Review: Does maladaptive repetitive thinking affect characteristics of mental time travel?

Hildur Finnbogadóttir and Dorthe K. Thomsen

Center on Autobiographical Memory Research,

Department of Psychology and Behavioural Sciences, Aarhus University

Author note

The authors thank the Danish Research Council for Independent Research: Humanities, as well as the Danish National Research Foundation for funding. Thanks to Lynn A. Watson, Peter Krøjgaard, and one anonymous reviewer for helpful comments and suggestions.

This is an Author's Accepted Manuscript of an article published in Nordic Psychology, 65:2, 137-165,
available online at: <http://www.tandfonline.com/10.1080/19012276.2013.807664>.

Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication.

Abstract

We review studies examining the relationship between maladaptive repetitive thinking (RT) and the following characteristics of mental time travel (MTT): 1) emotional response (22 studies), 2) sensory reliving (3 studies), 3) field-observer perspective (4 studies) and 4) reduced specificity (29 studies). The results suggest that maladaptive RT is associated with increased emotional response to mentally travelling to negative events and with reduced specificity of past MTT. The results for sensory reliving and field-observer perspective were mixed. We discuss why maladaptive RT is associated with both increased emotional response and reduced specificity, which has been suggested to decrease emotional responses to MTT. We suggest that differences in the conceptualization of maladaptive RT and sampling clinical versus healthy participants may explain this apparently contradictory finding. Alternatively, maladaptive RT may be characterized by both increased emotional response to MTT as well as attempts at reducing the emotional response through reduced specificity. Finally, we offer suggestions for future research.

Several times each day, individuals engage in mental time travel (MTT), reliving events in the past or future (Berntsen & Jacobsen, 2008; D'Argembeau, Renaud & van der Linden, 2011). MTT may occur voluntarily or involuntarily (Rasmussen & Berntsen, 2011) and include reliving of different sensory aspects, like the visual, auditory, olfactory and bodily aspects of the experience (Rubin, 2006). When the event that is (p)relived is an emotional event, individuals may also experience the emotions associated with the event and this may affect mood (Berntsen, 2009). Indeed, the effect of MTT on emotion is so reliable and substantial that it has been used as a mood-induction procedure (e.g. Gilboa & Gotlieb, 1997). MTT has generally been argued to be adaptive in that it assists goal-directed behavior and problem-solving, grounds the self and helps maintain and develop intimate relationships (Bluck, Alea, Habermas & Rubin, 2005; Conway, 2005; D'Argembeau et al., 2011; Pillemer, 1992; Szpunar, 2010). However, the emotional response that may occur as a part of MTT also indicates that travelling mentally to events in one's personal past or future is sometimes unpleasant. It has even been suggested that certain characteristics of MTT related to emotional response or reduction of emotional response contribute to the development and maintenance of emotional disorders (e.g. Brewin & Holmes, 2003; Rubin, Berntsen & Bohni, 2008; Williams et al., 2007).

Repetitive thinking (RT) has been defined as "the process of thinking attentively, repetitively or frequently about one self and one's world" (Segerstrom et al., 2003, p. 909). In a review of the literature Watkins (2008) identified negative thought valence, stressful situational or intrapersonal context, and an abstract, evaluative and conceptual mode of processing as factors characterizing maladaptive RT (although see Ehrling et al., 2011). Maladaptive RT include rumination and worry. While rumination is typically conceptualized as focusing on the past and worry as focusing on the future, the correlation between these two constructs is high (for a review see Watkins, Moulds &

Mackintosh, 2005). Hence, in this review we include studies on both rumination and worry.

Research has confirmed that maladaptive RT is associated with increased distress, like depression and anxiety (Aldao, Nolen-Hoeksema & Schweitzer, 2010; Segerstrom et al., 2000; Thomsen, 2006; Watkins, 2008). As events from the personal past or future may be the target of maladaptive RT, MTT may be one mechanism whereby maladaptive RT increases and maintains distress. When mentally travelling to an event, maladaptive RT may affect characteristics of the event influencing whether mentally travelling to the event reinstates, attenuates, maintains, or amplifies emotions (Denson, Moulds & Grisham, 2012).

Several characteristics of MTT could be influenced by maladaptive RT. Here we focus on those that are most relevant to the increase and maintenance of negative emotions, because these seem most relevant to understanding emotional disorders, which are largely characterized by excessive negative emotion (e.g., Campbell-Sills & Barlow, 2007). First, we review studies on how maladaptive RT directly affect the emotional response to MTT, that is whether maladaptive RT is associated with increased or prolonged emotional responses to (p)reliving events. Second, we review studies examining how maladaptive RT might indirectly affect the emotional response to MTT through the following characteristics of MTT: 1) reliving sensory characteristics, 2) observer/field perspective and 3) specificity of recall. We selected these characteristics because they are characteristics that may affect the emotional response to mentally travelling to an event in the past or future (see next section). Another reason for selecting these characteristics is that these have been most commonly studied in the literature; there may be other characteristics that are equally relevant, but have not yet been studied. Based on the literature, we suggest that mentally travelling to an event characterized by observer perspective, low sensory reliving and over-general content may attenuate the immediate emotional response, but if used in a rigid manner, contribute to longer

term problems and increased negative emotions (e.g. Campbell-Sills & Barlow, 2007; Debeer, Raes, Williams, & Hermans, 2011; Kuyken & Moulds, 2009; Sibrava & Borkovec, 2006; Williams et al., 2007). Before reviewing the studies in the area, we briefly describe theories and previous findings relevant to these predictions.

Maladaptive repetitive thinking and mental time travel

When individuals engage in maladaptive RT, as a part of the process they often focus on negative aspects of past or future events (Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998). This focus may increase and prolong the emotional response to the event. Nolen-Hoeksema and colleagues' (e.g. Nolen-Hoeksema, 1991) theory on the association between rumination and affect is based on Bower's (1981) network theory, which suggests that different affects can be seen as nodes in a semantic network. These nodes are connected to both related material, like memories, and physiological-behavioural systems. When a node is activated, the activation spreads to associated memories, which prolongs or increases the affect. The spreading of activation also leads to mood-congruence in cognitive processes, leading individuals to recall memories consistent with their present mood. Nolen-Hoeksema and colleagues suggest that rumination enhances spreading of activation by focusing attention on negative mood and thought content and thereby augmenting and prolonging the affect (Lyubomirsky & Nolen-Hoeksema, 1995, p. 186; Lyubomirsky, Tucker, Caldwell & Berg, 1999). This is supported by a study where it was found that rumination enhanced the mood congruence effect compared to reflection (McFarland & Buehler, 1998). Also studies show that participants who ruminate while in a negative mood recall more negative memories compared to individuals who distract, suggesting that rumination enhances the spread of activation between the affect node and the related memories (e.g., Rusting & Nolen-Hoeksema, 1998).

Likewise rumination may increase the spread of activation from memories to the related affect node, leading to an increased and prolonged emotional response to recalling memories.

However, maladaptive RT may also be associated with characteristics of MTT that lead to an immediate reduction of emotional response to the event, but perhaps at the cost of long term problems. One characteristic of MTT that affects the emotional response to the event is the perspective from which the event is generated. Traditionally two perspectives have been identified (Nigro & Neisser, 1983). Observer perspective refers to seeing the event in mind from an external viewpoint as an observer, whereas field perspective refers to seeing the event in mind from the viewpoint one would have in the event (Rice & Rubin, 2009). Studies have shown that recalling events from a field perspective is associated with increased emotional response, whereas recalling an event from observer perspective is associated with reduced emotional response (e.g., Berntsen & Rubin, 2006). Research has also shown that asking people to visualize their actions from a third person perspective, as opposed to field perspective, causes them to construe this at a more abstract level (Libby, Shaeffer, & Eibach, 2009). According to Libby, Eibach and Gilovich (2005), this increases the psychological distance from events, and thus accentuates the broader meaning of events (see also Trope & Liberman, 2003). Observer perspective may therefore be more likely to be adopted, if one is already engaged in abstract thinking or analyzing the meaning of events, both of which characterizes some conceptualizations of maladaptive RT (Nolen-Hoeksema, 1991; Borkovec, Ray, & Stöber, 1998; Watkins, 2008). While adopting an observer perspective could be adaptive in some contexts, it has also been suggested that observer perspective may serve as a form of avoidance, which hinders the emotional processing of the events and thus slowing recovery (e.g., Kenny & Bryant, 2007).

Reliving of sensory characteristics refers to how much the individual relives the sensory experiences connected to the events, like experiencing visual and auditory imagery during MTT (Rubin, Schrauf, & Greenberger, 2003). As mentioned earlier, it has been suggested that maladaptive RT may occur in an abstract format reducing sensory (p)reliving and emotional reactivation. This may hinder adaptive emotional processing of negative events (Sibrava & Borkovec, 2006). The reduced concreteness theory of worry holds that the abstract nature of worry produces less vivid and less frequent imagery (Stöber, 1998), and research conducted within the framework of dual-coding theory (Paivio, 1986) has demonstrated that the concreteness of words and sentences affects the speed, ease and vividness of associated imagery (Marschark & Cornoldi, 1991; Paivio & Marschark, 1991). Furthermore, worry has been found to involve less imagery-based thought (e.g., Borkovec & Inz, 1990; Freeston, Dugas, & Ladouceur, 1996). The low degree of imagery is thought to prohibit the emotional reactivation and processing of the event leading to longer term emotional problems (Sibrava & Borkovec, 2006). This is consistent with the finding that high imagery is connected with increased emotional responses (e.g., Holmes & Mathews, 2005; Vrana, Cuthbert & Lang, 1986). Thus, by mentally travelling to events low in sensory imagery the emotional response may be reduced.

Another characteristic of MTT is the degree of specificity of the event travelled to. Reduced specificity, or overgeneral recall, refers to recalling memories, that are summaries of repeated events, e.g. categoric memories (e.g., “bicycling to work every morning”) or extended periods (e.g., “my ski trip to Norway last winter”), rather than events located at a specific time and place, e.g. specific memories (“going to the theatre last month”) (Williams et al., 2007). Although Tulving originally used the term MTT to refer to mentally travelling to episodic (i.e., specific) events in the past or future (Tulving, 2002), studies have shown that individuals sometimes identify more general

events during MTT (e.g. Miles & Berntsen, 2011). Hence, we use the term MTT as referring to mentally travelling to both specific and general past and future events. Autobiographical memory is assumed to be organized in a hierarchical fashion, where general events, including categoric memories, are located at the intermediate level. These general events are then connected to a subset of specific memories at the lowest level of the hierarchy (Conway, 2005). According to this theory, during voluntary recall of specific memories, the individual starts the search at the general event level of the hierarchy, which is then used to access specific memories (Conway, 2005). The CaR-FA-X model (Williams et al., 2007) describes three processes, which alone or in combination could contribute to reduced memory specificity. The acronym CaR-FA-X refers to these three processes: Capture and Rumination, Functional Avoidance, and eXecutive Function. In the model it is suggested that abstract rumination may contribute to overgeneral recall, because abstract rumination focus descriptions at the general level (“I’m always failing exams”). Over time this focus on general events may lead to an over-elaborated network at the general level. In future attempts at retrieval, the over-elaborated network is likely to capture the recall process at the general event level leading to retrieval of more general events, instead of accessing specific events details that would give rise to emotional responses. This has been termed the mnemonic interlock. Furthermore, during retrieval semantic overlap between current concerns and cues used to search for a memory may also capture the search at the general level and trigger rumination, which again focuses retrieval at the general level. Reduced executive resources (e.g., during depression), may lead to more capture errors. First, because reduced executive resources makes it more difficult to disengage from ruminative thoughts. Second, because reduced executive resources decreases the likelihood that the individual can maintain the prolonged search process for a specific memory. Rumination may thus interact with reduced executive resources (e.g., due to depression) in contributing to overgeneral memory. Finally, some individuals may develop a tendency to avoid specific memories, as retrieving

memories from the general level may be reinforced by avoiding the more intense emotion associated with specific memories. While overgeneral recall may reduce the immediate emotional response (e.g., Raes et al., 2003, 2006; but see Philippot et al., 2003), it is associated with poorer problem solving and contributes to long-term emotional problems (e.g., Williams et al., 2005). Thus, reduced specificity has been found to predict depression in a number of studies (e.g., Brittlebank et al., 1993; Gibbs & Rude, 2004; Mackinger, Loschin, & Leibetseder, 2001).

To summarize, maladaptive RT may be associated with an increased emotional response to MTT as well as characteristics that are associated with reduced emotional response, i.e. observer-perspective, reduced sensory reliving and reduced specificity. Although it may at first seem contradictory to expect maladaptive RT to be associated with both increased emotional response and characteristics leading to reduced emotional response, it is possible that maladaptive RT will show associations with both increased emotional reactions and attempts at reducing emotional reactions. We will return to this issue in the discussion. In the following, we review the existing literature on maladaptive RT and 1) emotional response, 2) sensory characteristics, 3) perspective and 4) reduced specificity.

Overview

In reviewing the association between maladaptive RT and MTT, the academic database Psychinfo was searched using keyword terms. The search included the following word stems and terms: *Ruminat**, *worry**, *perseverative thinking*, *repetitive thinking*, *autobiographical memor**, *mental time travel*, *episodic future thinking*, *future scenarios*, *future projections*, *memories*. The last search was conducted in March 2012. Studies published in print and ahead of print in 2012, that were detected between this date and submission were added. Additional studies were detected from the reference lists of the obtained articles as well as review articles and book chapters.

Studies were included in this review if they (1) investigated the effects of manipulating maladaptive RT on the selected characteristics of MTT (i.e. experimental studies); and if they (2) investigated the association between a general (trait) tendency to engage in maladaptive RT and the selected characteristics of MTT (i.e. cross-sectional survey or diary studies).

We excluded studies where only abstract is available, or papers not reporting statistical analyses. The studies included had to examine events in the participants' personal past or personal future, in order to focus the review on MTT. Therefore, not included in this review are studies examining the association between state or trait maladaptive RT and hypothetical scenarios, scenes or imagery without any personal temporal reference (e.g., Borkovec & Hu, 1990, Luybomirsky & Nolen-Hoeksema, 1995; Watkins, Moberly, & Moulds, 2008) or events happening on the day of the study (i.e., worrying prior to giving a speech, e.g., Wong & Moulds, 2011). Furthermore, in order to maintain focus on what we conceptualize as maladaptive RT, we have chosen not to include studies that operationalize rumination as only immersing oneself in the memory or as only retrieving the event from field perspective (e.g., Kross, Davidson, Weber, & Ochsner, 2009), without at least including instructions on thinking analytically about the event (*why*) or turning the event over and over in one's mind (i.e., repetitive thinking). Several studies were excluded from the review based on other reasons. Of the cross-sectional studies examining trait measures of maladaptive RT, two studies (Finnbogadottir & Berntsen, 2011; Teasdale & Green, 2004) examined participants' retrospective ratings (or affective forecasting) of the intensity and valence of emotions at the time of the event, and not at the time of recalling or imagining the events. Three studies were excluded as the MTT condition was mixed with mood induction, followed by mRT, and it is not possible to determine whether the emotion induced by this is due to the mood induction alone or not (e.g., Blagden & Craske, 1996). Furthermore, for further two studies in the review (Field, Psychol, &

Morgan, 2004; Morgan & Banjere, 2008) it is not clear whether participants were rating emotions at the time of recall or at the time of the original event. One study by Behar et al. (2012) was excluded from the review, as it was unclear whether what was being examined was the effects of negative RT on emotion (with future event being the subject of worry) or whether what was being examined was the effect of repeated MTT on emotion.

In the review we indicate whether the studies include clinical, non-clinical, or vulnerable samples, or samples including other mental conditions. Here we classify samples as clinical if participants have a) been patients in psychiatric facilities due to a mood or an anxiety disorder, or b) have been diagnosed with a mood or anxiety disorder using structured clinical interviews (e.g., SCID-I; First, Spitzer, Gibbon, & Williams, 1997) or by a mental health professional. We classified samples as vulnerable, if they selected participants that measured high on psychometric measures assessing depressive symptoms, symptoms of anxiety disorders, or individual differences measures assessing trait maladaptive RT, such as rumination and worry. Samples were classified as other mental condition, if they included psychiatric patients with an unknown diagnosis, or a diagnosis of mental conditions other than anxiety or mood disorders. The majority of the studies reviewed examined past voluntary MTT and rumination, thus unless otherwise stated, the studies in Tables 1-3 examined voluntary past MTT and rumination.

Maladaptive RT and emotional response to MTT

In this section we review studies that have examined maladaptive RT in relation to the emotional response to MTT. We start the section by describing what we mean by emotional response. Next, we describe the findings of studies examining the relationship between maladaptive RT, MTT and emotional response.

Emotional response is here taken to mean intensity and/or duration of self-reported emotions and/or physiological responding, experienced during and after MTT. Some of the studies also included implicit mood measures or behavioural measures, which we include in Table 1 without discussing them further. We will review findings for self-report measures and physiological measures separately.

In the reviewed studies, participants are usually asked to retrieve (or imagine) an event of a particular type, such as an event where they felt intense anger. Participants' emotional response, both self-reported and/or physiological, is then measured at different times during the study. For self-reported emotions, some studies examine intensity of discrete emotions, whereas others examine degree of positive, negative, or depressed affect, mood, arousal or distress, while others examine felt sense of emotional (p)reliving or (p)reexperiencing (e.g., Kross et al., 2005; Thomsen et al., 2011). For these studies, we examine whether maladaptive RT is associated with increased or prolonged emotional response, often in comparison with some other cognitive strategy (e.g., reappraisal, reflection), distraction or spontaneous thought.

For the experimental studies, the comparison condition(s) used varies between studies. Furthermore, the way state maladaptive RT is conceptualized and operationalized also differs between studies. In this review, for each experimental study, we use the authors' conceptualization of which condition constitutes the maladaptive RT condition (see Table 1). For instance, six studies (nr. 1, 7, 9, 10, 11, 16) use a variation of the RT manipulation developed by Kross, Ayduk and Mischel (2005), where participants are instructed to either think about a previously retrieved event, by either focusing on *what* happened or *why* it happened (i.e., analytical thinking). Furthermore, in both the "what" and the "why" conditions, participants are either instructed to engage in that thinking from an *immersed* perspective, focusing on the event as it were happening to them now, or

from a *distanced* perspective, focusing on how the event unfolded for their distant self or an impartial observer. Typically, the *immersed why* condition is conceptualized as maladaptive RT (although see Wimalaweera & Moulds, 2009, nr. 16), which is then compared to the other conditions or to distraction. It should be noted that for these studies, the instructions for the rumination condition may have evoked field perspective in participants, as they were instructed to re-experience the situation in their mind's eye, whereas in the comparison condition (reappraisal or distanced-why), they were instructed to watch the distant self, which may have evoked observer perspective. Other studies (e.g., nr. 3, 5, 8, 13, 15) conceptualize maladaptive RT as analytical thinking (*why*), without distinguishing between immersed or distanced versions of analytical thinking.

22 studies were identified, 16 experimental and 6 cross-sectional (see Table 1). All 22 studies examined past voluntary MTT with one also examining future MTT (nr. 21), and all but 2 (nr. 2, 22) examined rumination. Of the 16 experimental studies, 4 (nr. 1, 4, 7, 11) examined physiological responding as well as self-report measures of emotion, and of the 6 cross-sectional studies, 3 (nr. 17, 19, 20) examine physiological responding only. As some studies examine both physiological and self-report, and some examine both past and future MTT, the number of studies in this section exceeds the total number of studies reported in Table 1.

Of the 3 cross-sectional studies examining only self-report measures (nr. 18, 21, 22) all used non-clinical samples. One study (nr. 22) examined nostalgic and everyday events and did not find maladaptive RT to be associated with increased emotional response. The other two studies examining self-defining memories (nr. 18) and positive and negative memories and future projections (nr. 21) found that trait maladaptive RT was associated with increased emotional response to MTT, although in one of the studies (nr. 18) the effect was found only for a measure of

tendency to ruminate on memories and not for the established trait measure of maladaptive RT, and the other (nr. 21) found the association more consistently for negative than positive events.

Of the 16 experimental studies examining self-report measures of emotion, all except 2 (nr. 7, 14) examined memories of negative events, and in all except 1 (nr. 2), participants engaged in maladaptive RT after they had retrieved an event. However four studies (nr. 1, 5, 9, 10) include no baseline measure of the self-reported emotional response and only measure the emotional response after completion of the RT task. The remaining 12 studies include some sort of a baseline measure of emotional response, at the start of the experiment (nr. 7, 13, 14, 16), or a “baseline” after recalling a memory (nr. 15), or a measure both at the start of the experiment and after recalling a memory (nr. 2, 3, 4, 6, 8, 11 s1, 12). Ideally, studies should include a baseline measure at least after recalling (imagining) an event because this makes it possible to determine whether maladaptive RT, in comparison to another condition, increases, maintains or decreases to a lesser degree the emotional response to MTT. Of the 14 studies (nr. 1-6; 8-13, 15-16) examining negative events, 11 found rumination to be associated with more intense or prolonged negative emotion, with 3 (nr. 2, 3, 12) finding mixed results. Furthermore, 4 of these 11 studies (nr. 4, 6, 11, 12) also examined positive emotion and 2 (nr. 6, 12) found rumination to be associated with less intense positive emotion and the other 2 (nr. 4, 11) found no association for positive affect. Of the two experimental studies examining a positive event, one (nr. 7) found rumination to be associated with more positive emotion, whereas the other (nr. 14) found that engaging in maladaptive RT after recalling a positive memory (preceded by a negative mood induction) maintained sad mood whereas the control condition reduced sad mood.

Physiological measures of emotional response include heart rate (HR), blood pressure (BP) or pulse, or speed of recovery from such physiological responding. Emotional response would be

indicated by either higher HR, BP or pulse and/or slower recovery from such responding. Seven studies, four experimental (nr. 1, 4, 7, 11) and three cross-sectional (nr. 17, 19, 20), were identified examining the relationship between maladaptive RT and physiological responding. All seven studies examined rumination, state and/or trait, and all studies examined voluntary recall. Two of the studies (nr. 7, 19) included clinical samples. All except one study (nr. 7) examined MTT involving negative events. Of the seven studies, one study examining trait maladaptive RT (nr. 19) found rumination to be associated with less emotional responding during MTT. One study (nr. 4) found no effects of state maladaptive RT on emotional response. The other five studies (nr. 1, 7, 11, 17, 20) found maladaptive RT to be associated with more intense or prolonged emotional response to MTT. However, for four of these studies (nr. 7, 11, 17, 20), the association was only found on some of the physiological measures used.

To summarize this section, the review suggests that maladaptive RT is associated with more intense or prolonged emotional response to negative MTT, although the evidence is stronger for self-reported emotion than for physiological indicators of emotional response and stronger for experimental studies. It should be noted that this finding is based on studies examining the effect of maladaptive RT engaged in *after* recall. The findings relating maladaptive RT to emotional response to positive events is mixed and this relationship clearly requires more research.

Maladaptive RT and sensory characteristics of MTT

In this section, we review studies that have examined the association between maladaptive RT and sensory (p)reliving and vividness of MTT (see Table 2a). Sensory (p)reliving and vividness refer to the degree to which the individual experiences imagery during MTT and are typically measured on continuous self-report scales. Only three studies were identified, all were cross-

sectional using non-clinical or vulnerable samples (nr. 1a, 2a, 3a). None of the studies found an association between maladaptive RT and sensory vividness or reliving.

Clearly, more studies, both survey and experimental, are needed to examine the potential associations between maladaptive RT on sensory reliving/vividness during the different types of MTT before any conclusions can be drawn.

Maladaptive RT and perspective in MTT

In this section we review studies that have examined maladaptive RT in relation to perspective. Visual perspective is usually measured either on a continuous scale, with one end representing events experienced from field perspective and the other end representing observer perspective, or as a categorization as either field or observer perspective.

Four studies have examined maladaptive RT in relation to visual perspective (see Table 2b). Of these, all four were cross-sectional. Two used clinical samples (nr. 3b, 4b) and two studies examined vulnerable and/or non-clinical samples (nr. 1b, 2b). Two of the studies (nr. 2b, 3b) found no association between trait maladaptive RT and visual perspective, and two found an association (nr. 1b, 4b), although for one the association was in the opposite directions (nr. 1b) and for the other the effect was found for dysphorics only (nr. 4b). Thus, the findings are mixed and there are not enough studies to make firm conclusions. Replications are therefore needed, studying the different types of MTT, preferably using both experimental and survey methods.

Maladaptive RT and reduced specificity of MTT

In this section we review studies that have examined maladaptive RT in relation to reduced specificity of MTT (see also, Sumner, 2012; Williams et al., 2007 for reviews). We start the section by describing how we define reduced specificity. Next, we describe the main findings, starting with

voluntary past MTT, on which the majority of the studies have focused, before summarizing the findings for spontaneous MTT, and future MTT (see Table 3). Unless stated otherwise in Table 3, specificity was assessed by raters (and not by participants).

29 studies were identified, 10 experimental (nr. 1-10) and 20 cross-sectional (nr. 1, 11-29) (i.e., study nr. 1 is both experimental and cross-sectional). Reduced specificity is here defined as either involving fewer specific events or more over-general events, regardless of whether this is operationalized as categoric and/or other types of non-specific events (i.e., extended events, semantic associates). The number of studies discussed in this section exceeds the total numbers reported in Table 3, as some studies (e.g., nr. 12) examine MTT using two different methodologies, or examine both state and trait RT, or examine both involuntary and voluntary MTT and are therefore counted more than once.

Of the 29 studies we identified, all except 1 (nr. 3) examined past voluntary MTT. Of these 28 studies examining past voluntary MTT, 24 studies, 8 experimental (nr. 1, 2, 4, 6-10) and 17 cross-sectional (nr. 1, 11-13, 16-27, 29), used the Autobiographical Memory Task (AMT; Williams & Broadbent, 1986). In the AMT participants are asked to recall a specific memory in response to cue words, usually negative, neutral and positive cue words. It is explained to participants what is meant by specific memories. Participants usually have 30 or 60 seconds to retrieve a specific memory, and they are given prompts if their first response isn't a specific memory. Participants' memory responses are then coded for specificity. Below, we first focus on the studies examining voluntary MTT using the AMT.

Eight experimental studies (nr. 1, 2, 4, 6-10) examined voluntary past MTT using the AMT. Of those, all eight studies find an association between maladaptive RT and reduced specificity. Additionally, in all of these studies, the effects of current mood or depressive symptoms were

controlled for and that did not change the findings. The four experimental studies examining clinical populations (nr. 4, 8-10) found an association between maladaptive RT and reduced specificity. The four studies using non-clinical, or vulnerable samples, or samples characterized by other mental conditions (nr. 1, 2, 6, 7) found an association, but two of these (nr. 2, 6) only found an effect in participants who were vulnerable (and not for healthy participants).

Seventeen cross-sectional studies examined voluntary past MTT using the AMT (nr. 1, 11-13, 16-27, 29). Eight of these studies examined clinical populations (nr. 16-22, 25), and six of these (nr. 17, 19, 20, 21, 22, 25) found an association between maladaptive RT and reduced specificity. Nine studies examined non-clinical participants (nr. 1, 11-13, 23, 24, 26, 27, 29). Of these nine studies, five (nr. 1, 11, 24, 26, 27) found an association between maladaptive RT and reduced specificity. Thus, 11 (nr. 1, 11, 17, 19-22, 24-27) out of 17 cross-sectional studies, examining voluntary MTT using the AMT find an association between maladaptive RT and reduced specificity.

We now turn to studies that have measured reduced specificity using others tests than the AMT. As can be seen from the above, studies using non-clinical samples appear to have slightly more non-significant results than studies using clinical samples. It has been suggested that this is due to ceiling effects, since participants are given extensive instructions and examples in the AMT, which may make the task too easy for healthy individuals who might otherwise show a tendency towards reduced specificity (Debeer, Hermans & Raes, 2009). Recent studies have begun to implement more sensitive specificity tests (e.g., Raes, Watkins, Williams & Hermans, 2008), such as the Sentence Completion from the Past Test (SCEPT; Raes, Hermans, Williams & Eelen, 2007), the Forced Choice SCEPT (FC-SCEPT; Raes, 2006), and the Minimal Instructions AMT (Debeer, Hermans & Raes, 2009). The SCEPT involves completing sentence stems probing for past experiences which are then coded for specificity, and the FC-SCEPT involves choosing between

completing a sentence stem probing overgeneral or specific memories. What these tests have in common is that participants are not explicitly instructed to recall specific memories. Of the 28 studies examining reduced specificity for past voluntary MTT, 3 studies, 2 cross-sectional (nr. 12, 23) and 1 experimental (nr. 5), have examined reduced specificity using these more sensitive tests, and all three studies found that in non-clinical samples, maladaptive RT is associated with the tendency to retrieve overgeneral memories.

Also of relevance to the issue of sensitivity of AMT in healthy samples, 4 studies (nr. 3, 14, 15, 28) of the 29 use other measures (e.g. diary studies) that do not explicitly instruct participants to retrieve specific events. Of these four studies, three examine voluntary MTT (nr. 14, 15, 28), and three examine involuntary MTT (nr. 3, 14, 28) and one examined future as well as past MTT (nr. 14). Of these studies only the one study using a clinical sample (nr. 28) found an association between maladaptive RT and reduced specificity, and only in the clinical group. Combining these findings with the findings described in the above paragraph, seven studies (nr. 3, 5, 12, 14, 15, 23, 28) have examined reduced specificity and maladaptive RT giving no explicit instruction to recall/identify specific events. Of these seven studies, three (nr. 5, 12, 23) find an association between maladaptive RT and reduced specificity in healthy samples, and one (nr. 28) found an association in a clinical sample.

In conclusion, there is strong evidence for an association between state maladaptive RT and reduced specificity (i.e. in experimental studies) of voluntary past MTT, with all finding an association, even when controlling for negative affect. The evidence from cross-sectional studies is somewhat weaker, with 14 out of 20 studies finding an association (nr. 1, 11, 12, 17, 19-28). For the cross-sectional studies, the effect appears to be slightly more consistent in clinical samples. The

paucity of studies examining specificity in relation to involuntary MTT as well as future MTT makes it difficult to draw any conclusions and clearly more research is needed in this area.

General discussion

To summarize the findings from the current review, we found strong relationships between maladaptive repetitive thinking (RT) and increased emotional response to negative memories across a number of outcome measures and research methods. Similarly, a strong relationship between maladaptive RT and reduced memory specificity was found, in particular for clinical populations. The findings for sensory characteristics and visual perspective were less clear and there were too few studies to draw any firm conclusions. Hence, we will focus the discussion mostly on the findings for reduced specificity and increased emotional response.

Reduced specificity and increased emotional response

As we mentioned in the introduction, it may seem contradictory that maladaptive RT is associated with both increased emotional response to MTT and reduced specificity of MTT, which is thought to be associated with decreased emotional response. There are several possible ways to explain this finding.

First, conceptualizations and hence operationalizations of maladaptive RT differs across studies. For the studies examining reduced specificity there seems to be consensus that maladaptive RT involves *analytical*, *abstract*, repetitive thinking. For the studies examining emotional reactivity, on the other hand, this conceptualization is not necessarily adopted. Many of these studies (e.g., Kross et al., 2005) differentiate *immersed* analytical RT and *distanced* analytical RT, conceptualizing the immersed analytical (*why*) RT as maladaptive rumination, and the distanced analytical (*why*) RT as adaptive. Thus, in one approach analytical RT is conceptualized as

maladaptive, whereas in the other approach analytical RT is conceptualized as adaptive when combined with a distanced perspective. It is thus possible that the analytical distanced condition (the adaptive RT condition in the emotional response approach) is similar to the abstract, analytical RT (the maladaptive RT condition in the reduced specificity approach). In line with this, some researchers have suggested that the distanced analytical RT may function as avoidance and prevent emotional processing from taking place, in reality being maladaptive (e.g., Wimalaweera & Moulds, 2008; Moulds, 2009; although see Fabianson et al., 2012; Grisham et al., 2011). The disagreement about the distanced why condition centers on whether the lowered emotional response is viewed as the result of emotional processing (adaptive) or the result of avoidance processes (maladaptive), which will in the long term lead to heightened negative emotions. To clarify this, the emotional effects of the distanced why condition need to be examined over longer time intervals (e.g., Kross & Ayduk, 2008; Wimalaweera & Moulds, 2008). If the distanced why condition is really the maladaptive condition, then the apparent contradiction in results disappears as maladaptive RT is associated with both reduced specificity and reduced emotional response (due to lack of emotional processing). However, two things speak against this conclusion. First, Watkins (2008) has pointed out that the abstract RT that he identified as maladaptive does not necessarily correspond to the distanced why thinking style. Second, studies using a conceptualization of maladaptive RT as analytical and abstract (i.e. not the distanced why operationalization) also find that this type of maladaptive RT is associated with increased emotional response (e.g. Denson, Moulds, & Grisham, 2012; Grisham et al., 2011; Hatzenbuehler, Nolen-Hoeksema & Dovidio, 2009, Rusting & Nolen-Hoeksema, 1998). Thus, although it varies what is conceptualized as maladaptive RT, this does not seem to explain why maladaptive RT is associated with both increased emotional response and reduced specificity.

Second, the studies examining reduced specificity often use clinical samples. In the cross-sectional studies, the effect appears to be slightly stronger in clinical groups. The studies examining emotional response, on the other hand, mostly use non-clinical samples. Thus, it is possible that maladaptive RT is associated with reduced specificity and hence decreased emotional response in clinical populations, while maladaptive RT is associated with increased emotional response in healthy populations. This difference in effect between clinical and healthy samples could be due to the reduction of executive resources in clinical population (Dalgleish et al., 2007). Thus, maladaptive RT may be more likely to lead to overgeneral MTT and reduced emotional response, when executive resources are depleted (Williams et al., 2007). In healthy samples, with normal executive function, maladaptive RT would be less likely to lead to overgeneral MTT and reduced emotional response, but may instead cause increased emotional response to MTT. However, the finding that overgeneral MTT is also observed in healthy samples, especially when using more sensitive tests (e.g. Raes et al., 2007), indicates that the effect of maladaptive RT may not consistently differ between clinical and healthy samples.

Third, the type of control condition varies. The most typical comparison in the studies examining reduced specificity is distraction or experiential self-focus. In the emotional response studies the control conditions are more diverse, including distraction, reflection, reappraisal, distanced analytical RT, distanced-what and immersed-what. Obviously the effect of maladaptive RT depends on what it is compared to. But since studies from both approaches usually include control conditions that would generally be considered beneficial compared to maladaptive RT (i.e., distraction, reappraisal, experiential self-focus), this does not seem to explain the finding that maladaptive RT is associated with both increased emotional response and reduced specificity.

Based on the above, it appears that differences in operationalizations, sample and control conditions do not fully explain why maladaptive RT is associated with both increased emotional response and reduced specificity, which is assumed to be associated with decreased emotional response. We suggest that the findings may appear because the two lines of research examine different phases of MTT. Thus, studies on emotional response examine the effects of maladaptive RT on response *after* MTT (with one exception), while studies on reduced specificity examine the effect of maladaptive RT at an earlier phase of MTT, namely the *identification* of the event that one will travel to. It is possible that the relationship between maladaptive RT and emotional response to MTT would be different if maladaptive RT is applied *before* MTT. We now turn to considerations of how maladaptive RT may be simultaneously associated with both reduced specificity of MTT (when applied before MTT) and increased emotional response (when applied after MTT).

Following the CaR-FA-X model, maladaptive RT may generally hinder the access to specific events because the abstractness of maladaptive RT captures the search process at the general level and over time leading to an over-elaborated network at this level. This tendency will be enhanced during times of depression, stress or other conditions causing reduced executive functions (Williams et al., 2007). However, even individuals with a tendency to maladaptive RT and hence overgeneral recall will sometimes travel mentally to specific events and when they do, this may trigger maladaptive RT where they focus on the negative emotional parts of the events for longer time leading to an increased emotional response (Kross et al., 2005; Lyubomirsky & Nolen-Hoeksema, 1995). Over time the accumulated experience with intense negative emotional reactions may even lead to the development of conditioned avoidance of mentally travelling to specific events (for similar views see Williams et al., 2007; Debeer et al., 2011; Raes, Hermans, de Decker, Eelen, & Williams, 2003). In this understanding, maladaptive RT will be associated with characteristics of

MTT leading to cycles of intense negative emotions and attempts at avoidance through overgeneral recall (and perhaps other characteristics of MTT). This is consistent with findings that maladaptive RT is associated with avoidance more generally (e.g. McEvoy, Mahoney & Moulds, 2010), that strong negative events generally lead to simultaneous intrusion and avoidance responses (e.g. Horowitz, Wilner & Alvarez, 1979) and that individuals high in maladaptive RT may generally be deficient in emotion-regulation, leading them to use a range of strategies that are not beneficial in the long term (e.g. Nolen-Hoeksema, Wisco & Lyubomirsky, 2008). The limitation of this hypothesis is that it is based on the assumptions that reduced specificity is associated with reduced emotional response and that overgeneral recall may develop through conditioned avoidance – two assumptions that need to be more thoroughly evaluated (but see Debeer et al., 2011; Raes et al., 2003, 2006; Williams et al., 2007 for some support, however see also Philippot, Schaefer, & Herbette, 2003).

Future directions

Based on the findings in this review we believe that future studies should focus on 1) clarifying and comparing the effect of the different conceptualizations of maladaptive RT within studies, some of the important dimensions being abstract-concrete, immersed-distanced (or field-observer), evaluative-mindful and past-future (i.e. comparing the effect of worry and rumination) (Kross et al., 2005; Watkins, 2008), 2) examining the effects of maladaptive RT on several characteristics of MTT within studies, e.g. emotional response, sensory characteristics, perspective and reduced specificity in the same study; 3) comparing the effects of maladaptive RT applied before, during and after MTT, on characteristics of MTT; 4) examining the effects of maladaptive RT on MTT and the associated emotional response over time, e.g. is maladaptive RT initially associated with increased emotional response to mentally travelling to certain events and later

associated with reduced emotional response to travelling to the same events because of reduced specificity or other strategies aimed at decreasing the emotional response to MTT?; 5) comparing the effect of maladaptive RT in clinical and healthy samples, e.g. do depression and anxiety alter the relationship between maladaptive RT and characteristics of MTT; 6) examining how maladaptive RT interacts with characteristics and emotional responses to mentally travelling to both positive and negative events, as well everyday events, and how these relationships manifest at different points during MTT and in different populations.

Also, the review shows that the far majority of studies examine voluntary past MTT, where memories are retrieved in response to cues, most often word-cues. Although involuntary MTT and future MTT are both based on the same general system as voluntary past MTT (e.g. Schachter, Addis & Buckner, 2007; Szpunar, 2010; Suddendorf & Corballis, 2007), they also differ in important ways. For instance, future MTT is thought to require more executive resources than past MTT (e.g. D'Argembeau, Ortola, Jumentier & van der Linden, 2010), whereas involuntary MTT is thought to require less executive resources than voluntary MTT (Berntsen, 2010). Given that executive resources may play an important role in the relationship between maladaptive RT and reduced specificity of MTT (Dagleish et al., 2007; Williams et al., 2007), it could be predicted that maladaptive RT would show stronger associations with reduced specificity of future MTT and weaker associations with reduced specificity in involuntary MTT (e.g., Watson, Berntsen, Kuyken, & Watkins, 2013).

Likewise, the type of MTT may affect the relationship between maladaptive RT and emotional response. Involuntary memories tend to come with more emotional impact than voluntary memories, possibly because the individual is not able to engage in any strategies to regulate the associated emotional response as the memories come unbidden (Berntsen, 2009). Because of this

difference, it may be that maladaptive RT will show stronger associations with the emotional response to involuntary MTT and weaker associations with the emotional response to voluntary MTT. Future studies will need to test these ideas in more detail.

Conclusion

The evidence for associations between maladaptive RT and observer-field perspective and sensory characteristics of MTT is too limited to make any firm conclusions. There was strong support for maladaptive RT being associated with both increased emotional response to mentally travelling to negative events in the past and with reduced specificity of past MTT, which is assumed to be characterized by decreased emotional response. The reason for the apparently contradictory finding may be 1) different conceptualizations of maladaptive RT in the two approaches, 2) sample differences (e.g. clinical versus healthy samples) in the two approaches and/or 3) focus on different phases of MTT in the two approaches. Future studies need to examine these possibilities in more detail.

References

- Ayduk, Ö., & Kross, E. (2008). Enhancing the pace of recovery. Self-distanced analysis of negative experiences reduces blood pressure reactivity. *Psychological Science, 19*, 229-231.
- Ayduk, O., & Kross, E. (2009). Asking “why” from a distance facilitates emotional processing: A reanalysis of Wimalaweera and Moulds (2008). *Behaviour Research and Therapy, 47*, 88-92.
- Ayduk, O., & Kross, E. (2010). From a distance: Implications of spontaneous self-distancing for adaptive self-reflection. *Journal of Personality and Social Psychology, 98*, 809-829.
- Aldao, A., Nolen-Hoeksema, S. & Schweitzer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217-237.
- Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory Manual* (2nd ed.). San Antonio: The Psychological Corporation.
- Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561-571.
- Behar, E., McGowan, S. K., McLaughlin, K. A., Borkovec, T. D., Goldwin, M., & Bjorkquist, O. (2012). Concreteness of positive, negative, and neutral repetitive thinking about the future. *Behavior Therapy, 43*, 300-312.
- Behar, E., Zellig, A. R., & Borkovec, T. D. (2005). Thought and imaginal activity during worry and trauma recall. *Behavior Therapy, 36*, 157-168.
- Berntsen, D. (2009). *Involuntary autobiographical memories. An introduction to the unbidden past*. Cambridge: Cambridge University Press.
- Berntsen, D. (2010). The unbidden past: Involuntary autobiographical memories as a basic mode of remembering. *Current Directions in Psychological Science, 19*, 138-142.
- Berntsen, D., & Jacobsen, A.S. (2008). Involuntary (spontaneous) mental time travel into the past and future. *Consciousness & Cognition, 17*, 1093-1104.

- Berntsen, D., & Rubin, D.C. (2006). Emotion and vantage point in autobiographical memory. *Cognition and Emotion, 20* (8), 1193-1215.
- Bessel, A. L., Watkins, E. R., & Williams, W. H. (2008). Depressive rumination reduces specificity of autobiographical memory recall in acquired brain injury. *Journal of the International Neuropsychological Society, 14*, 63-70.
- Bluck, S., Alea, N., Habermas, T. & Rubin, D. C. (2005). A TALE of three functions: The self-reported use of autobiographical memory. *Social Cognition, 23*, 97-117.
- Borkovec, T. D., & Hu, S. (1990). The effect of worry on cardiovascular response to phobic imagery. *Behaviour Research and Therapy, 28*, 69-73.
- Borkovec, T. D., & Inz, J. (1990). The nature of worry in generalized anxiety disorder: A predominance of thought activity. *Behaviour Research and Therapy, 31*, 321-324.
- Borkovec, T. D., Ray, W. J., & Stöber, J. (1998). Worry: A cognitive phenomenon intimately linked to affective, physiological, and interpersonal behavioral processes. *Cognitive Therapy and Research, 22*, 561-576.
- Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129-148.
- Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of posttraumatic stress disorder. *Clinical Psychology Review, 23*, 339-376.
- Brittlebank, A. D., Scott, J., Williams, J. M. G., & Ferrier, I. N. (1993). Autobiographical memory in depression: State or trait marker? *British Journal of Psychiatry, 162*, 118-121.
- Campbell-Sills, L., & Barlow, D. H. (2007). Incorporating emotion regulation into conceptualizations and treatments of anxiety and mood disorders. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 542-559). NY: Guildford Press.
- Chambers, L., & Davidson, K. (2000). Destructive anger rumination predicts resting blood pressure in older but not younger adults [Abstract]. *Annals of Behavioral Medicine, 22*, S204.

- Clohessy, S., & Ehlers, A. (1999). PTSD symptoms, response to intrusive memories and coping in ambulance service workers. *British Journal of Clinical Psychology, 38*, 251-265.
- Conway, M. A. (2005). Memory and the self. *Journal of Memory and Language, 53*, 594-628.
- Conway, M. A., Csank, P. A. R., Holm, S. L., & Blake, C. K. (2000). On assessing individual differences in rumination on sadness. *Journal of Personality Assessment, 75*, 404-425.
- Crane, C., Barnhofer, T., Visser, C., Nightingale, H., & Williams, J. M. G. (2007). The effect of analytical and experiential rumination on autobiographical memory specificity in individuals with a history of major depression. *Behaviour Research and Therapy, 45*, 3077-3087.
- Crane, L., Goddard, L., & Pring, L. (in press). Autobiographical memory in adults with autism spectrum disorder: The role of depressed mood, rumination, working memory and theory of mind. *Autism*, prepublished October, 5, 2011. doi:10.1177/1362361311418690
- Dalgleish, T., Golden, A.-M. J., Barret, L. F. Yeung, C. A., Murphy, V., Tchanturia, K., Williams, J. M. G., Perkins, N. & Barnard, P. J. (2007). Reduced specificity in autobiographical memory and depression: The role of executive control. *Journal of Experimental Psychology General, 136*, 23-42.
- D'Argembeau, A., Ortola, C., Jumentier, S. & van der Linden, M. (2010). Component processes underlying future thinking. *Memory & Cognition, 38*, 809-819.
- D'Argembeau, A., Renaud, O. & van der Linden, M. (2011). Frequency, characteristics and functions of future-oriented thoughts in daily life. *Applied Cognitive Psychology, 25*, 96-103.
- Debeer, E., Hermans, D., & Raes, F. (2009). Associations between components of rumination and autobiographical memory specificity as measured by a Minimal Instructions Autobiographical Memory Test. *Memory, 17*, 892-903.

- Debeer, E., Raes, F., Williams, J. M. G., & Hermans, D. (2011). Context-dependent activation of reduced autobiographical memory specificity as an avoidant coping style. *Emotion, 11*, 1500-1506.
- de Decker, A., Hermans, D., Raes, F., & Eelen, P. (2003). Autobiographical memory specificity and trauma in inpatient adolescents. *Journal of Clinical Child and Adolescent Psychology, 32*, 22-31.
- Denson, T. F., Moulds, M. L., & Grisham, J. R. (2012). The effect of analytical rumination, reappraisal, and distraction on anger experience. *Behavior Therapy, 43*, 355-364.
- Derogatis, L. R., Covi, L., & Lipman, R. S. (1973). SCL-90: An outpatient psychiatric rating scale-Preliminary report. *Psychopharmacology Bulletin, 9*, 13-28.
- Ehring, T., Zetsche, U., Weidacker, K., Wahl, K., Shönfeld, S., & Ehlers, A. (2011). The Perseverative Thinking Questionnaire (PTQ): Validation of a content-independent measure of repetitive negative thinking. *Journal of Behavior Therapy and Experimental Psychiatry, 42*, 225-232.
- Fabiansson, E. C., Denson, T. F., Moulds, M. L., Grisham, J. R., & Schira, M. M. (2012). Don't look back in anger: Neural correlates of reappraisal, analytical rumination, and angry rumination during recall of an anger-inducing autobiographical memory. *NeuroImage, 59*, 2974-2981.
- Field, A. P., Pscychol, C., & Morgan, C. (2004). Post-event processing and the retrieval of autobiographical memories in socially anxious individuals. *Anxiety Disorders, 18*, 647-663.
- Finnbogadottir, H., & Berntsen, D. (2011). Involuntary and voluntary mental time travel in high and low worriers. *Memory, 19*, 625-640.

- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1997). *Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I/P)*. New York: New York State Psychiatric Institute, Biometrics Research Department.
- Freeston, M.H., Dugas, M.J. & Ladouceur, R. (1996). Thoughts, images, worry, and anxiety. *Cognitive Therapy & Research*, 20, 265-273.
- Gerin, W., Davidson, K. W., Christenfeld, N. J. S., Goyal, T., & Schwartz, J. E. (2006). The role of angry rumination and distraction in blood pressure recovery from emotional arousal. *Psychosomatic Medicine*, 68, 64-72.
- Gibbs, B. R., & Rude, S. S. (2004). Overgeneral autobiographical memory as depression vulnerability. *Cognitive Therapy & Research*, 28, 511-526.
- Gilboa, E. & Gotlib, I. H. (1997). Cognitive biases and affect persistence in previously dysphoric and never-dysphoric individuals. *Cognition and Emotion*, 11, 517-538.
- Gover, M. (2011). The role of rumination in the function, content, and affective quality of self-defining memories. *Psychology Honors Papers*, Paper 12. <http://digitalcommons.conncoll.edu/psychhp/12>
- Grisham, J. R., Flower, K. N., Williams, A. D., & Moulds, M. L. (2011). Reappraisal and rumination during recall of a sad memory. *Cognitive Therapy and Research*, 35, 276-283.
- Gruber, J., Harvey, A. G., & Johnson, S. L. (2009). Reflective and ruminative processing of positive emotional memories in bipolar disorder and healthy controls. *Behaviour Research and Therapy*, 47, 697-704.
- Hackmann, A., Ehlers, A., Speckens, A., & Clark, D. M. (2004). Characteristics and content of intrusive memories in PTSD and their changes with treatment. *Journal of Traumatic Stress*, 17, 231-240.

- Hamilton, M. (1960). A rating scale for depression. *Journal of Neurology, Neurosurgery and Psychiatry*, 23, 56-62.
- Halligan, S. L., Michael, T., Wilhelm, F. H., Clark, D. M., & Ehlers, A. (2006). Reduced heart rate responding to trauma reliving in trauma survivors with PTSD: Correlates and consequences. *Journal of Traumatic Stress*, 19, 721-734.
- Hatzenbeuhler, M. L., Nolen-Hoeksema, S., & Dovidio, J. (2009). How does stigma “get under the skin”? *Psychological Science*, 20, 1282-1289.
- Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., et al. (2004). Measuring experiential avoidance: A preliminary test of a working model. *Psychological Record*, 54, 553-578.
- Hermans, D., Vandromme, H., Debeer, Raes, F., Demyttenaere, K., Brunfaut, E., & Williams, J.M.G. (2008). Overgeneral autobiographical memory predicts diagnostic status in depression. *Behaviour Research and Therapy*, 46, 668-677.
- Holmes, E. A., & Mathews, A. (2005). Mental imagery and emotion: A special relationship? *Emotion*, 5, 489-497.
- Horowitz, M. J., Wilner, N., & Alvarez, W. (1979). Impact of Event Scale: A measure of subjective stress. *Psychosomatic Medicine*, 41, 209-218
- Kao, C.-M., Dritschel, B., & Astell, A. (2006). The effects of rumination and distraction on overgeneral autobiographical memory retrieval during social problem solving. *British Journal of Clinical Psychology*, 45, 267-272.
- Kenny, L.M. & Bryant, R.A. (2007). Keeping memories at an arm’s length: Vantage point of trauma memories. *Behaviour Research and Therapy*, 45, 1915-1920.

- Key, B. L., Campbell, T. S., Bacon, S. L., & Gerin, W. (2008). The influence of trait and state rumination on cardiovascular recovery from a negative emotional stressor. *Journal of Behavioral Medicine, 31*, 237-248.
- Kleim, B., & Ehlers, A. (2008). Reduced autobiographical memory specificity predicts depression and posttraumatic stress disorder after recent trauma. *Journal of Consulting and Clinical Psychology, 76*, 231-242.
- Kross, E., & Ayduk, O. (2008). Facilitating adaptive emotional analysis: Distinguishing distanced-analysis of depressive experiences from immersed-analysis and distraction. *Personality and Social Psychology Bulletin, 34*, 924-938.
- Kross, E., Ayduk, O., & Mischel, W. (2005). When asking "why" does not hurt. Distinguishing rumination from reflective processing of negative emotions. *Psychological Science, 16*, 709-715.
- Kuyken, W., & Moulds, M. L. (2009). Remembering as an observer: How is autobiographical memory retrieval vantage perspective linked to depression? *Memory, 17*, 624-634.
- Libby, L. K., Eibach, R. P., & Gilovich, T. (2005). Here's looking at me: The effect of memory perspective on assessments of personal change. *Journal of Personality and Social Psychology, 88*, 50-62.
- Libby, L. K., Shaeffer, E. M., & Eibach, R. P. (2009). Seeing meaning in action: A bidirectional link between visual perspective and action identification level. *Journal of Experimental Psychology: General, 138*, 503-516.
- Luybomirsky, S., Caldwell, N. D. & Nolen-Hoeksema, S. (1998). Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories. *Journal of Personality and Social Psychology, 75*, 166-177.

- Lyubomirsky, S. & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology*, 69, 176-190.
- Lyubomirsky, S., Tucker, K.L., Caldwell, N.D. & Berg, K. (1999). Why ruminators are poor problem solvers: clues from the phenomenology of dysphoric rumination. *Journal of Personality and Social Psychology*, 77, 1041-1060.
- Maccallum, F., & Bryant, R. A. (2010). Impaired autobiographical memory in complicated grief. *Behaviour Research and Therapy*, 48, 328-334.
- Mackinger, H. F., Loschin, G. G., & Leibetseder, M. M. (2000). Prediction of postnatal affective changes by autobiographical memories. *European Psychologist*, 5, 52-61.
- Marschark, M., & Cornoldi, C. (1991). Imagery and verbal memory. In C. Cornoldi & A. McDaniel (Eds.), *Imagery and cognition* (pp. 133-182). New York: Springer-Verlag.
- McNally, R. J., Lasko, N. B., Macklin, M. L., & Pitman, R. K. (1995). Autobiographical memory disturbance in combat-related posttraumatic stress disorder. *Behaviour Research and Therapy*, 33, 619-630.
- Meyer, T. J., Miller, M. L., Metzger, R. L. & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy*, 28, 487-595.
- McEvoy, P. M., Mahoney, A. E. J. & Moulds, M. L. (2010). Are worry, rumination, and post-event processing one and the same?: Development of the Repetitive Thinking Questionnaire. *Journal of Anxiety Disorders*, 24, 509-519.
- McFarland, C. & Buehler, R. (1998). The impact of negative affect on autobiographical memory: the role of self-focused attention to moods. *Journal of Personality and Social Psychology*, 75, 1424-1440.

- McKinnon, A., Jorm, A F., Christensen, H., Korten, A. E., Jacomb, P. A., & Rodgers, B. A. (1999). A short form of the positive and negative affect schedule: evaluation of factorial validity and invariance across demographic variables in a community sample. *Personality and Individual Differences*, 6, 392-405.
- McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy*, 38, 23-38.
- Miles, A. N., & Berntsen, D. (2011). Odour-induced mental time travel into the past and future: Do odour cues retain a unique link to our distant past? *Memory*, 19, 930-940.
- Morgan, J., & Banerjee, R. (2008). Post-event processing and autobiographical memory in social anxiety: The influence of negative feedback and rumination. *Journal of Anxiety Disorders*, 22, 1190-1204.
- Moulds, M. L. (2009). Asking 'why' still increases intrusions: A response to Ayduk and Kross (2008). *Behaviour Research and Therapy*, 47, 93-96.
- Nigro, G., & Neisser, U. (1983). Point of view in personal memories. *Cognitive Psychology*, 15, 467-482.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effect on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100, 569-582.
- Nolen-Hoeksema, S., & Morrow, J. (1991). Effects of rumination and distraction on naturally occurring depressed mood. *Cognition and Emotion*, 7, 561-570.
- Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B. L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology*, 102, 20-28.
- Nolen-Hoeksema, S.; Wisco, B. E.; Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, 3, 400-424.

- Nowlis, V. (1954). Research with the mood adjective check list. In: S. S. Thomkins, & C. E. Izard (Eds.), *Affect, Cognition and Personality* (pp. 352-389). New York: Springer-Verlag.
- Park, R. J., Goodyer, I. M., & Teasdale, J. D. (2004). Effects of induced rumination and distraction on mood and overgeneral autobiographical memory in adolescent Major Depressive Disorder and controls. *Journal of Child Psychology and Psychiatry*, 45, 996-1006.
- Park, R. J., Goodyer, I. M., & Teasdale, J. D. (2005). Self-devaluative dysphoric experience and the prediction of persistent first-episode major depressive disorder in adolescents. *Psychological Medicine*, 35, 539-548.
- Paivio, A. (1986). *Mental Representations: A Dual Coding Approach*. New York: Oxford University Press.
- Paivio, A., & Marschark, M. (1991). Integrative processing of concrete and abstract sentences. In A. Paivio (Ed.), *Images in the mind: The evolution of a theory* (pp. 134-154). New York: Harvester Wheatsheaf.
- Pillemer, D. B. (1992). Remembering personal circumstances: A functional analyses. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall: Studies of "flashbulb" memories. Emory Symposium in Cognition*, 4 (pp. 236-264. New York: Cambridge University Press.
- Platt, J. J., & Spivack, G. (1975). *Manual for the Means-Ends Problem-Solving Test (MEPS): A measure of interpersonal problem solving skill*. Philadelphia, PA: Hahnemann Medical College Hospital.
- Raes, F., Hermans, D., de Decker, A., Eelen, P., & Williams, J. M. G. (2003). Autobiographical memory specificity and affect regulation: An experimental approach. *Emotion*, 3, 201-206.

- Raes, F., Hermans, D., Williams, J. M. G., Beyers, W., Brunfaut, E., & Eelen, P. (2006). Reduced autobiographical memory specificity and rumination in predicting the course of depression. *Journal of Abnormal Psychology, 115*, 699-704.
- Raes, F., Hermans, D., Williams, J.M.G., Demyttanaere, K., Sabbe, B., Pieters, G., & Eelen, P. (2005). Reduced specificity of autobiographical memories: A mediator between rumination and ineffective problem-solving in major depression? *Journal of Affective Disorders, 87*, 331-335.
- Raes, F., Hermans, D., Williams, J.M.G., Demyttanaere, K., Sabbe, B., Pieters, G., & Eelen, P. (2005). Is overgeneral autobiographical memory an isolated memory phenomenon in major depression? *Memory, 15*, 584-594.
- Raes, F., Hermans, D., Williams, J. M. G., Eelen, P. (2007). A sentence completion procedure as an alternative to the Autobiographical Memory Test for assessing overgeneral memory in non-clinical populations. *Memory, 15*, 495-507.
- Raes, F., Watkins, E. R., Williams, J. M., & Hermans, D. (2008). Non-ruminative processing reduces overgeneral autobiographical memory retrieval in students. *Behaviour Research and Therapy, 46*, 748-756.
- Ramponi, C., Barnard, P.J., & Nimmo-Smith, I. (2004). Recollection deficits in dysphoric mood: An effect of schematic models and executive mode? *Memory, 12*, 655-670.
- Rasmussen, A. S., & Berntsen, D. (2011). The unpredictable past: Spontaneous autobiographical memories outnumber memories retrieved strategically. *Consciousness and Cognition, 20*, 1842-1846.
- Ray, R., Wilhelm, F. H., & Gross, J. J. (2008). All in the mind's eye? Anger rumination and reappraisal. *Journal of Personality and Social Psychology, 94*, 133-145.

- Rice, H., & Rubin, D. C. (2009). I can see it both ways: First- and third-person visual perspectives at retrieval. *Consciousness and Cognition, 18*, 877-890.
- Robinson, M. S., & Alloy, L. B. (2003). Negative cognitive styles and stress-reactive rumination interact to predict depression: A prospective study. *Cognitive Therapy and Research, 27*, 275-292.
- Roger, D. & Najarian, B. (1989). The construction and validation of a new scale for measuring emotion control. *Personality and Individual Differences, 10*, 845-853.
- Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science, 1*, 277-311.
- Rubin, D. C., Berntsen, D. & Bohni, M. K. (2008). A memory-based model of Posttraumatic Stress Disorder: Evaluating basic assumptions underlying the PTSD diagnosis. *Psychological Review, 115*, 985-1011.
- Rubin, D.C., Schrauf, R.W. & Greenberg, D.L. (2003). Belief and recollection of autobiographical memories. *Memory and Cognition, 31*, 887-901.
- Rusting, C. L., & Nolen-Hoeksema, S. (1998). Regulating responses to anger: Effects of rumination and distraction on angry mood. *Journal of Personality and Social Psychology, 74*, 790-803.
- Schacter, D. L., Addis, D. R. & Buckner, R. L. (2007). Remembering the past to imagine the future: The prospective brain. *Nature Reviews Neuroscience, 8*, 657-661
- Schönfeld, S., & Ehlers, A. (2006). Overgeneral memory extends to pictorial retrieval cues and correlates with cognitive features in Posttraumatic Stress Disorder. *Emotion, 6*, 611-621.
- Segerstrom, S. C., Tsao, J. C. I., Alden, L. A., & Craske, M. G. (2000). Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research, 24*, 671-688.

- Segerstrom, S. C., Stanton, A. L., Alden, L. A., & Shortridge, B. E. (2003). A multidimensional structure for repetitive thought: What's on your mind, and how, and how much? *Journal of Personality and Social Psychology*, 85, 909-921.
- Sibrava, N.J., & Borkovec, T.D. (2006). The cognitive avoidance theory of worry. In G. C. L. Davey & A. Wells (Eds.), *Worry and its psychological disorders: Theory, assessment and treatment* (pp. 239-256). Chichester, UK: John Wiley & Sons.
- Spielberger, C. D. (1988). *State-trait Anger Expression Inventory: Professional Manual* (Research ed.). Odessa, FL: Psychological Assessment Resources.
- Spinhoven, P., Bamelis, L., Molendijk, M., Haringsma, R., & Arntz, A. (2009). Reduced specificity of autobiographical memory in cluster c personality disorders and the role of depression, worry, and experiential avoidance. *Journal of Abnormal Psychology*, 118, 520-530.
- Stöber, J. (1998). Worry, problem elaboration and suppression of imagery: The role of concreteness. *Behaviour Research and Therapy*, 36, 751-756.
- Suddendorf, T. & Corballis, M. C. (2007). The evolution of foresight: What is mental time travel, and is it unique to humans? *Behavioral and Brain Sciences*, 30, 299-351.
- Sumner, J. A. (2012). The mechanisms underlying overgeneral autobiographical memory: An evaluative review for the CaR-FA-X model. *Clinical Psychology Review*, 32, 34-48.
- Sumner, J. A., Griffith, J. W., & Mineka, S. (2011). Examining the mechanisms of overgeneral autobiographical memory: Capture and rumination, and impaired executive control. *Memory*, 19, 169-183.
- Sutherland, K., & Bryant, R. A. (2007). Rumination and overgeneral autobiographical memory. *Behaviour Research and Therapy*, 45, 2407-2416.
- Szpunar, K. K. (2010). Episodic future thought: An emerging concept. *Perspectives on Psychological Science*, 5, 142-162.

- Teasdale, J. D., & Green, H. A. C. (2004). Ruminative self-focus and autobiographical memory. *Personality and Individual Differences, 36*, 1933-1943.
- Thomsen, D. K. (2006). The association between rumination and negative affect: A review. *Cognition & Emotion, 20*, 1216-1235.
- Thomsen, D. K., Mehlsen, M. Y., Christensen, S., & Zachariae, R. (2003). Rumination – relationship with negative mood and sleep quality. *Personality and Individual Differences, 34*, 1293-1301.
- Thomsen, D. K., Schnieber, A., & Olesen, M. H. (2011). Rumination is associated with the phenomenal characteristics of autobiographical memories and future scenarios. *Memory, 19*, 574-584.
- Trapnell, P. D., & Campbell, J. D. (1999). Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology, 76*, 284-304.
- Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research, 27*, 247-259.
- Trope, Y., & Liberman, N. (2003). Temporal construal. *Psychological Review, 110*, 403-421.
- Tulving, E. (2002). Episodic memory: From mind to brain. *Annu. Rev. Psychol., 53*, 1-25.
- Verplanken, B. (2012). When bittersweet turns sour: Adverse effects of nostalgia on habitual worriers. *European Journal of Social Psychology, 42*, 285-289.
- Vrana, S. R., Cuthbert, B. M., & Lang, P. J. (1986). Fear imagery and text processing. *Psychophysiology, 23*, 247-253.
- Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163-206.

- Watkins, E. R., Ramponi, C., & Barnard, P. J. (2006). Reducing specificity of autobiographical memory in nonclinical participants: The role of rumination and schematic models. *Cognition & Emotion, 20*, 328-350.
- Watkins, E., Moulds, M., & Mackintosh, B. (2005). Comparison between rumination and worry in a non-clinical population. *Behaviour Research and Therapy, 43*, 1577-1585.
- Watkins, E., & Teasdale, J. D. (2001). Rumination and overgeneral memory in depression: Effects of self-focus and analytic thinking. *Journal of Abnormal Psychology, 110*, 353-357.
- Watkins, E., & Teasdale, J. D. (2004). Adaptive and maladaptive self-focus in depression. *Journal of Affective Disorders, 82*, 1-8.
- Watkins, E., Teasdale, J. D., & Williams, R. M. (2000). Decentring and distraction reduce overgeneral autobiographical memory in depression. *Psychological Medicine, 30*, 911-920.
- Watson, L., Berntsen, D., Kuyken, W., & Watkins, E. R. (2013). Involuntary and voluntary autobiographical memory retrieval as a function of depression. *Journal of Behavior Therapy and Experimental Psychiatry, 44*, 7-13.
- Watson, D., & Clark, L. A. (1994). *The PANAS-X. Manual for the positive and negative affect schedule-expanded form*. Unpublished manuscript, IA: University of Iowa City.
- Wenzel, A., & Jordan, J. (2005). Autobiographical memory in angry and anxious individuals. *Behaviour Research and Therapy, 43*, 1099-1109.
- Werner-Seidler, A., & Moulds, M. L. (2012). Mood repair and processing mode in depression. *Emotion, 12*, 470-478.
- Williams, J. M. G. (2006). Capture and rumination, functional avoidance, and executive control (CaRFAX): Three processes that underlie overgeneral memory. *Cognition and Emotion, 20*, 548-568.

- Williams, J. M. G., & Moulds, M. (2007). Cognitive avoidance of intrusive memories: Recall vantage perspective and associations with depression. *Behaviour Research and Therapy*, 45, 1141-1153.
- Williams, A. D., & Moulds, M. L. (2010). The impact of ruminative processing on the experience of self-referent intrusive memories in dysphoria. *Behavior Therapy*, 41, 38-45.
- Williams, J. M. G., Barnhofer, T., Crane, C., & Beck, A. T. (2005). Problem solving deteriorates following mood challenge in formerly depressed patients with a history of suicidal ideation. *Journal of Abnormal Psychology*, 114, 421-431.
- Williams, J. M. G., Barnhofer, T., Crane, C., Hermans, D., Raes, F., Watkins, E., Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin*, 133, 122-148.
- Williams, J. M. G., & Broadbent, K. (1986). Autobiographical memory in suicide attempters. *Journal of Abnormal Psychology*, 95, 144-149.
- Wimalaweera, S.W., & Moulds, M. L. (2008). Processing memories of anger-eliciting events: The effect of asking “why” from a distance. *Behaviour Research and Therapy*, 46, 402-409.
- Wong, Q. J. J., & Moulds, M. L. (2012). Processing mode during repetitive thinking in socially anxious individuals: Evidence for a maladaptive experiential mode. *Journal of Behavior Therapy and Experimental Psychiatry*.
- Zimmerman, M., Sheeran, T., & Young, D. (2004). The diagnostic inventory for depression: A self-report scale to diagnose DSM-IV major depressive disorder. *Journal of Clinical psychology*, 60, 87-110.

Table 1

Studies examining the relationship between maladaptive RT (mRT) and emotional response.

Nr.	Author(s) (Year)	Sample (N): C = Clinical NC = Non- clinical V = Vulnerable	Type of mRT if not rumination 1) Measure of trait mRT 2) Manipulation of state RT (mRT = maladaptive condition)	Type of MTT if not past, voluntary 1) Event type 2) Dependent variable(s)	Is mRT associated with increased/maintained emotional response to MTT? Y=yes N=no
Experimental studies					
1.	Ayduk & Kross (2008)	NC (90)	2) B-S: Immersed-why (mRT) vs. distanced- why	1) Anger event 2) Reexperiencing of emotions (1-7), physiological measure: MAP	Y-increased & maintained No baseline measure of emotion.
2.	Behar et al. (2005)	s1: NC (78) s2: V (31), V (34) & NC (30)	Worry 2) B-S: worry (mRT) → trauma recall vs. trauma recall → worry	1) Traumatic event 2) Relaxed, anxious, depressed state (1-5) at baseline, post worry, post trauma recall	N-less anxiety during trauma recall when preceded by worry vs. not preceded by worry, but only in s2. Y-more depressed state during recall when preceded by worry, but only for participants high on PTSD symptoms only. N-for relaxed state.
3.	Denson, Moulds, & Grisham (2012)	NC (121)	2) B-S writing task: Analyt. Rumination (mRT) vs. reappraisal vs. distraction vs. spontaneous thoughts	1) Anger event 2) Anger (1-7)	Y- maintained, compared to all but reappraisal Did not last through 15m delay
4.	Ehring et al. (2009)	NC (51)	1) RSQ-brooding; PSWQ; PTQ. 2) B-S: recall →Rumination (mRT) vs. distraction	1) Negative life event 2) Positive & negative mood (PANAS). HR	Y- maintained for negative mood N- for positive mood or HR
5.	Fabianson, et al. (2012)	NC (23)	2) W-S: Analyt. rumination vs. angry rumination (mRT) vs. reappraisal	1) Anger event 2) Anger (MACL: 1-7)	Y-increased (angry rum. > anal. rum. > reappr.) No baseline measure of emotion
6.	Grisham, et al. (2011)	NC (81)	2) B-S writing task: rumination (mRT) vs. reappraisal (reappraisal from 3rd person perspective)	1) Sad event 2) State PA & NA (0-4, combined scores from 6 positive and 6 negative emotions)	Y- increased for NA, reduced for PA Did not last through 5m delay
7.	Gruber, Harvey, & Johnson (2009)	C (27) & NC (27)	2) W-S: Rumination (mRT) vs. reflection	1) Happy event 2) PA (PANAS ^a : 1-5). Physiological measures: cardiovascular arousal (HR), sympathetic responding (PTE)	Y-increased, PA. Y-increased, physiological measures, but for HR only.

				& parasympathetic responding (RSA). Behavioural measures: facial expressions.	N-behavioural measures.
8.	Hatzenbuehler, Nolen-Hoeksema, & Dovidio (2009)	NC (s2: 53)	2) B-S: Rumination (mRT) vs. distraction	1) Discrimination event 2) Distress (1-9, combined score of: sad, depressed & anxious state). Implicit mood.	Y-maintained
9.	Kross & Ayduk (2008)	NC (s1: 141 s2: 328)	2)B-S: Immersed-why (mRT) vs. distanced-why vs. distraction	1) Event involving sadness/depression 2) s1 & s2: Depressed affect (1-9, combined score from sad and unhappy mood (unhappy assessed with SAM), s2: Depressed affect assessed again 1-7 days later after retrieving event again (T2)	Y-increased, but at T2 not significantly more than distraction No baseline measure of emotion
10.	Kross, Ayduk, & Mischel (2005)	NC (s1: 155, s2: 133)	2) B-S: s1: Immersed-why (mRT) vs. distanced-why vs. immersed-what (mRT) vs. distanced-what (mRT)	1) Anger event 2) s1: PANAS ^b : NA and anger-index (1-5), implicit anger, s2: Reexperiencing of emotions (1-7)	Y-increased (compared to distanced-why, no comparison was made to the what-conditions) No baseline measure of emotion
11.	Ray et al. (2008)	NC (s1: 82, s2: 117)	2) B-S: Immersed-rumination (mRT) vs. reappraisal from impartial observer perspective	1) Anger event 2) s1 & s2: Anger, positive & negative emotions (composite scores of emotions rated on 0-4) 2) s2: Sympathetic responding: central (PEP) & peripheral (composite of finger & ear pulse, finger temperature); parasympathetic responding (RSA)	Y-increased for anger & negative emotion, no effect for positive emotion. Y –increased for physiological responding, but not parasympathetic. S1: Did not last through delay for anger. S2: No separate measure for recall only.
12.	Rood et al. (2012)	NC (160)	1) SRRS-C 2) B-S: Rumination (mRT) vs. distancing vs. positive reappraisal vs. mindful acceptance	1) Recent stressful event 2) Gloomy, sad & happy mood (VAS 0-100)	Y-prolonged high negative mood and low positive mood compared to positive reappraisal, but not compared to distancing and acceptance (manipulation not successful for acceptance)
13.	Rusting & Nolen-Hoeksema (1998)	NC (s3: 60)	2) B-S: Rumination (mRT) vs. distraction vs. writing spontaneous thoughts	1) Anger event 2) Anger (composite score, 1-9)	Y- increased & maintained

14.	Werner-Seidler & Moulds (2012)	C (33) & C (25)	1) RRS 2) Sad mood induction → recall → abstract RT (mRT) vs. concrete RT	1) Positive event 2) Sad mood (1-9)	Y-maintained sad mood compared to concrete RT; concrete RT reduced sad mood
15.	Williams & Moulds (2010)	V (77)	2) B-S: Rumination (mRT) vs. distraction	1) Most typical intrusive AM of an unpleasant, negative event 2) Negative Affect (VAS 0-100 combined score from sadness and reversed happiness), intrusion related sadness & distress (0-100)	Y- increased Control for baseline ratings
16.	Wimalaweera & Moulds (2008) ⁱ	NC (60)	2) B-S: Immersed-why (M) vs. distanced-why (mRT) vs. immersed-what vs. distanced-what	1) Anger event 2) PANAS-X: global NA, anger-index; implicit anger, memory related anger and distress in the previous 24h (1-100).	Y- why conditions more increase in NA than what conditions, and more implicit anger in distanced why than what conditions. N- for anger-index (here all conditions > distanced what) and 24h memory related anger and distress.

Cross-sectional studies

17.	Gerin et al. (2006)	V (32) & NC (28)	1) DAB-VR: high vs. low ruminators W-S: Distraction vs. no distraction	1) Describe (verbally) anger event 2) BP & HR – rate of recovery	Y-maintained, for high ruminators in the non-distraction condition, only for BP, not for HR
18.	Gover (2011)	NC (60)	1) RRS: high vs. low ruminators; Rumination on memories scale: Number of memories reflected, brooded, or depressively ruminated on	1) 10 self-defining memories 2) Negative & positive feelings (0-4)	Y-increased for neg-feelings (decreased for pos-feelings)- but only for number of memories brooded on and depressively ruminated on (not reflected on), not for trait rumination (RRS: total, reflection, brooding, depressive, high vs. low ruminators)
19.	Halligan, et al. (2006)	C (25) & NC (38) assault victims	1) Trait rumination interview	1) Describe (verbally) trauma event 2) HR during retrieval	N-less
20.	Key et al. (2008)	V (25) & NC (39)	1) SRRS: high vs. low ruminators 2) Assessed with thought probes	1) Stressful negative event vs. everyday event 2) Recovery: BP (systolic & diastolic), HF-HRV	Y-maintained for trait mRT but only diastolic BP. Y-maintained for state mRT but only for low ruminators, and not systolic BP. Control for baseline reactivity

21.	Thomsen et al. (2011)	NC (s1: 82, s2: 132, s3: 583)	1) ECQ-R; RRQ	Past & future, voluntary 1) s1: Negative & positive memories, s2-s3: high point & low point memories, positive and negative future projections 2) s1-3: Emotional (p)reliving (1-7), s1-s2: physical reliving (1-7)	Y- increased for emotional (p)reliving of low point memories and neg. future events (s2 & s3 only), and pos. future events (but in s3 only). Y-increased for physical reliving of negative memories (but in s1 only)
22.	Verplanken (2012)	NC (203)	Trait worry 1) HINT	1) Nostalgic event vs. everyday experience 2) PANAS ^b (1-5) of positive & negative mood	N Control for baseline measures of mood

Note: B-S = Between-subjects. W-S = Within-subjects. C = clinical sample. NC = non-clinical sample. V = vulnerable sample. mRT = maladaptive repetitive thinking.

GAD = Generalized Anxiety Disorder. PTSD = Posttraumatic Stress Disorder. PA = Positive affect. NA = Negative affect. State PA and NA = State measure of positive and negative affect (Ray et al., 2008). PANAS^a = Positive and negative affect schedule (McKinnon et al., 1999). PANAS^b = Positive and negative affect schedule (Watson, Clark, & Tellegen, 1988). PANAS-X = Watson & Clark, 1994. MACL = Mood adjective checklist (Nowlis, 1965).

ECQ-R = Emotional Control Questionnaire– Ruminative subscale (Roger & Najarian, 1989). DAB-VR = Destructive Anger Behavior-Verbal Rumination (Chambers & Davidson, 2000). HINT = Habit Index of Negative Thinking (described in Verplanken, 2012). RRS = The Ruminative Response Scale (Treynor et al., 2003). Rumination on memories scale (Gover, 2011). Trait rumination interview (Michael, Halligan, Ehlers, & Clark, 2007). SRSS = Stress reactive rumination scale (Robinson & Alloy, 2003). RRQ = Rumination-Reflection Questionnaire (Trapnell & Campbell, 1999). VAS = Visual analogue scale.

BP = Blood Pressure. MAP = Mean arterial blood pressure. HR = heart rate. HRV = Heart rate variability (refers to the beat-to-beat variation in HR produced by the interplay between sympathetic and parasympathetic neural activity). HF-HRV recovery = HRV in high frequency areas (used to infer parasympathetic nervous activity). PEP = Preejection period (higher values reflect greater sympathetic activation). PTE = Pulse Transmission Time to Ear (Shorter PTE reflects greater autonomic sympathetic activation). RSA = Respiratory sinus arrhythmia (higher values reflect greater parasympathetic activity or cardiac vagal tone).

Table 2.

Studies examining the relationship between maladaptive RT (mRT) and, (a) reduced sensory characteristics, and (b) more observer perspective.

Nr.	Author(s) (Year)	Sample (N): C = Clinical NC = Non- clinical V = Vulnerable	Type of mRT, if not rumination 1) Measure of trait RT 2) Manipulation of state RT	Type of MTT, if not past, voluntary 1) Memory task (cue) 2) Dependent measure 3) Other relevant measures	Is mRT associated with reduced sensory characteristics, or more observer perspective? Y- yes N -no
(a) Sensory characteristics					
1a.	Behar et al. (2005)	s1: NC (78) s2: V (95)	Worry 2) B-S: worry → trauma recall vs. trauma recall → worry	1) Recall traumatic event 2) Percentage of time spent on thoughts vs. images	N (no effect of order on perc. of imagery during trauma recall)
2a.	Finnbogadottir & Berntsen (2011)	NC (16) & V(20)	Worry, 1) PSWQ: high vs. low worriers	Past & future, voluntary & involuntary 1) Involuntary MTT: diary method. Voluntary MTT: neutral word cues 2) P)reliving (1-7), visual vividness (1-7),	N
3a.	Thomsen et al. (2011)	NC (s1: 82, s2: 132)	1) ECQ-R; RRQ	1) s1: Negative & positive memories, s2: high point and low point memories 2) Vividness (1-7)	N
(b) Visual perspective					
1b.	Ayduk & Kross (2010)	NC (56)	1) RRS–brooding	1) Retrieve memory of rejection 2) Degree of field-observer (1-7)	N-associated with more field perspective
2b.	Finnbogadottir & Berntsen (2011)	NC (16) & V(20)	Worry 1) PSWQ: high vs. low worriers	Past & future, voluntary & involuntary 1) Involuntary MTT: diary method. Voluntary MTT: neutral word cues 2) Degree of field-observer (1-7)	N
3b.	Kuyken & Moulds (2009)	C (123)	1) RRQ	1) AMT (+ and – words) 2) Field or observer	N
4b.	Williams & Moulds (2007)	C (19); NC (128)	1) RRS of the RSQ	Past, involuntary 1) Intrusive memory interview 2) Degree of field-observer (1-7), recoded into field or observer 3) BDI-II	Y- for high dysphorics only

Note: B-S = Between-subjects. C = clinical sample. NC = non-clinical sample. V = vulnerable sample. mRT = maladaptive repetitive thinking. MTT = mental time travel. BDI-II = Beck Depression Inventory – Second Edition (Beck et al., 1996). ECQ-R = Emotional Control Questionnaire – Rumination subscale (Roger & Najarian, 1989). PSWQ = Penn State Worry

Questionnaire (Meyer et al., 1990). RRQ = Rumination-Reflection Questionnaire (Trapnell & Campbell, 1999). RRS-brooding = Brooding subscale of the Ruminative Responses Subscale – Revised (Treynor et al., 2003). RRS = Ruminative Response Scale of the Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991).

Table 3

Studies examining the relationship between maladaptive RT (mRT) and reduced specificity.

Nr.	Author(s) (Year)	Sample (N) C = Clinical NC = Non- clinical V = Vulnerable O = Other mental condition	Type of mRT, if not rumination 1) Measure of trait mRT 2) Manipulation of state RT (mRT = maladaptive condition)	Type of MTT if not past, voluntary 1) Memory task (cues) 2) Other specifications/ relevant measures	Is mRT associated with reduced specificity? Y=yes N=no
Experimental studies					
1.	Bessel, Watkins, & Williams (2008)	O (58)	1) RSQ ^a 2) B-S: Rumination (mRT) vs. distraction	1) AMT (+, - and neutral words) 2) BDI	Y, for both state and trait mRT Results for trait RT not due to depressive symptoms
2.	Crane et al. (2007)	NC (17) & V (16)	1) RRS ^b : high vs. low ruminators 2) B-S: Analytical (mRT) vs. experiential rumination	1) AMT (+ and – words) 2) Mood pre- post manipulation	Y, but only for those high on trait rumination Not due to mood change
3.	Kao, Dritschel, & Astell (2006)	NC (33) & V (33)	2) B-S: Rumination (mRT) vs. distraction	Involuntary 1) Memories spontaneously retrieved during MEPS after RT manipulation 2) Mood pre- post- manipulation 2) Not told to retrieve specific events	N
4.	Park et al. (2004)	C (75) & O (26) & NC (33)	2) B-S: Rumination (mRT) vs. distraction	1) AMT-adolescent version (+ and – words) 2) Mood pre- post- manipulation	Y, but for MDD patients only Not related to mood change
5.	Raes et al., (2008)	NC (195)	2) B-S: Abstract- evaluative thinking (mRT) vs. concrete- experiential thinking	1) SCEPT sentence completion; FC-SCEPT (+ and – words) 2) Mood & self-focus pre- post-manipulation	Y, for SCEPT. Y, for FC-SCEPT, but only for participants that successfully adopted manipulation. Not related to changes in self-focus or mood
6.	Sutherland & Bryant (2007)	s1: V(26) & NC (28). s2: V(48) & NC (50)	2) B-S: s1: Rumination (mRT) vs. distraction; s2: Positive vs. negative (mRT) rumination	1) AMT (+, - and neutral words) 2) s2: Mood (+ & -) pre- post-manipulation	Y, but only for the high dysphoric group S2: Not solely due to mood change (comparable mood changes in high & low dysphoric groups)
7.	Watkins, Barnard, & Ramponi (2006)	NC (s1: 36)	State RT 2) B-S: Analytical RT on <i>narrow</i> self-related theme (mRT) vs. <i>intermixed</i> self- related themes.	1) AMT (+, - and neutral words) 2) Mood ratings in each block. 2) Manipulation + AMT in 3 blocks	Y Not related to mood change

8.	Watkins & Teasdale (2001)	C (36)	2) B-S: Analytical thinking (mRT, high analysis, high self-focus) vs. abstraction (high analysis, low self-focus) vs. experiential thinking (low analysis, high self-focus) vs. distraction (low analysis, low self-focus)	1) AMT (+, - and neutral words) 2) Mood pre- post-manipulation	Y, but for both high analysis conditions (rumination, abstraction) Not related to mood change
9.	Watkins & Teasdale (2004)	C (28)	2) B-S: Analytical (mRT) vs. experiential rumination	1) AMT (+, - and neutral words) 2) Mood pre- post-manipulation	Y Not related to mood change
10.	Watkins, Teasdale & Williams (2000)	V(48) of which at least 54% =C	2) B-S: Rumination (mRT) vs. distraction	1) AMT (+, - and neutral words) 2) Mood pre- post-manipulation	Y Not related to mood change
Cross-sectional studies					
11.	Crane, Goddard, & Pring (in press)	O (28) & NC (28)	1) RRS ^a	1) AMT (+, - and neutral words)	Y, for the NC group only
12.	Debeer, Hermans, & Raes (2009)	NC (314)	1) RRS ^b ; total rumination score, brooding and reflection subscales B-S: TIG vs. MIG	1) TIG = AMT traditional, MIG = AMT minimal instructions (both: +, - and neutral words) 2) BDI-II	Y- for MIG only Not due to severity of depressive symptoms (for brooding)
13.	De Decker et al. (2003)	O (27)	Worry, trait 1) PSWQ	1) AMT (+ and – words) 3) Not reported whether self or observer rated	N
14.	Finnbogadottir & Berntsen (2011)	V (20) & NC (16)	Worry, trait 1) PSWQ: high vs. low worriers	Past & future, voluntary & involuntary 1) Diary method (voluntary MTT: neutral words) 2) Not told to retrieve specific events 2) Specificity self-rated.	N
15.	Gover (2011)	NC (60)	1) RRS ^b (total score, reflection, brooding, depressive subscales, high vs. low ruminators)	1) Retrieve 10 self-defining memories. 2) Not told to retrieve specific events	N
16.	Hermans et al. (2008)	C (26)	1) RSS	1) AMT (+ and – words)	N
17.	Kleim & Ehlers (2008)	C (80) & NC (123)	1) RIQ-rumination subscale	1)AMT (+ and – words)	Y
18.	Maccallum & Bryant (2010)	C (24) & NC (21)	1) RRS ^a -brooding subscale	1) AMT (+ and – words)	N
19.	Park, Goodyer, & Teasdale (2005)	C (94)	1) RSQ ^a	1) AMT (+ and – words)	Y-but only for positive cues
20.	Raes, Hermans, Williams,	C (28)	1) RSS	1) AMT (+ and – words) 2) HRSD	Y Not due to depression

	Beyers et al. (2006)				
21.	Raes et al. (2005)	C (24)	1) Composite score from RRS ^a & RSS	1) AMT (+ and – words)	Y
22.	Raes, Hermans, Williams, Demyttenaere et al. (2006)	C (26)	1) Composite score from RRS ^a & RSS	1) AMT (+ and – words) 3) HRSD	Y Not due to depression severity
23.	Raes et al. (2007)	NC (s1: 197, s2: 29)	1) VARS	1) s1:AMT written format (+ and – words); SCEPT; s2: SCEPT-SI	Y for SCEPT. N for AMT and SCEPT-SI
24.	Ramponi, Barnard, & Nimmo-Smith (2004)	V (16) & NC (16)	1) RSQ ^b , rumination subscale	1) AMT (+, - and neutral words) 2) BDI	Y Not due to depressive symptoms
25.	Schönfeld & Ehlers (2006)	C (29) & NC (26) trauma survivors.	1) RIQ, rumination subscale	1) AMT (+ and – words) 2) INT (intrusion frequency, intrusion newness), RIQ (thought suppression subscale)	Y Not due to intrusion frequency, intrusion newness or thought suppression
26.	Spinhoven et al. (2009)	O (294) & NC (108)	Worry, trait 1) PSWQ	1) AMT-personal trait version (+ and – words) 2) SCID-I, SCL-90-D, AAQ	Y Not due to depression severity, experiential avoidance, current or lifetime depression
27.	Sumner, Griffith, & Mineka (2011)	V (54) & NC (55)	1) RRS ^a : high vs. low ruminators	1) AMT (+ and – high & low self-relevant words; individualized for self- relevance) 2) DID	Y, for low self-relevant cues Not due to depressive symptoms
28.	Watson et al. (2013)	C (20) & NC (20)	1) RRS ^a	Past, voluntary & involuntary 1) Diary method (voluntary AMs: neutral words) 2) Specificity self-rated, and 30% observer-rated 2) Not told to retrieve specific events	Y, but only in the currently depressed group
29.	Wenzel & Jordan (2005)	V (33), V(35) & NC (29)	Worry, trait 1) PSWQ: high vs. non worriers	1) AMT (anger, anxiety and neutral words) 2) TAS; BDI	N

Note: B-S = Between-subjects. W-S = Within-subjects. MDD = Major Depressive Disorder. C = clinical sample. NC = non-clinical sample. V = vulnerable sample. mRT = maladaptive repetitive thinking. MTT = mental time travel.

AAQ = Acceptance and Action Questionnaire (Hayes et al., 2004). AMT = Autobiographical Memory Test (Williams & Broadbent, 1986). AMT-personal trait (McNally et al., 1995). BDI = Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). BDI-II = Beck Depression Inventory – second edition (Beck et al., 1996). DID = Diagnostic Inventory for Depression (Zimmerman, Sheeran, & Young, 2004). FC-SCEPT = Sentence Completion for Events from the Past Test – Forced Choice Version (Raes et al., 2008). HRSD = Hamilton Rating Scale for Depression (Hamilton, 1960). INT = Intrusions Questionnaire (Hackmann et al., 2004). MEPS = Means-End Problem-Solving task (Platt & Spivack, 1975). PSWQ = Penn State Worry Questionnaire (Meyer et al., 1990). RRS^a = Ruminative Response Scale (Nolen-Hoeksema & Morrow, 1991). RRS^b = Ruminative Responses Scale (Treynor et al. 2003). RSS = Rumination on Sadness Scale (Conway et al., 2000). RSQ^a = Response Style Questionnaire (Nolen-Hoeksema & Morrow, 1991). RSQ^b = Response Style Questionnaire (Nolen-Hoeksema, Morrow & Fredrickson, 1993). RIQ-rumination subscale = Responses to Intrusions Questionnaire (Clohessy & Ehlers, 1999). SCEPT = the Sentence Completion for Events from the Past Test (Raes, Hermans, Williams & Eelen, 2007). SCEPT-SI =

Sentence Completion for Events from the Past Test with Specificity Instructions (Raes et al., 2007). SCID-I = Structured Clinical Interview for the DSM-IV Axis I Disorders (First et al., 1996). RSST = Rumination scrambled sentences task (for description see Crane et al., 2007). SCL-90-D = Symptom Checklist-90 in Dutch (Derogatis et al., 1973). TAS = Trait Anger Scale (Spielberger, 1988). VARS = Visul Analogue Rumination Scale (Raes, Hermans, Williams & Eelen, 2007).

Footnotes

ⁱ Ayduk and Kross (2009) report a reanalysis of the findings by Wimalaweera & Moulds (2009), taking effect size into account due to small sample size, and find that by comparing immersed-why and distanced-why, the distanced-why group reported lower levels of explicit anger and NA than the immersed-why group. In response to this Moulds (2009) argues that the comparison conditions of immersed-what and distanced-what should have been included in the reanalysis of the data, as focus on “what” most closely resembles clinical interventions that are the gold standard therapy procedures for facilitating successful emotional processing of emotional events.