effect of time was found (F (1) = 97.03;p = .001; η_p^2 = .63), indicating a decrease in activation after the imagery task. No main effect of group was found (F (1) = 1.53;p = .221; η_p^2 = .03), with no time × group interaction (F (1) = .05;p = .818; η_p^2 = .01).

For HR, a main effect of time was also found (F (1) = 40.33; p = .001; η_p^2 = .42), indicating a decrease in HR after imagery. No significant main effect of

group was found (F (1) = .06; p = .810; η_p^2 = .01), with no time × group interaction (F (1) = .03; p = .852; η_p^2 = .01).

For the GSR, a significant main effect of time was found (F (1) = 23.25; p = .001; η_p^2 = .29), indicating an increase in the GSR after the imagery task. No significant main effect of group was found (F (1) = .12; p = .729; η_p^2 = .01),with no time × group interaction (F (1) = .01; p = .949; η_p^2 = .01). These results are shown in Figure 5.

Figure 5. Physiological responses during Session 1.



(a) Respiratory rate, (b) heart rate, and(c)galvanic skin response anger effects related to memory task (Session 1) and imagery task (Session 1) Comparisons were made between the experimental and control groups.

3.3.4.

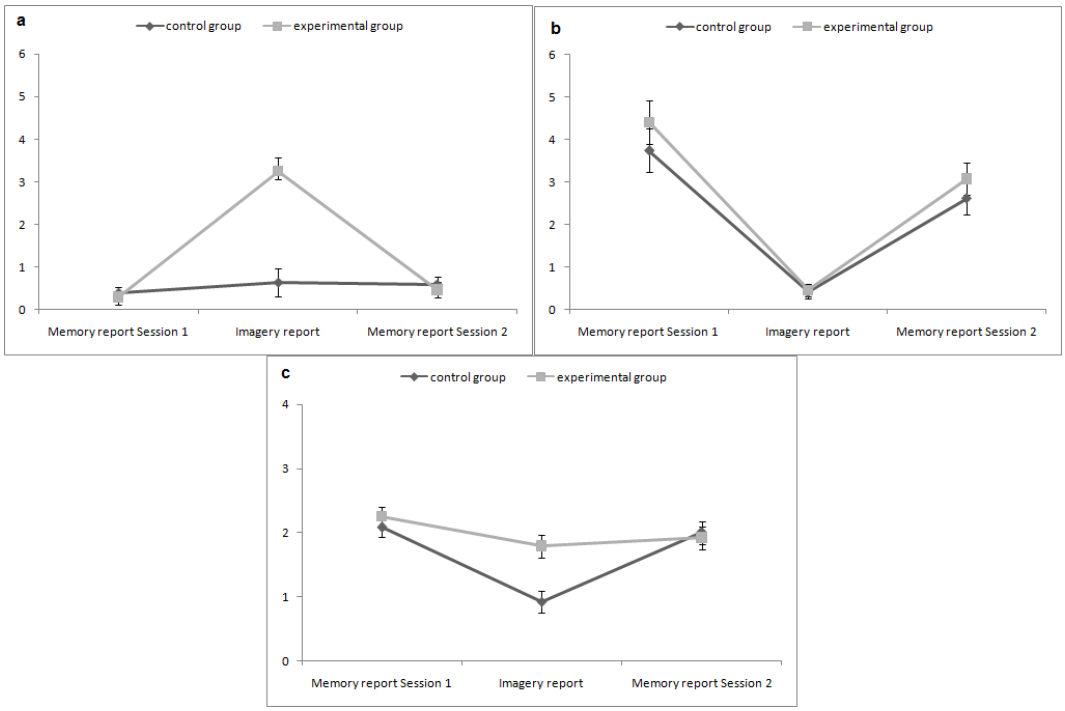
Effects of imagery on memory characteristics

With regard to the frequency of memory intrusions, no group differences were found (χ^2 (1) = 0.01; p = .999). For the characteristics of memory, both groups had the same frequency of intrusions of positive elements (n = 4). With regard to the thought/emotion positivity report, a time × group interaction was

found (F (2) = 24.48; p = .001; η_p^2 = .34). As expected, the experimental group had a more positive imagery report in Session 1 than the control group, which did not show variations across sessions. Main effects of group (F (1) = 16.71; p = .001; η_p^2 = .26; more positivity in experimental group) and time (F (2) = 30.1; p = .001; η_p^2 = .39; more positivity in imagery report) were also found. For the negativity of reports, a main effect of time was found (F (2) = 56.7; p = .001; η_p^2 = .55), indicating that the memory report in Session 1 had significantly higher negativity than the imagery report in Session 1 and memory report in Session 2.

No significant main effect of group was found (F (1) = 1.21, p = .278, η_p^2 = .03), with no interaction between group and time (F (2) = .42, p = .661, η_p^2 = .01). These results are shown in Figure 6.

Figure 6. Characteristics of memory and imagery reports.



(a) Positivity, (b) negativity, and (c) thought-emotion rating composite of reports at three moments: memory report (Session 1), imagery report (Session 1), and memory report (Session 2). Comparisons were made between the experimental and control groups.

For ratings of thought/emotion, a significant time × group interaction was found (F (2) = 5.75; p = .001; η_p^2 = .11), indicating that the control group had significantly lower richness of emotional details during the imagery report in

Session 1 compared with the experimental group. A main effect of time was found (F (2) = 16.61; p = .001; η_p^2 = .26), with no main effect of group (F (1) = 3.45; p = .069; η_p^2 = .09).

A main effect of session on the vividness of autobiographical recall was found (F (1) = 19.9; p = .001; η_p^2 = .256), indicating a greater level of vividness of memory in Session 2. No main effect of group was found (F (1) = .38; p = .541; η_p^2 = .01), with no significant interaction between session and group (F (1) = .05; p = .815; η_p^2 = .01).

3.4. Discussion

In this study, mood was manipulated using an autobiographical recall paradigm. Manipulation checks suggested that the procedure was effective, with more negative mood reported after sad memory recollection. However, negative mood after autobiographical recall was reduced in Session 2, which might suggest positive effects of imagery on the emotional content of memory. This is reinforced by the results of Session 1, indicating that positive mood increased after mental imagery in both groups (with no significant differences in the vividness of imagery). With regard to imagery characteristics, the experimental group had a more positive imagery report, confirming that the participants followed the task accurately. Nevertheless, no group differences were found in positivity or the presence of imagery-related intrusions during the memory report in Session 2. This outcome suggests that the emotional content of the imagery task did not influence memory characteristics in Session 2. These results were not confounded by demographic, cognitive (memory and imagery ability), or emotional (mood and anxiety state) factors, in which the groups were matched according to these variables.

Autobiographical memory mood induction was effective, consistent with previous studies (BRIÑOL, PETTY, & BARDEN, 2007; JALLAIS & GILET, 2010; MARKOWITSCH, VANDEKERCKHOVE, LANFERMANN, & RUSS, 2003; VAN DEN HOUT, MURIS, SALEMINK, & KINDT, 2001). The within-subjects design with pre- and post-assessments, based on the methodological

suggestions on an early critical review (KENEALY, 1986), supported the assumption that AM recall indeed decreased positive emotion. The assessment of mood alterations relied both on self-report and physiological measures. The HR and GSR results were consistent with other sad AM mood induction studies (KREIBIG, 2010; SCHAEFER; PHILIPPOT, 2005). The present study also assessed RR in a sad AM paradigm (KREIBIG, 2010), providing evidence that this measure is consistent with other physiological activity.

Overall, the results suggest that the MI task was effective, regardless of its emotional content (neutral or positive). Greater rates of positive self-reported emotion and lower physiological activation immediately after the imagery task and after the memory report were found in Session 2. Although the emotional content of the memories did not change from Session 1 to Session 2, less negative mood was reported after memory recall in Session 2. This may indicate emotional desensitization, in which the report in Session 2 was less emotional merely because the subjects were recently exposed to the emotional memory. However, this is unlikely because of the 2-week interval between sessions .Emotional desensitization tends to occur after repeated continuous exposure and is not a short-term process (KAZDIN & WILCOXON, 1976). Moreover, the visual vividness of memory was greater in Session 2, suggesting that the participants mentally reexperienced the event more vividly. Additionally, other positive MI mood induction studies suggest that this procedure can lead to more positive emotion after a certain time interval (MEEVISSEN, PETERS; ALBERTS, 2011; PETERS *et al.*, 2010; RENNER *et al.*, 2014; SHELDON; LYUBOMIRSKY, 2006).

In the present study, both positive and neutral MI led to more positive mood, which contrasts with the hypothesis that only positive MI causes such an effect. One explanation for this result is a shift in the participants' focus of attention, in which imagery would deviate attention from the distressful memory toward an alternative scenario, regardless of its neutral or positive content (SCHÖNFELDER *et al.*, 2013). Another interpretation for the lack of difference between groups may be related to the distressful task of imagining a more positive outcome for something sad that already occurred and the frustration of knowing that the scenario cannot be real, thus lowering the positive effects of positive MI and making them equivalent to the effects of neutral MI. Nevertheless, the report

of imagery positivity varied only in the experimental group, thus negating the possibility of a procedural error or an ineffective intervention. Additionally, the implementation of a third session, in which the participants recall the sad memory on more time, could provide an overview of the intervention's efficacy, confirming the emotional regulation effect.

According to the analysis of intrusions, the imagination inflation hypothesis was confirmed. Eight participants experienced intrusions from the imagery task in their report of memory in Session 2. Despite the low rate of intrusions, this result indicates that the imagery task generated elements that endured over time. In contrast to other imagination inflation studies of AMs (HEAPS; NASH, 2001; MARSH; PEZDEK; LAM, 2014), the likelihood of occurrence of the event was not assessed, thus impairing further comparisons. Notably, the intrusions had similar emotional content, regardless of the valence of the imagery task. Positive intrusions were also observed in the neutral imagery scenario, indicating that the participants may not have complied fully with task instructions. Alternatively, considering the aversive nature of memory recall, the intrusions may have been used as an emotional regulation strategy.

3.4.1.
Limitations

One limitation concerns the sample size. However, non significant results had a small effect size, such that increasing the number of subjects may not have significantly altered the results. Another limitation was that we did not analyze the reappraisal of memories, which could provide further data on the effect of imagery on AM. This issue should be explored in future studies.

3.4.2.
Conclusions and clinical implications

These findings reinforce the effectiveness of both sad AM and MI as MIPs. From the perspective of imagery as a tool for emotional regulation, the results suggest that the emotional content of imagery may be less relevant than the activity of imagery itself. Future studies may extend the present results to clinical populations. Future studies may also explore changes in the procedure with regard to the type of emotional memory (e.g., fear instead of sadness). Further

investigations are needed to understand the effects of mental imagery on emotional memory.

4
General Discussion

The present dissertation sought to relate AM and MI and their ability to elicit emotional states. The regulatory effects of the AM on MI were also investigated. To achieve these aims, a systematic review and an empirical study were conducted.

The systematic review indicated no apparent difference in efficacy between AM and MI (ZHANG; YU; BARRETT, 2014), which has been suggested by other reviews (LENCH, FLORES, & BENCH, 2011; WESTERMANN, STAHL, & HESSE, 1996). The results of the systematic review also indicated that few studies attempted to relate AM and MI (KEALY; KUIPER; KLEIN, 2006; RENNER *et al.*, 2014) by exploring, for example, how one process regulates emotional states that are generated by the other. Reviewing this theme allowed a wide examination of the methods that are used to standardize techniques that pertain to subjective processing, such as cue elicitors for such remembering or imagining events. This is a relevant topic for discussion because there are methodological controversies regarding the ways in which MIP cues influence emotions. Additional studies should further investigate this issue by comparing the efficacy of cued and uncued MIPs (e.g., differences between uncued memory recall and memory recall that is elicited by a picture, differences in memory recall that is elicited by a picture and a picture-based MIP).

The present empirical study in this dissertation supported the hypothesis that MI influences AM emotionally (assessed by self report). Notably, positive MI increased positive affect that was associated with a sad memory, and neutral MI achieved similar results. However, emotional characteristics (positivity/negativity) of the memory report were not affected by the imagery task. This result could be attributable to the emotional relevance of the memory, which was the saddest within the past 10 years. According to Baddeley, Anderson, and Eysenck (2011), remarkable events are recalled more accurately because they are consolidated with more detail, thus making them unmistakable. For this reason, the negative characteristics of the memory did not change compared with the first report.

With regard to reconsolidation theories, the memory flexibility hypothesis was confirmed (SCHWABE; NADER, PRUESSNER, 2014). The results indicated the intrusion of imagined details in the memory report in Session 2. For example, one of the participants' memory reports from Session 1 was "(my dad) didn't have the courage to tell me and my brother." During the imagery task, the participant reported, "An honest conversation could have happened in our family; (my dad) could have explained what happened and what it was going to be like from now on." Two weeks later, in Session 2, when instructed to report the memory again, this participant reported, "My dad came and talked to me and my brother, saying that because of a few problems, he would have to leave."

The ratio of intrusions was low compared with other reconsolidation and imagination inflation studies (DEVITT *et al.*, 2016; MARSH, PEZDEK; LAM, 2014; MAZZONI; MEMON, 2003; MCLELLAND *et al.*, 2015). This result could be attributable to the type of memory that was reconsolidated. In the present study, we attempted to modify emotionally relevant memories. This was done as a model of real situations, with the aim of increasing ecological validity, and is in contrast to paradigms that rely on simple sentences (e.g., "Ewan and I went to Bethells Beach and saw a penguin";MCLELLAND *et al.*, 2015) or Life Events Inventory statements (e.g., "Broke a window with your hand"; GARRY, MANNING, WFFUS, & SHERMAN, 1996). Further replication using the method that was employed in the present study is necessary, particularly considering the need to generate evidence with clear applications in psychotherapy settings. Imagery has been successfully employed in psychotherapy, especially in cognitive behavioral therapy (e.g., to disengage automatic thought schema and the processing of traumatic material; HOLMES, E. A.; ARNTZ; SMUCKER, 2007; MOUNTFORD; WALLER, 2006).

The type of imagery task that was utilized in this dissertation has been mentioned as a rescripting technique in other publications, in which preexisting negative mental imagery (AM) is altered to become a more positive or benign form, so that mood can be regulated (HOLMES, E. A.; ARNTZ; SMUCKER, 2007). Nevertheless, complementary to these previous publications, the present study contained an analysis of imagery and memory reports using an autobiographical interview technique (LEVINE *et al.*, 2002), which allowed an investigation of the way in which rescripting was achieved. Furthermore,

measuring autonomic physiological responses (i.e., HR, RR, and GSR) that were associated with memory and imagination allowed an analysis of involuntary emotional variations during the rescripting process. In future studies, it is crucial to explore in more depth these variables with regard to the rescripting of negative memory using neutral tasks to confirm that both positive and neutral imagery have a positive effect on emotions.

4.1. Limitations

For the present systematic review, only three databases were assessed to compile the articles, which may have limited the number of publications that were retrieved. However, these are the major databases that include experimental psychological research, and few, if any, additional studies would be found in other platforms. Additionally, because of the heterogeneity of eliciting cue combinations, a meta-analysis was not performed. Nevertheless, a critical review was conducted to methodologically analyze the MIPs. The empirical study's limitations concern the small sample size, which may have decreased the statistical power to detect the effects of the intervention. Nevertheless, the effect sizes indicated that increasing the sample size may not have influenced the results because they were only medium or low effect sizes. Finally, some of the sample characteristics may impair the generalizability of the findings, in which the level of education, socioeconomic status, and age were within a very narrow range. However, the empirical study proposes a novel analysis of reports of memory, intrusions, and combinations of MIPs. It was important to test these new experimental variables in a specific population to test the efficacy and applicability of such techniques. Future research may broaden the procedures and results to other populations.

4.2. Conclusion

The present study provided empirical and theoretical evidence that imagery and memory are congruent mental processes and that the act of imagination plays a regulatory role on emotions that are related to memories, regardless of its neutral or positive content. Moreover, MI could be used as a

technique to assist patients with coping with sad memories in the context of psychotherapy. For example, a patient may have been suffering from grief for more than 2 years, which impairs his quality of life. Imagery and rescripting techniques could be applied to disengage the thought pattern regarding the death that was experienced, and the patient could be guided to imagine how the recalled moment could be different. Similar work was applied in a depressed population but not using an experimental approach (WHEATLEY et al., 2007). In this study, depressive symptoms were assessed over 16 weeks while a rescripting technique was proposed to the participants. The participants were instructed to recall intrusive memories (usually distressful) and creatively imagine details about them to pursue a change in content, which would lead to a decrease in the frequency of intrusive memories. Two clinical cases were analyzed, revealing a decrease in both depression symptoms (assessed by the BDI) and frequency of intrusive memories. Similar methodology could be applied in clinical populations to develop approaches to modulate negative emotion that is related to past distressing events.

5
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6
Attachments

Study protocol (Portuguese version)

SESSÃO 1

- RECEBER OS PARTICIPANTES

  Certificar-se de que eles estão em condições de fazer parte da pesquisa (ex. disponibilidade de tempo, necessidade de ir ao banheiro, fome, sede etc).

- EXPLICAR A PESQUISA E LER O TERMO DE CONSENTIMENTO COM O PARTICIPANTE

  "Primeiramente, gostaríamos de agradecer sua presença e participação. Esta pesquisa é sobre memória autobiográfica e imaginação. A sua participação será anônima, os dados coletados sigilosos, portanto não se preocupe com a identificação e assinatura no termo de consentimento, pois não serão associados aos questionários respondidos. Lerei com você agora o termo de consentimento livre esclarecido."

- ASSINATURA DO TERMO DE CONSENTIMENTO

- FORMULÁRIO SÓCIO-DEMOGRÁFICO

- TESTES

  BAI

  Entregar o questionário e explicar o procedimento:

  "Este é um questionário de rastreio de ansiedade. Vou ler as instruções, qualquer dúvida, pode perguntar".

  "Abaixo está uma lista de sintomas comuns de ansiedade. Por favor, leia cuidadosamente cada item da lista. Identifique o quanto você tem sido incomodado por cada sintoma durante a última semana, incluindo hoje,

colocando um "X" no espaço correspondente, na mesma linha de cada sintoma. Não é necessário ter pressa. Avise-me quando acabar."

Verificar se o participante pulou algum item.

BDI

Entregar o questionário e explicar o procedimento:

"Este é um questionário de rastreio de depressão. Vou ler as instruções, qualquer dúvida, pode perguntar".

"Este questionário consiste em 21 grupos de afirmações. Depois de ler cuidadosamente cada grupo, faça um círculo em torno do número (0, 1, 2 ou 3) próximo à afirmação que descreve melhor a maneira que você tem se sentindo na última semana, incluindo hoje. Se várias afirmações parecerem se aplicar igualmente bem, faça um círculo em torno de cada um. Tome cuidado de ler todas as informações em cada grupo, antes de fazer a sua escolha. Não é necessário ter pressa. Avise-me quando acabar."

Verificar se o participante pulou algum item.

TESTE DE MEMÓRIA LÓGICA

"Este é um teste de memória. Vou ler um curto texto. Depois de cada parágrafo, eu gostaria que você me resumisse o que acabou de acontecer na história, usando suas próprias palavras."

VVIQ

Entregar o questionário e explicar o procedimento:

"Este é um questionário de avaliação de vividez de imaginação. Ele possui quatro cenários, com quatro itens cada. Imagine os detalhes de cada um. Você deve dar uma nota para cada item, variando de 1 a 5. Preste atenção, pois 1 significa 'perfeitamente claro e tão vívido quanto uma visão normal', 2 significa 'claro e razoavelmente vívido', 3 moderadamente claro e vívido, 4 'pouco claro e vago' e 5 significa 'nenhuma imagem, você apenas sabe que está pensando no cenário'. Primeiramente peço que imagine todos os cenários de olhos abertos, com o máximo de detalhes possível. Assim que eu terminar

de ler o item, peço que diga em voz alta a nota atribuída à vividez e clareza da imaginação, de 1 a 5."

"Agora lerei novamente os cenários. Peço que imagine todos os cenários com os olhos fechados, com o máximo de detalhes possível. Assim que eu terminar de ler o item, peço que diga em voz alta a nota atribuída à vividez e clareza da imaginação, de 1 a 5, lembrando que 1 significa 'perfeitamente claro e tão vívido quanto uma visão normal' e 5 significa 'nenhuma imagem, você apenas sabe que está pensando no cenário".

- PROCEDIMENTO PRÉ-TAREFA

  Antes de começar qualquer procedimento, após conectar os aparelhos de medidas fisiológicas no participante, deixar que ele se acostume com a sensação física.

  "Procure sentar em posição confortável, com as mãos apoiadas sobre o braço da cadeira. Procure relaxar enquanto fazemos últimos ajustes para o experimento."

- BASELINE

  Gravar 5 minutos de medidas de base com o monitor do computador desligado, em posição confortável. Anotar o início e o final deste período de acordo com a hora do computador.

- QUESTIONÁRIO DE EMOÇÕES I

  Imediatamente antes de começar a tarefa, apresentar o questionário para verificar o estado emocional presente: **"Agora me responda numa escala de 0 a 7, onde 0 significa "nada" e 7 "totalmente", como você está de sentindo neste exato momento em relação à "raiva", "tristeza", "alegria", "nojo", "surpresa", "medo"".**

- EXPLICAR A TAREFA

  "Pedirei que você realize duas tarefas. No final de cada uma delas, você irá descrever brevemente a sua experiência e completar um questionário."

- TAREFA DE MEMÓRIA TRISTEZA

  “Agora peço que se lembre com riqueza de detalhes no evento mais triste que aconteceu na sua vida, nos últimos 3 anos. Não precisa falar em voz alta, apenas se lembre do evento mais triste que possa ter acontecido a partir de 2013. Concentre-se em um único evento. Lembre-se do cenário, das pessoas envolvidas. Lembre-se do que sentiu no momento, do que pensou. Observe o que você sentiu, o que você viu, o que você ouviu. Procure reviver o momento.Deixe-o fluir sem censurá-lo, como se o momento estivesse acontecendo, mesmo que seja uma memória desagradável. Sugerimos que feche os olhos. Você terá dois minutos, sinalizarei após o término do tempo.”

- MARCAR O TEMPO DE INÍCIO DA TAREFA

- MARCAR O TEMPO DE TÉRMINO DA TAREFA

- RELATO DA MEMÓRIA (LIGAR GRAVADOR)

  “Eu gostaria que você descrevesse com detalhes a memória que você acabou de lembrar. Quando aconteceu? Quem estava presente? Onde aconteceu? Como você se sentiu? O que você pensou?”

- MARCAR O TEMPO DE INÍCIO DO RELATO

- MARCAR O TEMPO DE TÉRMINO DO RELATO

- QUESTIONÁRIO DE EMOÇÕES II

  Depois de realizada a tarefa, apresentar o questionário para verificar o estado emocional presente: **“Agora me responda numa escala de 0 a 7, onde 0 significa “nada” e 7 “totalmente”, como você está de sentindo neste exato momento em relação à “raiva”, “tristeza”, “alegria”, “nojo”, “surpresa”, “medo””.**

- QUESTIONÁRIO DE VIVIDEZ I

"Agora me responda numa escala de 1 a 5 o quão vívida e clara é a imagem que vem à sua mente, sendo que 1 é perfeitamente clara e tão vívida quanto uma visão normal e 5 não há imagem nenhuma, está apenas pensando no que lhe foi pedido."

- TAREFA DE IMAGINAÇÃO I (FELICIDADE)

  "Agora peço que procure imaginar com riqueza de detalhes uma situação possível *mais positiva* relacionada à memória que acabou de relatar. Mesmo sabendo o que aconteceu, imagine um desfecho positivo alternativo, como se as coisas tivessem acontecido de uma forma diferente, mais positiva. Observe o cenário, as pessoas envolvidas. Observe como você se sente, o que está pensando. Observe o que você sente, o que você vê, o que você ouve. Deixe fluir sem censurar, como se o momento estivesse acontecendo. Sugerimos que feche os olhos. Você terá dois minutos, sinalizarei após o término do tempo."

- MARCAR O TEMPO DE INÍCIO DA TAREFA

- MARCAR O TEMPO DE TÉRMINO DA TAREFA

- RELATO DA IMAGINAÇÃO (LIGAR GRAVADOR)

  "Eu gostaria que você descrevesse com detalhes o que você acabou de imaginar. Quando aconteceu? Quem estava presente? Onde aconteceu? Como você se sentiu? O que você pensou? O que aconteceu de diferente no desfecho?"

- MARCAR O TEMPO DE INÍCIO DO RELATO

- MARCAR O TEMPO DE TÉRMINO DO RELATO

- QUESTIONÁRIO DE EMOÇÕES III

  Depois de realizada a tarefa, apresentar o questionário para verificar o estado emocional presente: **"Agora me responda numa escala de 0 a 7,**

onde 0 significa "nada" e 7 "totalmente", como você está de sentindo neste exato momento em relação à "raiva", "tristeza", "alegria", "nojo", "surpresa", "medo"".

- QUESTIONÁRIO DE VIVIDEZ II

"Agora me responda numa escala de 1 a 5 o quão vívida e clara é a imagem que vem à sua mente, sendo que 1 é perfeitamente clara e tão vívida quanto uma visão normal e 5 não há imagem nenhuma, está apenas pensando no que lhe foi pedido."

OU

- TAREFA DE IMAGINAÇÃO I (NEUTRA)

"Agora peço que você imagine com riqueza de detalhes uma situação comum possível do seu dia a dia. Observe o cenário, as pessoas envolvidas. Observe como você se sente, o que está pensando. Deixe fluir sem censurar, como se o momento estivesse acontecendo. Sugerimos que feche os olhos. Você terá dois minutos, sinalizarei após o término do tempo."

ou

"Agora peço que você imagine com riqueza de detalhes você observando um elemento do cenário da memória que acabou de relatar. Pode ser um móvel, um objeto decorativo, algo que você não tenha notado que estava ali antes. Observe a cor, o formato, a textura, onde está localizado. Deixe fluir sem censurar, como se o momento estivesse acontecendo. Sugerimos que feche os olhos. Você terá dois minutos, sinalizarei após o término do tempo."

- MARCAR O TEMPO DE INÍCIO DA TAREFA

- MARCAR O TEMPO DE TÉRMINO DA TAREFA

- DESCRIÇÃO DA IMAGINAÇÃO (LIGAR GRAVADOR)

“Eu gostaria que você descrevesse com detalhes o que você acabou de imaginar. Quando aconteceu? Quem estava presente? Onde aconteceu? Como você se sentiu? O que você pensou?”

ou

“Eu gostaria que você descrevesse com detalhes o que você acabou de imaginar. Qual elemento você imaginou? Quando? Onde estava? Alguém estava presente? Como você se sentiu? O que você pensou?”

- MARCAR O TEMPO DE INÍCIO DO RELATO

- MARCAR O TEMPO DE TÉRMINO DO RELATO

- QUESTIONÁRIO DE EMOÇÕES III

  Depois de realizada a tarefa, apresentar o questionário para verificar o estado emocional presente:

  “Agora me responda numa escala de 0 a 7, onde 0 significa “nada” e 7 “totalmente”, como você está de sentindo neste exato momento em relação à “raiva”, “tristeza”, “alegria”, “nojo”, “surpresa”, “medo””.

- QUESTIONÁRIO DE VIVIDEZ III

  “Agora me responda numa escala de 1 a 5 o quão vívida e clara é a imagem que vem à sua mente, sendo que 1 é perfeitamente clara e tão vívida quanto uma visão normal e 5 não há imagem nenhuma, está apenas pensando no que lhe foi pedido.”

- TAREFA POSITIVA – Participante assiste um vídeo de conteúdo positivo. Verificação de se está em um estado de humor positivo ou neutro.

SESSÃO 2

(uma semana depois da sessão 1)

- AGENDAMENTO: Ligar para o participante para agendar a Sessão 3.

- QUESTIONÁRIO DE EMOÇÕES V

  “Me responda numa escala de 0 a 7, onde 0 significa “nada” e 7 “totalmente”, como você está de sentindo neste exato momento em relação à “raiva”, “tristeza”, “alegria”, “nojo”, “surpresa”e “medo”.”

- TAREFA DE IMAGINAÇÃO II

  “Gostaria que sentado, em uma posição confortável e, se desejar, de olhos fechados, o cenário que imaginou na semana passada.”

  Narrar o relato de imaginação do participante (neutro ou positivo).

  “Observe o cenário, as pessoas envolvidas. Observe como você se sente. Observe o que você sente, o que você vê, o que você ouve. Deixe fluir sem censurar, como se o momento estivesse acontecendo.”

- QUESTIONÁRIO DE EMOÇÕES V

  “Agora me responda numa escala de 0 a 7, onde 0 significa “nada” e 7 “totalmente”, como você está de sentindo neste exato momento em relação à “raiva”, “tristeza”, “alegria”, “nojo”, “surpresa”, “medo””.

- QUESTIONÁRIO DE VIVIDEZ IV

  “Agora me responda numa escala de 1 a 5 o quão vívida e clara é a imagem que vem à sua mente, sendo que 1 é perfeitamente clara e tão vívida quanto uma visão normal e 5 não há imagem nenhuma, está apenas pensando no que lhe foi pedido.”

SESSÃO 3

(uma semana depois da sessão 2)

- RECEBER OS PARTICIPANTES

Certificar-se de que eles estão em condições de fazer parte da pesquisa (ex. disponibilidade de tempo, necessidade de ir ao banheiro, efeito de substâncias etc.).

- PROCEDIMENTO PRÉ-TAREFA

  Antes de começar qualquer procedimento, após conectar os aparelhos de medidas fisiológicas no participante, deixar que ele se acostume com a sensação física.

  "Procure sentar em posição confortável, com as mãos apoiadas sobre o braço da cadeira. Procure relaxar enquanto fazemos últimos ajustes para o experimento."

- BASELINE

  Gravar 5 minutos de medidas de base com o participante sozinho na sala, monitor do computador desligado, em posição confortável. Anotar o início e o final deste período de acordo com a hora do computador.

- QUESTIONÁRIO DE EMOÇÕES VI

  Imediatamente antes de começar a tarefa, apresentar o questionário para verificar o estado emocional presente: **"Agora me responda numa escala de 0 a 7, onde 0 significa "nada" e 7 "totalmente", como você está de sentindo neste exato momento em relação à "raiva", "tristeza", "alegria", "nojo", "surpresa", "medo"".**

- TAREFA DE MEMÓRIA TRISTEZA

  "Agora peço que se lembre com riqueza de detalhes do evento que se lembrou na primeira sessão da pesquisa, como sendo o evento mais triste dos últimos 3 anos. Você consegue se lembrar? Lembre-se do cenário, das pessoas envolvidas. Lembre-se do que sentiu no momento, o que pensou. Observe o que você sentiu, o que você viu, o que você ouviu. Procure reviver o momento. Deixe-o fluir sem censurá-lo, como se o momento estivesse acontecendo. Sugerimos que feche os olhos. Você terá dois minutos, sinalizarei após o término do tempo."

- MARCAR O TEMPO DE INÍCIO DA TAREFA

- MARCAR O TEMPO DE TÉRMINO DA TAREFA

- RELATO DA MEMÓRIA (LIGAR GRAVADOR)

  "Eu gostaria que você descrevesse com detalhes a memória que você acabou de lembrar. Quando aconteceu? Quem estava presente? Onde aconteceu? Como você se sentiu? O que você pensou?"

- MARCAR O TEMPO DE INÍCIO DO RELATO

- MARCAR O TEMPO DE TÉRMINO DO RELATO

- QUESTIONÁRIO DE EMOÇÕES VII

  Depois de realizada a tarefa, apresentar o questionário para verificar o estado emocional presente: **"Agora me responda numa escala de 0 a 7, onde 0 significa "nada" e 7 "totalmente", como você está de sentindo neste exato momento em relação à "raiva", "tristeza", "alegria", "nojo", "surpresa", "medo"".**

- QUESTIONÁRIO DE VIVIDEZ V

  "Agora me responda numa escala de 1 a 5 o quão vívida e clara é a imagem que vem à sua mente, sendo que 1 é perfeitamente clara e tão vívida quanto uma visão normal e 5 não há imagem nenhuma, está apenas pensando no que lhe foi pedido."