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The mechanisms underlying overgeneral autobiographical memory: An evaluative review of evidence for the CaR-FA-X model

Jennifer A. Sumner[a,*]
[a]Department of Psychology, Northwestern University, 2029 Sheridan Road, Swift Hall, Suite 102, Evanston, IL 60208 USA

Abstract

Overgeneral autobiographical memory (OGM) has been found to be an important cognitive phenomenon with respect to depression and trauma-related psychopathology (e.g., posttraumatic stress disorder), and researchers have been interested in better understanding the factors that contribute to this proposed vulnerability factor. The most prominent model of mechanisms underlying OGM to date is Williams et al.'s (2007) CaR-FA-X model. This model proposes that three processes influence OGM: capture and rumination, functional avoidance, and impaired executive control. The author reviews the current state of support for the CaR-FA-X model by evaluating 38 studies that have examined OGM and one or more mechanisms of the model. Collectively, these studies reveal robust support for associations between OGM and both rumination and impaired executive control. OGM also appears to be a cognitive avoidance strategy, and there is evidence that avoiding the retrieval of specific memories reduces distress after an aversive event, at least in the short term. Important issues that have been left unresolved are highlighted, including the nature of the capture phenomenon, the role of trauma in functional avoidance, and the developmental nature of functional avoidance. Recommendations for future research that will enhance understanding of the factors that contribute to OGM are suggested.

Keywords

overgeneral autobiographical memory; autobiographical memory specificity; CaR-FA-X model; capture and rumination; functional avoidance; executive control

Autobiographical memory refers to a knowledge base of personal information that encompasses both specific episodic memories of past events and more conceptual, self-related information (Conway & Pleydell-Pearce, 2000). Autobiographical memories are a critical component of the human experience. Not only do they play a key role in creating a sense of self and identity (e.g., McAdams, 2008), but they also serve as important guides for the future. As records of personal past experiences, such memories provide reminders of the lessons learned from them, thereby helping individuals to solve similar problems in the present or to plan for future action (Williams, 2006).

*Corresponding author: Tel.: 1 847 491 3843; fax: 1 847 491 7859; Jennifer.Sumner@gmail.com.

Over the past 25 years, research has shown that the *way* in which people remember aspects of their personal past namely—whether they recall their past in specific versus overgeneral ways—has important consequences for psychological functioning. First described by Williams and Broadbent (1986) in a study of suicidal patients, overgeneral autobiographical memory (OGM) refers to the finding that, when asked to come up with a specific autobiographical memory in response to a cue word, individuals with certain characteristics are less specific and/or more overgeneral in their recall than others. Rather than retrieving a specific memory for an event that occurred at a particular time and place, and lasted less than a day (e.g., "My college graduation"), individuals with these characteristics often retrieve memories that are summaries or classes of events (categoric memories, e.g., "When I'm with my family"), or memories for events that lasted longer than a day (extended memories, e.g., "My trip to Spain").

What are the characteristics of individuals who are more likely to exhibit OGM? Over the years, the OGM phenomenon has been found to have a robust and replicable association with depression and trauma-related anxiety disorders, such as posttraumatic stress disorder (PTSD; see Moore & Zoellner, 2007 and Williams et al., 2007, for reviews). Furthermore, OGM is not only associated with these disorders, but it is a proposed vulnerability factor for depression and PTSD as well. Consistent with this notion, OGM has been found to predict the onset and/or recurrence of depression and PTSD (e.g., Kleim & Ehlers, 2008; Sumner, Griffith, Mineka, Rekart et al., 2011), as well as a worse course of depression (Hermans, Vandromme et al. 2008; see Sumner, Griffith, & Mineka, 2010, for a meta-analytic review). Moreover, OGM has been associated with deficits in social problem solving (e.g., Goddard, Dritschel, & Burton, 1996) and feelings of increased hopelessness (e.g., Evans, Williams, O'Loughlin, & Howells, 1992).

The CaR-FA-X Model of Mechanisms Underlying OGM

Given that OGM is associated with the etiology and maintenance of depression and trauma-related psychopathology, researchers have been interested in better understanding the factors that contribute to this cognitive phenomenon. Over the years, researchers have postulated various mechanisms that may underlie OGM, and a number of studies have begun to test these relationships. Williams and colleagues (Williams, 2006; Williams et al., 2007) reviewed this work, and they integrated the findings to develop a comprehensive model of factors that may contribute to OGM: the CaR-FA-X model. The CaR-FA-X model is the most prominent and comprehensive model of mechanisms underlying OGM to date, and it is the focus of this review. The model delineates three processes that may underlie OGM: capture and rumination, functional avoidance, and impaired executive control. Capture and rumination are thought to occur when conceptual self-relevant information activates ruminative processes during retrieval, thereby "capturing" cognitive resources and disrupting the retrieval search. Functional avoidance refers to when the retrieval of specific memories is passively avoided as a means of affect regulation, and it is thought to occur in response to early trauma. Impaired executive control refers to when deficits in executive resources limit the ability to conduct a successful retrieval search. These mechanisms are hypothesized to contribute to OGM, alone or in interaction.

The CaR-FA-X model can be understood within the context of a basic model of autobiographical memory: the Self Memory System model of Conway and colleagues (e.g., Conway & Pleydell-Pearce, 2000). The Self Memory System model proposes that there is a continuous hierarchy of autobiographical memory, with representations ranging from 1) more broad, conceptual themes in the life story (e.g., relationships), to 2) lifetime periods (e.g., "my time in college"), to 3) general events (e.g., "parties with friends"), to 4) event-specific knowledge (i.e., specific episodic memories, such as "the party with my friends on the day of our graduation;" Conway & Pleydell-Pearce, 2000; see Figure 1). Specific

autobiographical memories can be retrieved via two processes: generative retrieval and direct retrieval. Generative retrieval is a top-down process involving the delineation of a retrieval model specifying the desired memory recollection. In contrast, direct retrieval results in the retrieval of a specific memory when event-specific knowledge is activated by cues in the environment (rather than retrieved intentionally by the individual). More conceptual, intermediate representations (e.g., general events) are often activated during the early stages of generative retrieval. Generative retrieval involves moving down the memory hierarchy from these intermediate representations that correspond to overgeneral memories in order to access event-specific knowledge, which contains information about the sensory and perceptual aspects of unique events. The CaR-FA-X model postulates that OGM results when the generative retrieval search process is aborted prematurely as a result of one or more of the three proposed mechanisms (Williams et al., 2007).

In addition to delineating the CaR-FA-X model in its entirety, Williams et al. (2007) summarized the empirical support for associations between OGM and the three mechanisms. Further evaluation of factors that may contribute to OGM was provided by Moore and Zoellner's (2007) review on the relationship between trauma and OGM as well. In the latter paper, Moore and Zoellner examined the evidence for the notion that trauma exposure may lead to OGM, which is a key aspect of the theory behind the functional avoidance mechanism.

The publication of these two comprehensive reviews in the same year marked an important point in OGM research. Not only did they evaluate various factors that may contribute to OGM, but these papers also raised important questions regarding the mechanisms underlying this cognitive phenomenon. For example, Moore and Zoellner (2007) suggested that a history of trauma does not seem to be sufficient for the development of OGM via the functional avoidance mechanism. However, they noted that more well-controlled studies of the association between trauma and OGM were needed before definitive conclusions could be reached. Additionally, it was not clear to what extent the different mechanisms of the CaR-FA-X model might interact with one another to contribute to OGM, even though Williams et al. (2007) posited that interactions between the mechanisms are possible. By highlighting important unanswered questions in the literature and offering new testable hypotheses, these two reviews provided an influential framework for subsequent research on this proposed vulnerability factor for depression and trauma-related psychopathology. Much work has been done in the time since on the mechanisms underlying the OGM phenomenon.

Overview of the Current Review

In this paper, I review and evaluate the literature on the mechanisms underlying OGM that has emerged since the Moore and Zoellner (2007) and Williams et al. (2007) reviews. The goal of this review is to ascertain the state of support for the CaR-FA-X model, and to address certain questions that were unable to be answered by the previous reviews because relevant results have only appeared since then. Specifically, I first examine the evidence for each of the three mechanisms of the CaR-FA-X model separately. I then expand the scope of this review and consider the results on the extent to which multiple mechanisms of the model may contribute to OGM, alone and in interaction. Finally, I highlight important questions that remain unanswered regarding the mechanisms underlying OGM, and suggest avenues for further research.

A better understanding of the factors that contribute to OGM has important implications for both future research and clinical applications. For example, research on the mechanisms underlying OGM may provide insights into how this cognitive phenomenon initially develops. In addition, such work may identify ways to refine our conceptual models of the OGM construct, and it may help to inform the designs of subsequent studies. Furthermore,

information on the mechanisms underlying OGM has potential clinical implications. In recent years, OGM has sometimes been the target of clinical intervention. Initial evidence suggests that it is possible to increase memory specificity with training interventions, and that this increase in specificity is associated with beneficial clinical outcomes, such as decreased depressive symptoms and hopelessness (e.g., Raes, Williams, & Hermans, 2009; Serrano, Latorre, Gatz, & Montanes, 2004). Thus it is possible that memory specificity training may be incorporated into future therapeutic interventions, such as treatment for depression. Consequently, knowledge of the mechanisms that are associated with the development of this proposed vulnerability factor for both depression and trauma-related psychopathology might be used to influence intervention and prevention strategies by suggesting targets for treatment and/or training. For instance, if rumination and impaired executive control are found to interact in contributing to OGM, then interventions aimed at reducing ruminative processing and fostering cognitive control of executive processes could have promising implications for the treatment of depression and trauma-related psychopathology by reducing OGM (see Ekkers et al., 2011 and Morrison & Chein, 2011 for interventions that target depressive rumination and executive control deficits).

Review of the Empirical Literature

The papers reviewed in this article were identified by conducting PsycINFO and PubMed searches using the following terms: 1) *overgeneral autobiographical memory*, and 2) *autobiographical memory specificity*.[1] Because the focus of this paper was to review the state of the literature in the time since the Moore and Zoellner (2007) and Williams et al. (2007) reviews, the search was limited to papers that were published from 2005 through May 2011. It was thought that this time frame would allow for the identification of relevant papers that were published after the Moore and Zoellner (2007) and Williams et al. (2007) reviews, along with some earlier papers that might not have been available when these two reviews were written. The search was also limited to papers that were published in English and that included only human participants.

Based on these searches, abstracts were reviewed, and papers were selected if they investigated the relationship between OGM and one or more mechanisms of the CaR-FA-X model. Reference lists from these studies were also reviewed as a source of information. If relevant papers had been cited in the Moore and Zoellner (2007) and/or Williams et al. (2007) reviews, they were only included in the current review if pertinent findings had not been discussed in the prior papers. Some previous reviews on the OGM phenomenon (e.g., Moore & Zoellner, 2007) have only included studies that employed the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986), a cuing methodology that is the most widely used approach for assessing OGM. On the AMT, individuals are presented with cues (e.g., positive and negative words), and are asked to retrieve a unique specific memory in response to each cue. In this review, studies could be included if they used the AMT and/or other measures to assess OGM (i.e., studies included in the review were not limited only to those that used the AMT). By incorporating studies that used measures other than the AMT, this review was able to examine whether the predictions of the CaR-FA-X model hold when applied to OGM as measured with multiple methodologies. The benefit of considering the generalizability of findings in the literature was thought to outweigh the possibility that methodological differences might account for potentially discrepant findings across studies.

Ultimately, 38 studies were included in this review (as summarized in Table 1). The vast majority of these studies were peer-reviewed journal articles (n = 36), although there was one book chapter and one unpublished dissertation. There were 6 studies with primary

[1]The search terms could appear in any search field (e.g., keyword, title).

relevance to the capture and rumination mechanism, 18 studies with primary relevance to the functional avoidance mechanism, 9 studies with primary relevance to the impaired executive control mechanism, and 6 studies that addressed multiple mechanisms of the CaR-FA-X model within a single investigation. The studies included a wide range of participants, including individuals with a history of trauma, individuals with MDD or PTSD, healthy adults from the community, and undergraduate students (see Table 1). The subsequent review is organized accordingly. I briefly describe and review the empirical support for each of the mechanisms of the CaR-FA-X model individually, and then evaluate the literature that examines multiple mechanisms of the model.

Mechanism 1: Capture and Rumination

The capture mechanism posits that individuals can remain at more general levels of memory representation if conceptual information activated during the early stages of generative memory retrieval is related to one's personal concerns and/or self-representation, such as being loved by others or being helpful to others (Williams et al., 2007). If such information is highly elaborated and thereby easily activated, then individuals can be "captured" at this level (see Figure 2). If this occurs, individuals are likely to stay focused on this conceptual information rather than accessing event-specific knowledge. The strong interconnections among this self-related conceptual information can result in intermediate self-representations leading to the activation of other intermediate self-representations, rather than the activation of episodic details, a phenomenon Williams (1996) refers to as mnemonic interlock. Thus, when "captured" in this way, individuals are thought to move across, rather than down, the hierarchy of autobiographical memory. As a result, the process to retrieve a specific memory is disrupted, thereby resulting in OGM. Such capture errors may be especially likely to occur in individuals prone to rumination. According to Nolen-Hoeksema, Wisco, and Lyubomirsky (2008), rumination involves focusing on one's depressive symptoms and the implications of those symptoms in a repetitive, passive, and abstract way (e.g., asking oneself "Why did this happen to me?"). Through this repetitive, self-focused processing style, rumination is postulated to further elaborate intermediate conceptual information in the autobiographical memory hierarchy, thereby increasing the likelihood of being captured during retrieval. Most of the studies on the mechanism of capture and rumination that were identified in this literature review examined either: 1) factors that may increase the likelihood of capture errors, or 2) features of ruminative processing that may be especially related to OGM. Each of these lines of research is reviewed in turn.

The Capture Phenomenon and OGM

As summarized by Williams et al. (2007), the majority of studies on the capture phenomenon have investigated the extent to which there is a relationship between OGM and the degree to which the prompts for specific memories, such as cue words on the AMT, are self-relevant (i.e., related to one's personal concerns). This literature suggests that for individuals in remission from major depressive disorder (MDD), the more that cues on the AMT were judged to be self-relevant, the greater the likelihood of capture, as indicated by higher levels of OGM on the AMT (Crane, Barnhofer, & Williams, 2007 and Spinhoven, Bockting, Kremers, Schene, & Williams, 2007, as reviewed in Williams et al., 2007). Furthermore, no systematic relationship between cue self-relevance and OGM has generally been detected for controls. Such research is in line with the idea that OGM in depression may result when cues activate highly elaborated networks of self-related information (e.g., those corresponding to negative self-schemas), thereby leading to capture and interruption of the retrieval of specific memories (Dalgleish et al., 2003).

In the time since the publication of the Williams et al. (2007) review, some initial findings have emerged that suggest that associations between cue self-relevance and OGM may exist

in nonclinical samples. For example, Sumner, Griffith, and Mineka (2011) studied undergraduate students who were selected on the basis of high and low rumination. Participants rated the extent to which adjectives were self-relevant, and these ratings were used to select cue words for the AMT that were high and low on self-relevance. Rumination was also measured. Contrary to predictions based on the capture phenomenon, greater cue self-relevance was actually associated with a *greater* likelihood of retrieving a specific memory. Furthermore, there was a significant cue self-relevance x rumination interaction, such that higher rumination was associated with a lower probability of retrieving a specific memory primarily for low self-relevant cues. This study differed from prior research in that it recruited a nonclinical sample on the basis of rumination, and history of MDD was not assessed. Furthermore, the self-relevance of cues was rated directly by participants, whereas prior studies used judges to determine whether cues were relevant to participants' self-concerns. Nevertheless, these findings question the notion that capture and OGM are always more likely to occur when retrieval cues map on to high (vs. low) self-relevant concerns. Given that support for an association between greater cue self-relevance and greater OGM comes primarily from studies of clinical samples, such as individuals in remission from MDD, Williams et al.'s (2007) definition of the capture process may be limited to cases in which negative self-schemas are present and activated by retrieval cues. More research with both clinical and nonclinical samples is needed to further examine this issue.

Rumination and OGM

Whereas the literature on the capture phenomenon is somewhat mixed, there is robust support for the notion that rumination is positively associated with OGM in the studies that were reviewed. Based on this literature, two components of ruminative processing in particular appear to be especially maladaptive for autobiographical memory specificity. These include: 1) adopting an abstract, analytical, and evaluative processing style that focuses on the causes, meanings, and consequences of one's experience, and 2) processing negatively-valenced self-related material.

Support for this first component of ruminative processing comes from research that has experimentally induced ruminative or non-ruminative processing modes and then examined their effects on OGM (e.g., Crane, Barnhofer, Visser, Nightingale, & Williams, 2007; Raes, Watkins, Williams, & Hermans, 2008; Sutherland & Bryant, 2007). This work is based on the processing mode theory of rumination (e.g., Watkins, Moberly, & Moulds, 2008). This theory posits that thinking in an abstract, analytical, and evaluative way (e.g., thinking about the causes, meanings, and consequences of one's feelings and depressive symptoms) has more maladaptive consequences than thinking in a concrete, sensory, and experiential way (e.g., focusing on the specific experience of one's feelings and symptoms; see Watkins, 2008, for a review). Indeed, these studies have found that inducing an analytical, evaluative processing mode is associated with higher levels of OGM than inducing a sensory/ experiential processing mode.

Additional support for the notion that an analytical and evaluative way of thinking is especially maladaptive comes from a study that examined the relationship between different subtypes of rumination and OGM (Debeer, Hermans, & Raes, 2009). Reflection and brooding are two moderately correlated subtypes of rumination that have been determined to not be confounded with depressive symptoms (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Whereas reflection is defined as "a purposeful turning inward to alleviate one's depressive symptoms," brooding is defined as "a passive comparison of one's current situation with some unachieved standard" (Treynor et al., 2003, p. 256). Of these two rumination subtypes, brooding is more akin to the analytical processing mode than reflection because it contains more of an evaluative component. In a study of nonclinical undergraduate students by Debeer et al. (2009), only brooding was found to mediate the

relationship between higher levels of depressive symptoms and higher levels of OGM. In contrast, reflection was not a significant mediator.

Together, the findings from these studies suggest that a more analytical and evaluative way of thinking is associated with OGM. Moreover, the results from the studies that employed experimental designs to induce different processing modes suggest that ruminative processing has a causal effect on OGM. In addition, the effects of rumination on OGM do not appear to be mediated by changes in depressed mood (e.g., Sutherland & Bryant, 2007), and similar findings have been observed across samples from diverse populations, including individuals in recovery from MDD (Crane, Barnhofer, Visser et al., 2007), nonclinical/nonselected undergraduate students (Raes et al., 2008), and acute brain injury patients (Bessell, Watkins, & Williams, 2008). Further evidence of the generalizability of these findings comes from the consistency in the results across studies that have employed different measures of OGM. Most work has measured OGM using the AMT (e.g., Crane, Barnhofer, Visser et al., 2007), but ruminative processing was also found to relate to OGM as measured by sentence completion tasks, such as the Sentence Completion for Events from the Past Test (SCEPT; Raes, Hermans, Williams, & Eelen, 2007) and the forced choice SCEPT (Raes et al., 2008). On the SCEPT, individuals complete sentence stems (e.g., “In the past…) with personal memories, and on the forced choice SCEPT, individuals must choose to respond to either a sentence stem that probes for a specific memory or one that probes for an overgeneral memory. Unlike the AMT, these tasks do not prompt participants to retrieve specific memories. These results thus suggest that inducing ruminative processing may impact overall retrieval style, and not just those retrieval processes that are activated when instructed to search for a specific memory.

There is also initial evidence that the valence of ruminative content is related to OGM. Sutherland and Bryant (2007) found that a negative rumination induction (i.e., thinking about negatively-valenced ruminative prompts, such as “Think about the weaknesses in your character”) increased OGM more in nonclinical dysphoric participants than a positive rumination induction (i.e., thinking about positively-valenced ruminative prompts, such as “Think about the strengths in your character”). In dysphoric (and likely depressed) individuals, negative rumination may be more likely to activate networks of negative self-schemas, thereby possibly increasing the likelihood of capture and OGM. As suggested above, additional research is needed to determine whether the capture and rumination mechanism is indeed most likely to occur in the context of depression when negative self-schemas are activated. The results of such studies could serve to further refine the CaR-FA-X model as it operates in the case of depression.

As mentioned above, findings from studies that experimentally induced different processing modes suggest that rumination has a causal influence on OGM. However, there is also evidence that OGM may influence rumination. For example, Raes, Hermans, Williams, Geypen, and Eelen (2006) examined whether OGM may have a causal influence on rumination by inducing either specific or overgeneral memory retrieval styles in a nonclinical sample of undergraduate students. They then investigated the effects of these two memory retrieval inductions on ruminative processing by examining the extent to which participants unscrambled sentences in ways that were or were not consistent with a ruminative interpretation [e.g., “do, something, understand, to, trying” could be unscrambled as either “trying to understand something” (ruminative interpretation) or “trying to do something” (non-ruminative interpretation)]. Compared to high trait ruminators who underwent the specific memory style induction, high trait ruminators who underwent the overgeneral memory style induction completed the scrambled sentences task in a way that was more consistent with ruminative than non-ruminative interpretations. No significant effects of memory style induction were observed for low trait ruminators. Taken together

with the results of the studies cited above, these findings suggest that there is a bidirectional relationship between rumination and OGM, and this is consistent with theorizing on the association between these two constructs (e.g., Williams, 1996).

Summary

In sum, there is strong support for an association between rumination and OGM, with adopting an abstract, analytical processing style and focusing on negative, self-related content being aspects of rumination that are most maladaptive for memory specificity. Furthermore, rumination and OGM appear to be mutually reinforcing processes. In contrast, the evidence for the capture phenomenon is less robust. The self-relevance of cues on the AMT appears to relate to the likelihood of capture, but findings are mixed as to whether greater cue self-relevance is associated with higher or lower levels of OGM. Methodological differences across studies of the capture phenomenon (e.g., differences in the rating of cue self-relevance and in the use of clinical vs. nonclinical samples) complicate interpretations of disparate findings. Thus more research is needed to better understand how this process may operate with respect to OGM.

Mechanism 2: Functional Avoidance

The second mechanism that is thought to contribute to OGM, a proposed vulnerability factor for depression and trauma-related psychopathology, is functional avoidance. The functional avoidance mechanism refers to when the retrieval of specific memories is passively avoided as a means of affect regulation (Williams et al., 2007). According to Conway and Pleydell-Pearce (2000), retrieving memories of negative events, such as childhood trauma, in less specific ways is thought to generate less emotional distress during recall in comparison to retrieving such memories in more specific ways. As a result, it is posited that this less specific retrieval style is less disruptive to the individual than a more specific retrieval style because the influence of potentially emotional material is dampened. Thus a less specific retrieval style is thought to serve a function of regulating negative affect.

Major theorizing on the functional avoidance mechanism can be broken down into four key ideas. First, OGM is thought to develop via functional avoidance in response to trauma, particularly trauma that occurs early in life. Second, OGM is thought to be a cognitive avoidance strategy. Third, it is postulated that specific memories that are highly distressing (e.g., those that are related to a trauma) are especially likely to be avoided, at least in the early stages of the development of the functional avoidance mechanism. Fourth, the avoidance of specific details in memories is thought to reduce emotional distress after an aversive experience; over time, this is thought to develop into an overgeneral retrieval style that is applied generally because the avoidance of specific information is thought to be repeatedly reinforced. I review the empirical evidence for each of these ideas separately. Given the emphasis on the role of trauma (especially early trauma) in theorizing on the functional avoidance mechanism (e.g., Williams, Stiles, & Shapiro, 1999), most of the work that is evaluated examined individuals with a history of trauma and/or PTSD. However, some work has also been conducted with non-traumatized, nonclinical samples of individuals who had undergone a difficult or stressful experience, such as undergraduates who failed an exam (Hermans, de Decker et al., 2008) or who had to solve frustrating puzzles (Raes, Hermans, Williams, & Eelen, 2006).

Is Early Trauma Key to the Development of OGM via Functional Avoidance?

As emphasized by Moore and Zoellner (2007), a substantial body of evidence suggests that a history of trauma—either early or later in life—is not sufficient for the development of OGM because, for example, there have been a number of studies where trauma exposure is

not associated with higher levels of OGM (although nonsignificant findings could be the result of low statistical power). However, several studies examined in this review suggested potential moderators of the trauma OGM relationship. Specifically, the type of trauma, the method of memory retrieval, and the age of abuse onset have been investigated as moderating variables. One caveat is that these moderator findings are initial results that have not yet been replicated. Thus these findings are tentative, and need to be corroborated. Nevertheless, they are presented in order to summarize the state of the literature and to suggest avenues for further exploration.

A number of studies have examined the extent to which the type of trauma might moderate the relationship between trauma and OGM. Such work is motivated by the notion that certain types of trauma may be more likely than others to elicit avoidance strategies and/or the need to regulate affect, and thus may have a stronger association with OGM. For example, Valentino, Toth, and Cicchetti (2009) suggested that retrieving memories of physical and sexual abuse might be more distressing—and therefore more likely to trigger affect regulation strategies for some people—in comparison to retrieving memories of neglect. There is, however, a lack of consistent support for associations between particular types of trauma and OGM. A number of investigations have focused on the relationship between childhood sexual abuse in particular and OGM (e.g., McNally et al., 2006; Raymaekers, Smeets, Peters, & Merckelbach, 2010; Sinclair, Crane, Hawton, & Williams, 2007), but not all studies have found an association with higher levels of OGM (e.g., Johnson, Greenhoot, Glisky, & McCloskey, 2005). Inconsistencies across studies regarding the type of trauma and OGM are likely to be due, at least in part, to low statistical power given that the sample sizes for different types of trauma (e.g., sexual abuse, emotional abuse) tend to be small. In order to systematically examine the relationship between type of trauma and OGM, further research with sufficiently large sample sizes is needed.

The method of memory retrieval (i.e., generative versus direct retrieval) has also been examined as a moderator of the relationship between trauma and OGM, and this investigation has its basis in predictions of the CaR-FA-X model. The model postulates that the three proposed mechanisms should only exert an influence on generative—and not direct—retrieval (Williams et al., 2007). With generative retrieval, individuals strategically search for a specific memory, whereas with direct retrieval, a specific memory is activated by cues in the environment. Hauer, Wessel, Geraerts, Merckelbach, and Dalgleish (2008) tested this prediction within the context of the functional avoidance mechanism. They found that people with a history of childhood sexual abuse were less specific in their memory retrieval than those without a history of childhood sexual abuse when they completed the traditional AMT, a task that is thought to require generative retrieval. In contrast, there was no significant difference in the memory specificity of these two groups on a version of the AMT that was designed to elicit direct retrieval. These results are consistent with the notion that the functional avoidance mechanism of OGM may only be observed when generative retrieval is employed.

As mentioned above, the functional avoidance mechanism posits that trauma that occurs early in life is especially important for the development of OGM via this pathway (e.g., Williams et al., 1999), and this theoretical proposal has begun to be examined in recent years. For example, a few studies have investigated the relationship between the age of abuse onset and OGM. This work can help to begin to delineate the time course of OGM development via the functional avoidance mechanism, and the results may potentially suggest refinements to the theory (e.g., if avoidance of trauma that onsets later in life is found to relate to OGM). To date, there is mixed support for the notion that early trauma is particularly instrumental in the development of OGM via functional avoidance. Indeed, Moore and Zoellner (2007) noted the inconsistency in findings of an association between

childhood trauma and OGM in the four studies they reviewed, and a similar picture emerged from the studies reviewed in this paper. For example, one study of adults with a history of childhood sexual abuse found that a younger age of trauma onset was associated with higher levels of OGM on the AMT, and this is consistent with predictions from the functional avoidance mechanism (Crane & Duggan, 2009). In contrast, in a study of adolescents, higher levels of OGM were positively correlated with current exposure to family violence, but there was no significant association between OGM and exposure to family violence during childhood (Johnson et al., 2005). Although there are methodological differences between these two investigations [e.g., Crane and Duggan (2009) used the traditional AMT to assess OGM, whereas Johnson et al. (2005) measured OGM with a memory test that asked participants to retrieve as many specific memories as they could to different cue words within 3 minutes], the results suggest that the age of abuse onset might be a moderator of the relationship between trauma and OGM. However, the direction of this relationship is not yet clear. In addition, it is important for studies to not confound the age of abuse onset with other factors that could potentially influence OGM, such as the duration and severity of abuse.

Is OGM a Cognitive Avoidance Strategy?

In contrast to the mixed findings on the trauma-OGM link, there was convergent evidence that OGM is a cognitive avoidance strategy, and this is consistent with the conclusion reached by Williams et al (2007). For instance, higher levels of OGM in individuals with PTSD have been found to be positively correlated with a number of avoidance strategies, such as dissociation, thought suppression, and the avoidance of private personal experiences, such as emotional and physical symptoms (Schönfeld & Ehlers, 2006). There is also some evidence that OGM is positively associated with avoidance symptoms of PTSD, such as the extent to which people try to exclude memories of a trauma from consciousness (e.g., Lemogne et al., 2009; Schönfeld & Ehlers, 2006; Schönfeld, Ehlers, Bollinghaus, & Rief, 2007; but see Moradi et al., 2008). These findings are consistent with the aspect of the functional avoidance mechanism that posits that people who are more troubled by their memories of traumatic experiences will be more likely to develop a nonspecific retrieval style that serves to regulate affect.

Are Highly Distressing Memories Especially Likely to Be Retrieved in Less Specific Ways?

Not only does the functional avoidance mechanism propose that OGM is a cognitive avoidance strategy, but it is also thought that the generative retrieval of specific memories is more likely to be avoided for some memories than others. Memories that are highly distressing, such as those related to a trauma, are thought to be especially likely to motivate affect regulation processes, at least in the initial stages of development of the functional avoidance mechanism (Williams et al., 2007). Based on this notion, specific memories that are related to the source of an individual's distress (e.g., a traumatic event) might be more likely to be avoided than specific memories that are unrelated to the source of distress. Over time, this approach to memory retrieval is thought to generalize to the entire autobiographical memory knowledge base.

Some research on this issue has been conducted with bereaved individuals with and without symptoms of complicated grief (CG), a disorder characterized by a number of symptoms of grief that result in functional impairment, such as persistent yearning for and preoccupation with the deceased individual, and intrusive memories about the deceased individual (Prigerson et al., 2009). For individuals with CG, memories about the deceased individual are highly distressing, and they are similar in nature to the trauma-related memories of individuals with PTSD. Compared to bereaved individuals without CG, those with CG might thus be especially likely to exhibit avoidance of specific memories about the deceased

individual. This question has been examined in a number of investigations. For example, in a study of bereaved adults with and without CG, Golden, Dalgleish, and Mackintosh (2007) used cue word tasks based on the AMT to examine participants' memory specificity for 1) their own life, 2) the life of the deceased individual, and 3) the life of a living significant other. Contrary to predictions of the functional avoidance hypothesis, participants with CG were actually *more* specific on the task that asked them to retrieve specific memories about the life of the deceased individual than they were on tasks when they were asked to retrieve specific memories about either their own life or the life of a living significant other. Furthermore, there was no significant difference in the memory specificity of participants with and without CG on the task for retrieving memories about the life of the deceased individual, even though those with CG were less specific than bereaved controls on the other two tasks. In another investigation of OGM in bereaved individuals (Boelen, Huntjens, van Deursen, & van den Hout, 2010), a preferential retrieval of specific memories that were related to the loss versus unrelated to the loss was associated with greater symptoms of CG, depression, and PTSD. Together, these results suggest that some memories that are related to the source of an individual's distress (e.g., the deceased individual for an individual with CG) may actually be "immune" to affect regulation processes.

Nevertheless, not all research is consistent with this view. For example, in a study of bereaved individuals with and without CG, Maccallum and Bryant (2010) coded the content of memories generated on an AMT for relatedness to the loss. In accordance with predictions from the functional avoidance mechanism, they found that individuals with CG recalled fewer specific memories that were related to the loss than those without CG. Methodological differences across these studies exist that make direct comparisons of the results difficult though. For instance, in the study by Golden et al. (2007), loss-relatedness of memories was based on instructions to retrieve memories related to the deceased individual, whereas in the study by Maccallum and Bryant (2010), loss-relatedness of memories was based on coding the content of memories that were retrieved without any instructions constraining memory content. Further research is thus needed to examine this question. Research on this topic should also be expanded to examine these processes in populations beyond individuals with CG.

Does Avoiding the Retrieval of Specific Memories Reduce Emotional Distress after an Aversive Experience?

Despite the inconsistent support for the notion that the specific retrieval of highly distressing memories is especially likely to be avoided, a growing body of evidence suggests that the act of avoiding the retrieval of specific memories after an aversive experience is associated with reduced emotional distress, and this is consistent with the affect regulation component of the functional avoidance mechanism. For example, in a sample of undergraduate students who failed their first exams at university, lower levels of memory specificity 2 weeks after learning of their exam failure predicted lower levels of emotional distress 9 weeks later (Hermans, de Decker et al., 2008). Furthermore, in another investigation, undergraduate students imagined either a negative or neutral specific memory, and then underwent either a thought suppression manipulation or a control manipulation (Geraerts, Hauer, & Wessel, 2010). The thought suppression manipulation was intended to induce avoidance of the memory that was previously imagined, whereas with the control manipulation, participants were told that they could think of any memory. In comparison to those who underwent the control manipulation after imagining a negative specific memory, participants who were instructed to suppress a negative specific memory after imagining it tended to exhibit less of an increase in negative mood from before to after the manipulation. Together these results suggest that the avoidance of specific memory retrieval can have beneficial effects on an individual's emotional state, at least in the short term.

Interestingly, the effects of OGM on emotional distress after an aversive experience may depend on the way in which OGM is defined (i.e., as low memory specificity or high memory overgenerality). Although these two definitions of OGM are often used interchangeably in the literature, they are not necessarily synonymous: Nonspecific memory responses can reflect categoric memories (i.e., high memory overgenerality), but they can also indicate other responses, such as omissions (Williams, 2006). Findings from a study by Raes, Hermans, Williams, and Eelen (2006) suggest that low memory specificity and high memory overgenerality may not have the same effects on emotional experience. For example, in one study (Raes, Hermans, Williams, & Eelen, 2006, Study 1), high-specific students reported higher levels of distress after a frustrating puzzle task than low-specific students who exhibited high levels of omissions. However, there was no significant difference in reported distress between high- and low-specific students after a neutral puzzle task. This finding that lower (versus higher) levels of memory specificity were initially more adaptive after a mild aversive experience is consistent with the notion that reduced memory specificity is advantageous in the short term because the experience of negative emotions is avoided at first. Furthermore, it appears that the avoidance of retrieving specific memories (e.g., by omitting responses), rather than retrieving more overgeneral memories, is particularly associated with this affect regulation process. In another study (Raes, Hermans, Williams, & Eelen, 2006, Study 2), when low-specific students were induced to retrieve memories in a categoric/overgeneral way, they reported *higher* levels of distress after a frustrating puzzle task than low-specific students who completed the same task and were induced to retrieve memories in a specific way. Together, these findings suggest that affect regulation may be accomplished in the short term by avoiding the retrieval of highly specific memories, rather than by retrieving more categoric/overgeneral memories.

Although the above studies have examined the effects of specific and overgeneral memory retrieval on individuals' affective state after a mild aversive experience in the short term, little work has been done to examine the developmental component of the functional avoidance mechanism. The CaR-FA-X model proposes that OGM that develops via the functional avoidance mechanism is initially advantageous because the experience of negative emotions is avoided (Williams et al., 2007). It is thought that an overgeneral retrieval style that is applied more generally across situations then develops over time as the avoidance of specific details of negative experiences is repeatedly reinforced due to its affect regulating properties (Williams et al., 2007). However, OGM that develops in this way is thought to become maladaptive in the long term when it is used as a habitual retrieval response style (i.e., not used only in certain situations to avoid the experience of negative emotions), and thus puts individuals at risk for negative psychological consequences, such as depression. Thus there should be a time period initially after the occurrence of negative experiences (e.g., trauma) where OGM is protective. However, with time, OGM should put individuals with a history of such experiences at risk for adverse psychological outcomes as it become a more inflexible retrieval strategy.

Although there were no direct empirical tests of this notion in this review of the literature, some preliminary indirect support was provided by a study by Aglan, Williams, Pickles, and Hill (2010). Aglan et al. (2010) found that among women with a reported history of childhood sexual abuse, those with adult-onset depression exhibited higher levels of OGM than those with juvenile-onset depression. There was, however, no significant difference in OGM between participants with adult- versus juvenile-onset depression who did not report a history of childhood sexual abuse. Thus for women with early traumatic experiences, greater OGM in adulthood was observed in those with depression that onset later in life after the trauma compared to those with depression that onset earlier in life and closer in time to the occurrence of the trauma. These findings are consistent with the notion that, in those with a history of childhood trauma, OGM may initially be protective but be maladaptive later on.

However, the cross-sectional design of the study and measurement of OGM only during adulthood preclude conclusions about whether the consequences of OGM truly differ with increasing time after a traumatic experience. As a result, direct longitudinal investigations with multiple measurements of memory specificity and its impact on psychological functioning over time are needed.

Summary

Overall, the reviewed studies suggest that OGM is a cognitive avoidance strategy and that a nonspecific retrieval style is associated with less distress after an aversive experience, at least in the short term. There is much less consistent support for the notions that a history of early trauma is a key component of the functional avoidance mechanism and that the retrieval of more (vs. less) distressing specific memories is especially likely to be avoided as a means of affect regulation. One major limitation of the research on functional avoidance is that many studies provide only indirect tests of this proposed mechanism. The functional avoidance mechanism posits that an overgeneral retrieval style that is applied more generally across situations develops over time as the avoidance of specific details of negative experiences is repeatedly reinforced due to its affect regulating properties (Williams et al., 2007). Studies that, for example, find correlational relationships between OGM and other avoidance strategies or symptoms thus cannot offer very compelling support for this mechanism. Longitudinal studies are therefore needed to provide direct tests of the different aspects of the functional avoidance mechanism.

Mechanism 3: Impaired Executive Control

Impaired executive control is the third mechanism that is proposed to underlie OGM, a cognitive phenomenon that has repeatedly been shown to have important consequences for psychological functioning (Williams et al., 2007). Executive control refers to the processes that allow for goal-directed action, such as planning, monitoring, and inhibiting irrelevant information (e.g., Strauss, Sherman, & Spreen, 2006). As summarized by Williams et al. (2007), it is clear that executive control plays a role in the generative retrieval of specific memories. In the time since the publication of the Williams et al. (2007) paper, a number of studies have examined which aspects of executive control might be most associated with OGM. In this review, there was evidence that higher levels of OGM appear to be particularly associated with difficulties with 1) inhibition (Piolino et al., 2010; Raes, Verstraeten, Bijttebier, Vasey, & Dalgleish, 2010), 2) working memory capacity (Birch & Davidson, 2007; Neshat-Doost, Dalgleish, & Golden, 2008; Ros, Latorre, & Serrano, 2010), 3) the ability to update and maintain information in working memory (Piolino et al., 2010; Yanes, Roberts, & Carlos, 2008), and 4) verbal fluency (Heeren, Van Broeck, & Philippot, 2009). These findings are based on studies with samples from a variety of participant populations, including children (Raes et al., 2010), undergraduate students (e.g., Yanes et al., 2008), and older adults (e.g., Ros et al., 2010). Furthermore, these studies employed a wide range of executive control measures, including the Stroop, Hayling, and phonemic fluency tasks (see Strauss et al., 2006, for more details). Each of these executive processes plays a role in the strategic retrieval of a specific memory. For example, inhibition is important for ignoring information that is not directly relevant to the goal of retrieving a specific memory (e.g., categoric memories). Furthermore, on the AMT, individuals need to keep the instructions to retrieve a unique specific memory in working memory, and they also need to hold a retrieval model in working memory during the task. Verbal fluency is a broad measure of executive control that reflects the ability to organize retrieval, initiate and maintain a search set, and inhibit inappropriate responses (Swan & Carmelli, 2002), and these processes also play a role in the strategic search for a specific memory.

Furthermore, the reviewed literature suggests that the effects of impaired executive control on OGM are not merely due to the effects of concurrent mood. Such a conclusion comes from findings that associations between various measures of executive control (e.g., block design, errors on a verbal fluency task) and OGM remained significant even when statistically controlling for levels of depressive symptoms (e.g., Dalgleish et al., 2007). Additional support comes from a study that examined the effects of mood and executive control manipulations on OGM (Rutherford, 2010). In this study, undergraduate students completed the AMT before and after either a positive or negative mood induction. In addition, some participants were assigned to a digit recall condition during the AMT that simulated impaired executive control; others were assigned to a control condition in which they completed the AMT on its own. Participants retrieved fewer specific memories on the AMT in the digit recall condition compared to the control condition, regardless of the valence of induced mood (i.e., deficits in memory specificity were observed for both positive and negative mood inductions). Together, these findings suggest that executive control deficits are associated with OGM irrespective of mood valence.

Some of the recent research on executive control and OGM has adopted certain study designs that appear to be especially helpful for elucidating the relationship between impaired executive control and OGM. These include: 1) incorporating multiple measures of an executive control construct and using structural equation modeling as an analytic strategy (Ros et al., 2010), 2) measuring multiple aspects of executive control and examining the specificity of relationships between particular executive control components and OGM (Heeren et al., 2009), 3) employing experimental manipulations to impair executive control (e.g., Neshat-Doost et al., 2008; Rutherford, 2010), and 4) measuring theoretically-relevant mechanism variables, such as executive control, when investigating change in OGM in an effort to better understand the mechanisms by which such change occurs (Heeren et al., 2009). Not only have these study designs helped to advance research on this topic, but they also offer promising approaches for future investigations. Nevertheless, one limitation of the extant literature is that different studies sometimes reference the same executive control task in different ways. For example, Heeren et al. (2009) referred to the Trail Making Test as a measure of behavioral flexibility, whereas Piolino et al. (2010) referred to it as a measure of shifting. Such inconsistency can complicate comparisons across studies. Even though a given executive control measure is often thought to assess multiple processes (e.g., Strauss et al., 2006), greater consistency in the definitions of executive control tasks across investigations would benefit this line of research.

Summary

In sum, a growing body of literature suggests that OGM is associated with impairments in executive control, especially deficits in inhibition, working memory capacity, the ability to update and maintain information in working memory, and verbal fluency. Furthermore, the link between executive control and OGM does not seem to be accounted for by concurrent mood valence. Executive control encompasses a set of processes that allow for goal-directed action (Strauss et al., 2006), and a strength of several studies in this review is that they incorporated multiple measures of multiple aspects of executive control. Nevertheless, given the complexity of executive control, it is important to have greater consistency in the operationalizations of executive control tasks across investigations in the future.

Examinations of Multiple Mechanisms of the CaR-FA-X Model

As summarized above, the vast majority of research on the CaR-FA-X model has studied the relationship between OGM and one of the proposed mechanisms. Collectively, there is robust support for associations between OGM and both rumination and impaired executive control, and OGM appears to be a cognitive avoidance strategy that reduces distress after an

aversive event, at least in the short term. However, this research does not provide a complete examination of the CaR-FA-X model because Williams et al. (2007) postulate that the three mechanisms may all contribute to OGM, and may potentially interact with one another in doing so.

To date, only a few studies have begun to investigate the extent to which multiple mechanisms of the CaR-FA-X model may jointly underlie OGM. Some of these studies have included measures of multiple CaR-FA-X mechanisms and then examined the unique relationship between one mechanism and OGM when statistically controlling for another mechanism. This approach can be used to examine whether there might be redundancies among the mechanisms in the CaR-FA-X model (i.e., whether one mechanism might account for the relationship between another mechanism and OGM). For example, Raes, Hermans, Williams, Demyttenaere et al. (2006) investigated whether the inverse relationship between rumination and memory specificity in a sample of adults with MDD might be explained by an aspect of executive control, namely working memory (as measured by letter-number sequencing score). In this sample, rumination was negatively correlated with both the proportion of specific memories generated on the AMT and the measure of working memory. Additionally, greater working memory was correlated with greater memory specificity. However, the rumination-memory specificity relationship was still significant when statistically controlling for the measure of working memory. These results suggest that the relationship between rumination and memory specificity in this study was not accounted for by this aspect of executive control.

Some other studies have explicitly examined the main effects and potential interactions among multiple CaR-FA-X mechanisms with respect to OGM. There were no studies in this review that considered all three mechanisms of the model within a single investigation, but there were three studies that adopted this approach to examine two mechanisms. In one study, Raes, Hermans, Williams, Brunfaut et al. (2006) examined the extent to which rumination and a history of trauma (as reported on the Trauma Experiences Checklist) contributed to OGM in a sample of adults with MDD, both alone and in interaction. Higher levels of rumination were associated with higher levels of OGM, and this main effect was qualified by a significant rumination x trauma history interaction. Specifically, among participants who reported a history of higher levels of trauma, high ruminators exhibited higher levels of OGM than low ruminators. However, there was no significant difference in OGM levels for high and low ruminators among participants who reported low levels of trauma. Thus in this study of adults with MDD, rumination was only associated with OGM if individuals reported a history of trauma.

Additionally, two studies have investigated aspects of both the capture and rumination, and impaired executive control mechanisms. In the first study, Barnhofer, Crane, Spinhoven, and Williams (2007) examined this question in a sample of individuals with and without a prior history of MDD. Barnhofer et al. (2007) used the self-relevance of cue words to assess the capture phenomenon, and they experimentally manipulated cognitive load to study the impaired executive control mechanism. In the second study, Sumner, Griffith, and Mineka (2011) studied undergraduate students who were selected on the basis of high and low rumination (as discussed above). Like Barnhofer et al. (2007), they used cue word self-relevance to assess the capture phenomenon, but they expanded their study of the capture and rumination mechanism by measuring rumination, and they assessed naturally occurring (rather than experimentally manipulated) differences in executive control. Barnhofer et al. (2007) found that participants exhibited greater OGM when presented with self-relevant cue words on the AMT under conditions of high—but not low—cognitive load, and this was only true for those with a history of MDD. In the high cognitive load condition, individuals performed a random key-pressing task during the AMT; this was thought to simulate

impaired executive control, and thus these results support the idea of an interaction between capture and rumination, and impaired executive control. As discussed in the section on the capture and rumination mechanism, Sumner, Griffith, and Mineka (2011) observed a significant rumination x cue self-relevance interaction, such that higher rumination was associated with a lower probability of retrieving a specific memory, but only for low self-relevant cues. Furthermore, they found that higher verbal fluency scores (indicative of greater executive control) predicted a greater probability of retrieving a specific memory on the AMT. However, there was no evidence of interactions among the capture and rumination, and impaired executive control mechanisms in this investigation.

Finally, some studies have examined multiple mechanisms of the CaR-FA-X model by employing a unique "reversed" variation of the AMT (AMT-R) that pits the functional avoidance and impaired executive control mechanisms against one another. In this version of the AMT, participants are instructed to come up with categoric memories rather than specific memories as with the traditional AMT (Dalgleish et al., 2007; Dalgleish, Rolfe, Golden, Dunn, & Barnard, 2008). With the traditional AMT, both the functional avoidance and impaired executive control mechanisms predict lower memory specificity, and thus it can be difficult to isolate which mechanism is operating. However, with the AMT-R, the functional avoidance and impaired executive control mechanisms predict different patterns of performance with respect to memory specificity. According to Dalgleish et al. (2007, 2008), with the AMT-R, a negative association between emotional distress and memory specificity is consistent with functional avoidance because higher levels of distress should be associated with a greater need for affect regulation—and therefore lower levels of memory specificity—regardless of the instructions. In contrast, the impaired executive control mechanism would predict a positive association between emotional distress and memory specificity: Higher levels of distress should be linked to greater deficits in executive control, which would lead to a greater inability to reject inappropriate responses specific—memories in the case of the AMT-R—during the retrieval process.

Dalgleish and colleagues used the AMT-R to examine the relationship between memory specificity and symptoms of both depression and PTSD. Interestingly, Dalgleish et al. (2007) found that depressive symptoms were positively correlated with memory specificity on the AMT-R in a community volunteer sample, which is consistent with an impaired executive control account. Moreover, lower scores on the Operation Span Task, a measure of executive control, were associated with greater specificity on the AMT-R in this sample. In contrast, Dalgleish et al. (2008) found that posttraumatic stress symptoms were negatively correlated with memory specificity on the AMT-R in a trauma-exposed sample, which is consistent with a functional avoidance account. Furthermore, in this sample, there was no significant association between scores on Cattell's Culture Fair Test of "g," a broad measure of executive control, and memory specificity on the AMT-R. These findings suggest that different mechanisms may underlie memory specificity in samples with symptoms of depression versus PTSD.

Recommendations for Future Research

Since its discovery by Williams and Broadbent (1986), the OGM phenomenon has been established as a cognitive phenomenon with relevance to the etiology, phenomenology, and maintenance of depression and trauma-related psychopathology (Williams et al., 2007). Over the past several years, a substantial body of work has been accumulating on the mechanisms that may underlie OGM. The CaR-FA-X model of Williams and colleagues (Williams, 2006; Williams et al., 2007) has provided an influential conceptual framework for much of this research. As reviewed above, there is a good deal of empirical support for several aspects of the CaR-FA-X model, with the most robust support for associations

between OGM and rumination and impaired executive control. Nevertheless, a number of questions regarding key aspects of the different mechanisms and how they may jointly contribute to OGM remain unanswered. Furthermore, there are some methodological limitations associated with the investigations in the extant literature (e.g., a reliance on cross-sectional designs for testing the inherently developmental functional avoidance mechanism) that therefore prompt the need for additional research. Here, I highlight several issues that would likely benefit from further study. I also present recommendations for such future research, both with respect to each of the individual proposed mechanisms and to the CaR-FA-X model as a whole.

Capture and Rumination

Although there is robust support for an association between rumination and OGM, further research is needed to better understand how the capture process may operate in both nonclinical and clinical (e.g., depressed) samples. Such work may help to clarify the somewhat discrepant findings in the literature regarding the relationship between OGM and the self-relevance of cues on the AMT (e.g., Spinhoven et al., 2007, versus Sumner, Griffith, & Mineka, 2011). For example, is cue self-relevance only associated with OGM if maladaptive negative self-schemas are present and are activated by self-relevant cues? If so, then the capture phenomenon might be more likely to contribute to OGM in clinical disorders where negative schemas play a prominent role, such as depression, than in nonclinical samples.

Furthermore, the exact process by which rumination contributes to OGM is not well understood. For instance, does rumination reduce working memory capacity, such that participants forget the instructions of the AMT and then retrieve OGM? Or does rumination activate negative self-schemas, which become the focus of attention and thereby “hijack” the retrieval process? The use of a think-aloud study design (cf. Barnhofer, de Jong-Meyer, Kleinpaβ, & Nikesch, 2002) might offer a useful future direction for better understanding this process. For example, a ruminative processing mode could be induced, and then a think-aloud approach could be used to assess the content of individuals’ thought processes during the AMT. In conjunction with the think-aloud approach, an assessment of participants’ understanding for the instructions of the AMT, and/or measurement of aspects of executive control before and after inducing a ruminative processing mode, would also be helpful for shedding light on this process.

Another methodological approach that may have potential for study of the capture and rumination mechanism is the use of the trait AMT (e.g., McNally, Lasko, Macklin, & Pitman, 1995). On this version of the AMT, individuals are presented with trait cue words, and they are instructed to retrieve specific memories about times when they exhibited the trait in question (e.g., in response to the cue word “*clumsy*,” the memory “*When I tripped on the stair*” would be an acceptable answer, but “*When I saw my friend slip on ice*“ would not). This particular methodology may be more likely to tap into memories that are related to self-schemas and self-identity than the traditional AMT because the pool of acceptable responses is limited to memories in which the person exemplified the given trait. In contrast, with the traditional AMT, memories can be retrieved from the entire autobiographical memory knowledge base. Thus the trait AMT might be particularly useful for assessing the capture phenomenon given that capture errors are thought to be more likely when conceptual information activated during the early stages of generative memory retrieval is related to one’s personal concerns and/or self-representation (Williams et al., 2007). Future research could examine this issue by using trait words that map on to individuals’ self-schemas to varying degrees as cues on both the traditional and trait AMTs. If higher levels of OGM were observed for cues that map more closely onto self-schemas for the trait AMT

compared to the traditional AMT, then this might suggest that the trait AMT would be a particularly well-suited methodology for studying capture errors.

Functional Avoidance

A key component of the functional avoidance mechanism that has yet to be adequately examined is the developmental nature of this process. In particular, it is thought that a nonspecific retrieval style employed after a traumatic event is initially advantageous, but then ends up having maladaptive consequences over the long term after the trauma. However, one problem with most studies that have been conducted on the functional avoidance mechanism is that they employ cross-sectional, rather than longitudinal, designs (e.g., Aglan et al., 2010). Cross-sectional designs cannot examine the proposed developmental component of this mechanism, and thus it is not clear at what point the avoidance of retrieving specific memories is no longer adaptive. For instance, is it only when this retrieval strategy is applied generally to all situations—and not only to those that are associated with a traumatic experience—that a nonspecific retrieval style has maladaptive consequences? Longitudinal research that examines both the short term and long term impact of adopting a nonspecific retrieval style after a traumatic experience is important for better understanding this issue. Furthermore, given findings of differential effects of low-specific and high-overgeneral retrieval styles on affective distress after a negative experience (Raes, Hermans, Williams, & Eelen, 2006), it is of interest to investigate whether these two retrieval styles may be related. For example, do individuals exhibit a low-specific retrieval style after an aversive experience as a result of affect regulation and then transition to a high-overgeneral retrieval style as they get older?

Another question for further research is whether a tendency toward avoidance is sufficient to contribute to OGM via the functional avoidance mechanism. Given the role of trauma in theorizing on the functional avoidance mechanism (e.g., Williams et al., 1999), most research on this topic has studied individuals with a history of trauma. However, as reviewed above, research suggests that a history of trauma on its own is not sufficient for the development of OGM. Thus it is of interest to examine whether avoidant tendencies even in the absence of trauma can lead to the development of OGM.

Nevertheless, there is support for the functional avoidance hypothesis in certain traumatized populations (e.g., Dalgleish et al., 2008), and future research on trauma and functional avoidance would benefit from a clarification of what aspects of traumatic experience are most likely to elicit the functional avoidance mechanism. A wide range of experiences has been included in the research on the functional avoidance mechanism. Some studies have examined histories of trauma, such as sexual or physical abuse during childhood (e.g., Valentino et al., 2009), whereas others have looked at responses to frustrating experiences (e.g., a difficult puzzle task; Raes, Hermans, Williams, & Eelen, 2006). A systematic examination of different aspects of trauma and aversive experiences (e.g., the nature, severity, duration, and expectedness of the experience, along with the degree of threat to well-being), and how these relate to OGM would likely provide a more thorough understanding of the functional avoidance mechanism.

Furthermore, much research on trauma and the functional avoidance mechanism has relied on retrospective reports of trauma that are often not verified, and such work is limited by the biases associated with retrospective reporting. However, some studies have used documented cases of abuse. For example, Valentino et al. (2009) recruited maltreated children who were referred by the Department of Human Services, and others have made attempts to corroborate reports of abuse (e.g., Hauer et al., 2008). In addition, the use of interview, rather than questionnaire, measures of trauma (e.g., the Childhood Trauma Interview; Fink, Bernstein, Handelsman, Foote, & Lovejoy, 1995) may help to improve the

study of trauma and the functional avoidance mechanism, as self-report checklists of traumatic experiences have been found to have significant limitations (e.g., Monroe, 2008). Although these approaches may be more challenging to employ, they will likely provide better tests of the processes in question.

Impaired Executive Control

Although research is accumulating that suggests that particular aspects of executive control (e.g., inhibition; Piolino et al., 2010) are associated with OGM, additional research is needed to replicate and extend these findings. An especially promising approach is to include measures of multiple aspects of executive control in the same study in order to determine whether some aspects of executive control are more strongly related to OGM than others. It would also be interesting to examine the contributions of the three CaR-FA-X mechanisms to OGM when variance due to "secondary goal neglect" is minimized. Dalgleish (2004) coined the term "secondary goal neglect" to refer to difficulties with keeping the requirements of the AMT (e.g., providing a unique specific memory) in working memory during the task. A study that minimized variance due to "secondary goal neglect" would provide a test of the associations between the CaR-FA-X mechanisms and OGM that is not the result of individuals forgetting the instructions to retrieve a specific memory on the AMT. Researchers could examine this question by providing continuous reminders of the requirement to retrieve a specific memory throughout the AMT, and this work could potentially offer insights into relationships between the various CaR-FA-X mechanisms and a more habitual overgeneral retrieval style.

Additional Considerations with Respect to the CaR-FA-X Model as a Whole

Importantly, empirical tests of the CaR-FA-X model in its entirety are needed, complete with examinations of main effects and potential interactions of the mechanisms. To date, I am unaware of any studies that examine the model as a whole, and this work is needed to advance and refine our understanding of the mechanisms that underlie OGM. In particular, the field will benefit from pointed tests of interactions among the mechanisms that are based on thoughtful consideration of theories and models of autobiographical memory. Furthermore, studies that employ a longitudinal design will be especially helpful for better understanding how OGM initially develops. In addition, it is of interest to conduct meta-analyses of findings from studies of the CaR-FA-X model in the future. The studies in this review were too varied in nature to provide meaningful overall effect size indices for each of the CaR-FA-X mechanisms. Nevertheless, meta-analytic approaches would be useful for estimating the magnitude of the relationships between OGM and the proposed mechanisms as more studies accumulate.

Given some findings that the differential relationships between OGM and the various CaR-FA-X mechanisms may vary as a function of the type of psychopathology being studied (e.g., Dalgleish et al., 2007, 2008), it is of interest to examine the CaR-FA-X model separately in different populations, such as individuals with current depression, individuals in remission from depression, individuals with PTSD, and nonclinical samples of healthy individuals. As noted by Crane, Barnhofer, Visser et al. (2007), the CaR-FA-X model is not necessarily a "one-size-fits-all" model. For example, capture and rumination may be especially related to OGM in one population, whereas impaired executive control may be the primary mechanism underlying OGM in another population. Not only can such examinations potentially help to identify ways in which the model may differ for different populations, but they might also be used to inform and tailor prevention and intervention efforts for different populations.

Summary and Conclusions

Although this review was not meant to be exhaustive, it is evident that a great deal of work has been conducted in recent years on the mechanisms of the CaR-FA-X model and how they relate to OGM. In this review, there was robust support for an association between rumination and OGM. Rumination and OGM appear to be mutually reinforcing processes, and aspects of rumination that appear to be the most maladaptive for memory specificity include adopting an abstract, analytical processing style, and focusing on negative, self-related content. However, more research is needed to better understand the capture phenomenon and how it operates with respect to OGM. The self-relevance of cues on the AMT appears to relate to the likelihood of becoming "captured" during retrieval, but findings are mixed as to whether greater cue self-relevance is related to higher or lower levels of OGM. With respect to the functional avoidance mechanism, there is strong support for the notions that OGM is a cognitive avoidance strategy and that a nonspecific retrieval style is associated with less distress after an aversive experience, at least in the short term. However, further studies are needed to determine whether a history of early trauma is indeed a key aspect of the functional avoidance mechanism and whether the retrieval of more (vs. less) distressing specific memories is especially likely to be avoided as a means of affect regulation. Direct tests of the developmental nature of the functional avoidance mechanism are also required. In general, there is robust support for an association between impaired executive control and OGM, and this relationship does not appear to be dependent on concurrent mood valence. At present, there is too little research on multiple mechanisms of the CaR-FA-X model and how they may interact to draw definitive conclusions.

In general, a greater understanding and refinement of the CaR-FA-X model will likely be achieved by routinely incorporating measures of the proposed mechanisms when possible in studies of OGM. Such an approach will continue to expand the knowledge base on the factors that underlie OGM, thereby helping us to better understand how this important cognitive phenomenon develops and is maintained.

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References

Aglan A, Williams JMG, Pickles A, Hill J. Overgeneral autobiographical memory in women: Association with childhood abuse and history of depression in a community sample. British Journal of Clinical Psychology. 2010; 49:359–372.10.1348/014466509X467413 [PubMed: 19719909]

Barnhofer T, Crane C, Spinhoven P, Williams JMG. Failures to retrieve specific memories in previously depressed individuals: Random errors or content-related? Behaviour Research and Therapy. 2007; 45:1859–1869.10.1016/j.brat.2007.02.006 [PubMed: 17399680]

Barnhofer T, de Jong-Meyer R, Kleinpaß A, Nikesch S. Specificity of autobiographical memories in depression: An analysis of retrieval processes in a think-aloud task. British Journal of Clinical Psychology. 2002; 41:411–416.10.1348/014466502760387524 [PubMed: 12437795]

Bessell AL, Watkins ER, Williams WH. Depression rumination reduces specificity of autobiographical memory recall in acquired brain injury. Journal of the International Neuropsychological Society. 2008; 14:63–70.10.1017/S1355617708080065 [PubMed: 18078532]

Birch LS, Davidson KM. Specificity of autobiographical memory in depressed older adults and its relationship with working memory and IQ. British Journal of Clinical Psychology. 2007; 46:175–186.10.1348/014466506X119944 [PubMed: 17524211]

Boelen PA, Huntjens RJC, van Deursen DS, van den Hout MA. Autobiographical memory specificity and symptoms of complicated grief, depression, and posttraumatic stress disorder following loss.

Journal of Behavior Therapy and Experimental Psychiatry. 2010; 41:331–337.10.1016/j.jbtep.2010.03.003 [PubMed: 20394916]

Conway MA, Pleydell-Pearce CW. The construction of autobiographical memories in the self-memory system. Psychological Review. 2000; 107:261–288.10.1037/0033-295X.107.2.261 [PubMed: 10789197]

Crane C, Barnhofer T, Visser C, Nightingale H, Williams JMG. The effects of analytical and experiential rumination on autobiographical memory specificity in individuals with a history of major depression. Behaviour Research and Therapy. 2007; 45:3077–3087.10.1016/j.brat.2007.05.009 [PubMed: 17632075]

Crane C, Barnhofer T, Williams JMG. Cue self-relevance affects autobiographical memory specificity in individuals with a history of major depression. Memory. 2007; 15:312–323.10.1080/09658210701256530 [PubMed: 17454667]

Crane C, Duggan DS. Overgeneral autobiographical memory and age of onset of childhood sexual abuse in patients with recurrent suicidal behaviour. British Journal of Clinical Psychology. 2009; 48:93–100.10.1348/014466508X370600 [PubMed: 18922212]

Dalgleish, T. Emotional autobiographical memories, depression and goal neglect. Paper presented at the Annual Congress of the European Association for Behavioural and Cognitive Therapies; Manchester, UK. 2004.

Dalgleish T, Rolfe J, Golden A, Dunn BD, Barnard P. Reduced autobiographical memory specificity and posttraumatic stress: Exploring the contributions of impaired executive control and affect regulation. Journal of Abnormal Psychology. 2008; 117:236–241.10.1037/0021-843X.117.1.236 [PubMed: 18266501]

Dalgleish T, Tchanturia K, Serpell L, Hems S, Yiend J, de Silva P, Treasure J. Self-reported parental abuse relates to autobiographical memory style in patients with eating disorders. Emotion. 2003; 3:211–222.10.1037/1528-3542.3.3.211 [PubMed: 14498792]

Dalgleish T, Williams JMG, Golden AJ, Perkins N, Barrett LF, Barnard PJ, Watkins E. Reduced specificity of autobiographical memory and depression: The role of executive control. Journal of Experimental Psychology: General. 2007; 136:23–42.10.1037/0096-3445.136.1.23 [PubMed: 17324083]

Debeer E, Hermans D, Raes F. Associations between components of rumination and autobiographical memory specificity as measured by a Minimal Instructions Autobiographical Memory Test. Memory. 2009; 17:892–903.10.1080/09658210903376243 [PubMed: 19882439]

Ekkers W, Korrelboom K, Huijbrechts I, Smits N, Cuijpers P, van der Gaag M. Competitive Memory Training for treating depression and rumination in depressed older adults: A randomized controlled trial. Behaviour Research and Therapy. 2011; 49:588–596.10.1016/j.brat.2011.05.010 [PubMed: 21784413]

Evans J, Williams JMG, O'Loughlin S, Howells K. Autobiographical memory and problem-solving strategies of parasuicide patients. Psychological Medicine. 1992; 22:399–405.10.1017/S0033291700030348 [PubMed: 1615107]

Fink L, Bernstein D, Handelsman L, Foote J, Lovejoy M. Initial reliability and validity of the Childhood Trauma Interview: A new multidimensional measure of childhood interpersonal trauma. American Journal of Psychiatry. 1995; 152:1329–1335. [PubMed: 7653689]

Geraerts E, Hauer BJA, Wessel I. Effects of suppressing negative memories on intrusions and autobiographical memory specificity. Applied Cognitive Psychology. 2010; 24:387–398.10.1002/acp.1684

Goddard L, Dritschel B, Burton A. Role of autobiographical memory in social problem solving and depression. Journal of Abnormal Psychology. 1996; 105:609–616.10.1037/0021-843X.105.4.609 [PubMed: 8952194]

Golden A, Dalgleish T, Mackintosh B. Levels of specificity of autobiographical memories and of biographical memories of the deceased in bereaved individuals with and without complicated grief. Journal of Abnormal Psychology. 2007; 116:786–795.10.1037/0021-843X.116.4.786 [PubMed: 18020724]

Hauer BJA, Wessel I, Geraerts E, Merckelbach H, Dalgleish T. Autobiographical memory specificity after manipulating retrieval cues in adults reporting childhood sexual abuse. Journal of Abnormal Psychology. 2008; 117:444–453.10.1037/0021-843X.117.2.444 [PubMed: 18489221]

Heeren A, Van Broeck N, Philippot P. The effects of mindfulness on executive processes and autobiographical memory specificity. Behaviour Research and Therapy. 2009; 47:403–409.10.1016/j.brat.2009.01.017 [PubMed: 19232573]

Hermans D, de Decker A, de Peuter S, Raes F, Eelen P, Williams JMG. Autobiographical memory specificity and affect regulation: Coping with a negative life event. Depression and Anxiety. 2008; 25:787–792.10.1002/da.20326 [PubMed: 17393378]

Hermans D, Vandromme H, Debeer E, Raes F, Demyttenaere K, Brunfaut E, Williams JMG. Overgeneral autobiographical memory predicts diagnostic status in depression. Behaviour Research and Therapy. 2008; 46:668–677.10.1016/j.brat.2008.01.018 [PubMed: 18342835]

Johnson RJ, Greenhoot AF, Glisky E, McCloskey LA. The relations among abuse, depression, and adolescents' autobiographical memory. Journal of Clinical Child and Adolescent Psychology. 2005; 34:235–247.10.1207/s15374424jccp3402_3 [PubMed: 15901224]

Kleim B, Ehlers A. Reduced autobiographical memory specificity predicts depression and posttraumatic stress disorder after recent trauma. Journal of Consulting and Clinical Psychology. 2008; 76:231–242.10.1037/0022-006X.76.2.231 [PubMed: 18377120]

Lemogne C, Bergouignan L, Piolino P, Jouvent R, Allilaire J, Fossati P. Cognitive avoidance of intrusive memories and autobiographical memory: Specificity, autonoetic consciousness, and self-perspective. Memory. 2009; 17:1–7.10.1080/09658210802438466 [PubMed: 18979356]

Maccallum F, Bryant RA. Impaired autobiographical memory in complicated grief. Behaviour Research and Therapy. 2010; 48:328–334.10.1016/j.brat.2009.12.006 [PubMed: 20100607]

McAdams, DP. Personal narratives and the life story. In: John, OP.; Robins, RW.; Pervin, LA., editors. Handbook of personality. New York, NY: Guilford Press; 2008. p. 242-264.

McNally RJ, Clancy SA, Barrett HM, Parker HA, Ristuccia CS, Perlman CA. Autobiographical memory specificity in adults reporting repressed, recovered, or continuous memories of childhood sexual abuse. Cognition and Emotion. 2006; 20:527–535.10.1080/02699930500342779

McNally RJ, Lasko NB, Macklin ML, Pitman RK. Autobiographical memory disturbance in combat-related posttraumatic stress disorder. Behaviour Research and Therapy. 1995; 33:619–630.10.1016/0005-7967(95)00007-K [PubMed: 7654154]

Monroe SM. Modern approaches to conceptualizing and measuring human life stress. Annual Review of Clinical Psychology. 2008; 4:33–52.10.1146/annurev.clinpsy.4.022007.141207

Moore SA, Zoellner LA. Overgeneral autobiographical memory and traumatic events: An evaluative review. Psychological Bulletin. 2007; 133:419–437.10.1037/0033-2909.133.3.419 [PubMed: 17469985]

Moradi AR, Herlihy J, Yasseri G, Shahraray M, Turner S, Dalgleish T. Specificity of episodic and semantic aspects of autobiographical memory in relation to symptoms of posttraumatic stress disorder (PTSD). Acta Psychologica. 2008; 127:645–653.10.1016/j.actpsy.2007.11.001 [PubMed: 18178168]

Morrison AB, Chein JM. Does working memory training work? The promise and challenges of enhancing cognition by training working memory. Psychonomic Bulletin and Review. 2011; 18:46–60.10.3758/s13423-010-0034-0 [PubMed: 21327348]

Neshat-Doost HT, Dalgleish T, Golden AJ. Reduced specificity of emotional autobiographical memories following self-regulation depletion. Emotion. 2008; 8:731–736.10.1037/a0013507 [PubMed: 18837625]

Nolen-Hoeksema S, Wisco BE, Lyubomirsky S. Rethinking rumination. Perspectives on Psychological Science. 2008; 3:400–424.10.1111/j.1745-6924.2008.00088.x

Piolino P, Coste C, Martinelli P, Macé A, Quinette P, Guillery-Girard B, Belleville S. Reduced specificity of autobiographical memory and aging: Do the executive and feature binding functions of working memory have a role? Neuropsychologia. 2010; 48:429–440.10.1016/j.neuropsychologia.2009.09.035 [PubMed: 19804792]

Prigerson HG, Horowitz MJ, Jacobs SC, Parkes CM, Aslan M, Goodkin K, Maciejewski PK. Prolonged grief disorder: psychometric validation of criteria proposed for DSM-V and ICD-11. PLoS Medicine. 2009; 6(8):e1000121. [PubMed: 19652695]

Raes, F.; Hermans, D.; Williams, JMG.; Brunfaut, E.; Hamelinck, L.; Eelen, P. Reduced autobiographical memory specificity and trauma in major depression: On the importance of post-trauma coping versus mere trauma exposure. In: Sturt, SM., editor. New developments in child abuse research. Hauppauge, NY: Nova Science Publishers; 2006. p. 61-72.

Raes F, Hermans D, Williams JMG, Demyttenaere K, Sabbe B, Pieters G, Eelen P. Is overgeneral autobiographical memory an isolated memory phenomenon in major depression? Memory. 2006; 14:584–594.10.1080/09658210600624614 [PubMed: 16754243]

Raes F, Hermans D, Williams JMG, Eelen P. Reduced autobiographical memory specificity and affect regulation. Cognition and Emotion. 2006; 20:402–429.10.1080/02699930500341003

Raes F, Hermans D, Williams JMG, Eelen P. A sentence completion procedure as an alternative to the Autobiographical Memory Test for assessing overgeneral memory in non-clinical populations. Memory. 2007; 15:495–507.10.1080/09658210701390982 [PubMed: 17613793]

Raes F, Hermans D, Williams JMG, Geypen L, Eelen P. The effect of overgeneral autobiographical memory retrieval on rumination. Psychologica Belgica. 2006; 46:131–141.

Raes F, Verstraeten K, Bijttebier P, Vasey MW, Dalgleish T. Inhibitory control mediates the relationship between depressed mood and overgeneral memory recall in children. Journal of Clinical Child and Adolescent Psychology. 2010; 39:276–281.10.1080/15374410903532684 [PubMed: 20390819]

Raes F, Watkins ER, Williams JMG, Hermans D. Non-ruminative processing reduces overgeneral autobiographical memory retrieval in students. Behaviour Research and Therapy. 2008; 46:748–756.10.1016/j.brat.2008.03.003 [PubMed: 18456242]

Raes F, Williams JMG, Hermans D. Reducing cognitive vulnerability to depression: A preliminary investigation of MEmory Specificity Training (MEST) in inpatients with depressive symptomatology. Journal of Behavior Therapy and Experimental Psychiatry. 2009; 40:24–38.10.1016/j.jbtep.2008.03.001 [PubMed: 18407245]

Raymaekers L, Smeets T, Peters MJV, Merckelbach H. Autobiographical memory specificity among people with recovered memories of childhood sexual abuse. Journal of Behavior Therapy and Experimental Psychiatry. 2010; 41:338–344.10.1016/j.jbtep.2010.03.004 [PubMed: 20378099]

Ros L, Latorre JM, Serrano JP. Working memory capacity and overgeneral autobiographical memory in young and older adults. Aging, Neuropsychology, and Cognition. 2010; 17:89–107.10.1080/13825580903042650

Rutherford BJ. Autobiographical memory specificity, negative mood state, and executive control: Implications for clinical depression. Dissertation Abstracts International: Section B Sciences and Engineering. 2010; 70(11):7220.

Schönfeld S, Ehlers A. Overgeneral memory extends to pictorial retrieval cues and correlates with cognitive features in posttraumatic stress disorder. Emotion. 2006; 6:611–621.10.1037/1528-3542.6.4.611 [PubMed: 17144752]

Schönfeld S, Ehlers A, Böllinghaus I, Rief W. Overgeneral memory and suppression of trauma memories in post-traumatic stress disorder. Memory. 2007; 15:339–352.10.1080/09658210701256571 [PubMed: 17454669]

Serrano JP, Latorre JM, Gatz M, Montanes J. Life review therapy using autobiographical retrieval practice for older adults with depressive symptomatology. Psychology and Aging. 2004; 19:272–277.10.1037/0882-7974.19.2.272

Sinclair JMA, Crane C, Hawton K, Williams JMG. The role of autobiographical memory specificity in deliberate self-harm: Correlates and consequences. Journal of Affective Disorders. 2007; 102:11–18.10.1016/j.jad.2006.12.006 [PubMed: 17258815]

Spinhoven P, Bockting CLH, Kremers IP, Schene AH, Williams JMG. The endorsement of dysfunctional attitudes is associated with an impaired retrieval of specific autobiographical memories in response to matching cues. Memory. 2007; 15:324–338.10.1080/09658210701256555 [PubMed: 17454668]

Strauss, E.; Sherman, EMS.; Spreen, O. A compendium of neuropsychological tests: Administration, norms, and commentary. New York, NY: Oxford University Press; 2006.

Sumner JA, Griffith JW, Mineka S. Overgeneral autobiographical memory as a predictor of the course of depression: A meta-analysis. Behaviour Research and Therapy. 2010; 48:614–625.10.1016/j.brat.2010.03.013 [PubMed: 20399418]

Sumner JA, Griffith JW, Mineka S. Examining the mechanisms of overgeneral autobiographical memory: Capture and rumination, and impaired executive control. Memory. 2011; 19:169–183.10.1080/09658211.2010.541467 [PubMed: 21294036]

Sumner JA, Griffith JW, Mineka S, Rekart KN, Zinbarg RE, Craske MG. Overgeneral autobiographical memory and chronic interpersonal stress as predictors of the course of depression in adolescents. Cognition and Emotion. 2011; 25:183–192.10.1080/02699931003741566 [PubMed: 21432666]

Sutherland K, Bryant RA. Rumination and overgeneral autobiographical memory. Behaviour Research and Therapy. 2007; 45:2407–2416.10.1016/j.brat.2007.03.018 [PubMed: 17506978]

Swan GE, Carmelli D. Evidence for genetic mediation of executive control: A study of aging male twins. Journal of Gerontology: Psychological Sciences. 2002; 57B:133–143.10.1093/geronb/57.2.P133

Treynor W, Gonzalez R, Nolen-Hoeksema S. Rumination reconsidered: A psychometric analysis. Cognitive Therapy and Research. 2003; 27:247–259.10.1023/A:1023910315561

Valentino K, Toth SL, Cicchetti D. Autobiographical memory functioning among abused, neglected, and nonmaltreated children: The overgeneral memory effect. Journal of Child Psychology and Psychiatry. 2009; 50:1029–1038.10.1111/j.1469-7610.2009.02072.x [PubMed: 19490313]

Watkins ER. Constructive and unconstructive repetitive thought. Psychological Bulletin. 2008; 134:163–206.10.1037/0033-2909.134.2.163 [PubMed: 18298268]

Watkins E, Moberly NJ, Moulds ML. Processing mode causally influences emotional reactivity: Distinct effects of abstract versus concrete construal on emotional response. Emotion. 2008; 8:364–378.10.1037/1528-3542.8.3.364 [PubMed: 18540752]

Williams, JMG. Depression and the specificity of autobiographical memory. In: Rubin, DC., editor. Remembering our past: Studies in autobiographical memory. New York, NY: Cambridge University Press; 1996. p. 244-267.

Williams JMG. Capture and rumination, functional avoidance, and executive control (CaRFAX): Three processes that underlie overgeneral memory. Cognition and Emotion. 2006; 20:548–568.10.1080/02699930500450465

Williams JMG, Barnhofer T, Crane C, Hermans D, Raes F, Watkins E, Dalgleish T. Autobiographical memory specificity and emotional disorder. Psychological Bulletin. 2007; 133:122–148.10.1037/0033-2909.133.1.122 [PubMed: 17201573]

Williams JMG, Broadbent K. Autobiographical memory in suicide attempters. Journal of Abnormal Psychology. 1986; 95:144–149.10.1037/0021–843X.95.2.144 [PubMed: 3711438]

Williams JMG, Stiles WB, Shapiro DA. Cognitive mechanisms in the avoidance of painful and dangerous thoughts: Elaborating the assimilation model. Cognitive Therapy and Research. 1999; 23:285–306.10.1023/A:1018743615228

Yanes PK, Roberts JE, Carlos EL. Does overgeneral autobiographical memory result from poor memory for task instructions? Memory. 2008; 16:669–677.10.1080/09658210802135351 [PubMed: 18608978]

Highlights

- OGM is a proposed risk factor for depression and PTSD.
- The CaR-FA-X model proposes three mechanisms that may underlie OGM.
- The author reviews the current state of support for the CaR-FA-X model.
- Overall, rumination, cognitive avoidance, and executive control are linked to OGM.
- Important unresolved issues and suggestions for future research are discussed.

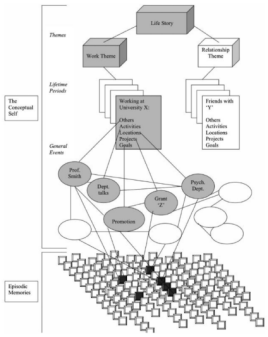

Figure 1.

Hierarchy of autobiographical memory representations. From “Memory and the Self,” by M. A. Conway, 2005, *Journal of Memory and Language*, *53*, p. 609. Copyright 2005 by Elsevier.

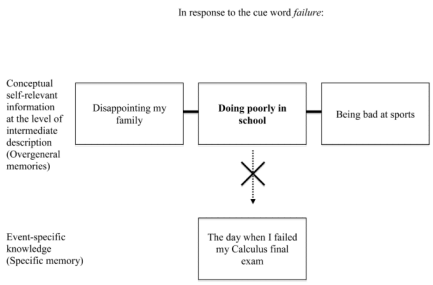

Figure 2.

Hypothetical depiction of the capture phenomenon. In response to the cue word "failure," a conceptual autobiographical representation at the level of intermediate description ("Doing poorly in school") is initially activated. In this example, conceptual self-representations (overgeneral memories) are highly elaborated and interconnected because they are related to a fundamental aspect of the individual's self-conceptualization (as indicated by the bold lines linking the conceptual representations). These connections are stronger than the link between the intermediate conceptual information "Doing poorly in school" and a specific memory at the level of event-specific knowledge: "The day when I failed my Calculus final exam." As a result, the individual becomes "captured" at the intermediate level of conceptual self-relevant information, and a specific memory is not retrieved (as indicated by the "X" on the dashed arrow connecting the level of overgeneral memories and the level of specific memories).

Table 1

Summary of Studies Examining the CaR-FA-X Model of Mechanisms Underlying Overgeneral Autobiographical Memory (OGM)

Authors (year)	Participants (*N*)	Measure of CaR-FA-X Mechanism(s)	Assessment of OGM[a]	Overall Findings Consistent with the CaR-FA-X Model
Capture and Rumination				
Bessell et al. (2008)	Adults with acquired brain injury (*N* = 58)	Rumination vs. distraction induction	AMT	Y: consistent with rumination mechanism
Crane, Barnhofer, Visser et al. (2007)	Adults with past MDD (*N* =34)	Analytical/abstract vs. concrete/experiential self-focus induction	AMT	Y: consistent with rumination mechanism
Debeer et al. (2009)	Undergraduate students (*N* = 314)	RRS measure of rumination, including brooding and reflection subscales	Standard and Minimal Instructions AMTs	Y: consistent with rumination mechanism
Raes, Hermans, Williams, Geypen et al. (2006)	Secondary school students (*N* = 112)	Extent to which participants unscrambled sentences in ruminative vs. non-ruminative ways; RSS measure of rumination	Overgeneral vs. specific retrieval style induction	Findings suggest rumination OGM relationship is bidirectional
Raes et al. (2008)	Undergraduate students (*N* = 195)	Analytical/abstract vs. concrete/experiential self-focus induction	SCEPT and forced-choice SCEPT	Y: consistent with rumination mechanism
Sutherland & Bryant (2007)	High (*n* = 26 and 48 for Studies 1 and 2) and low (*n* = 28 and 50 for Studies 1 and 2) dysphoric undergraduate students	Rumination vs. distraction induction (Study 1); rumination induction on positive or negative content (Study 2	AMT	Y: consistent with rumination mechanism
Functional Avoidance				
Aglan et al. (2010)	Adult women with (*n* = 46) and without (*n* = 57) a history of MDD	History of CSA	AMT	Y: consistent with functional avoidance mechanism
Boelen et al. (2010)	Bereaved adults (*N* = 109)	Extent to which specific memories were related vs. unrelated to the loss	Standard and trait AMTs	N: inconsistent with functional avoidance mechanism
Crane & Duggan (2009)	Adults with recurrent suicidal behavior (*N* = 49)	History of CSA	AMT	Y: consistent with functional avoidance mechanism
Geraerts et al. (2010)	Undergraduate students (*N* = 87)	Thought suppression vs. control conditions for negative vs. neutral memories	AMT	Y: consistent with functional avoidance mechanism
Golden et al. (2007)	Bereaved adults with (*n* = 16) and without (*n* = 13) CG	Extent to which memories were related to the self, the deceased, or a living significant other	AMT, BMT for the deceased, and BMT for a living significant other	N: inconsistent with functional avoidance mechanism
Hauer et al. (2008)	Adults with (*n* = 70) and without (*n* = 63) CSA	History of CSA	Standard AMT and direct retrieval AMT	Y: consistent with functional avoidance mechanism
Hermans, de Decker et al. (2008)	Undergraduate students (*N* = 39)	Failure of an exam (unexpected aversive experience	AMT	Y: consistent with functional avoidance mechanism
Johnson et al. (2005)	Adolescents in a longitudinal study on family violence (*N* = 134)	Exposure to family violence and sexual abuse between 6–12 and 12–18 years	Asked to retrieve as many specific childhood memories to cues within 3min; coded for specificity	N: inconsistent with functional avoidance mechanism
Lemogne et al. (2009)	Healthy adults (*N* = 38)	Avoidance symptoms on the IES-R	Interview assessing several aspects of episodic memory	Y: consistent with functional avoidance mechanism

Authors (year)	Participants (*N*)	Measure of CaR-FA-X Mechanism(s)	Assessment of OGM[a]	Overall Findings Consistent with the CaR-FA-X Model
			(e.g., specificity) for positive and negative events	
Maccallum & Bryant (2010)	Bereaved adults with (*n* = 24) and without (*n* = 21) CG	Extent to which memories were related or unrelated to the loss	AMT	Y: consistent with functional avoidance mechanism
McNally et al. (2006)	Adults with (*n* = 139) and without (n = 25) CSA	Continuous memory, recovered memory, repressed memory, or no memory of CSA	AMT for memories from before and after age 13	Mixed support for functional avoidance mechanism
Moradi et al. (2008)	Adult refugees (*N* = 37; Study 1)	Avoidance symptoms on the PDS	AMT	N: inconsistent with functional avoidance mechanism
Raes, Hermans, Williams, & Eelen (2006)	Low- (*n* = 45) and high- (*n* = 45) specific undergraduate students (Study 1); low-specific female undergraduate students (*n* = 48; Study 2)	Low- and high-specific tendencies; frustrating vs. neutral puzzle task (aversive experience vs. control)	AMT	Mixed support for functional avoidance mechanism
Raymaekers, Smeets, Peters, & Merckelbach (2010)	Adults with (*n* = 86) and without (*n* = 26) CSA	Continuous memory, recovered memory, or no memory of CSA	AMT	Y: consistent with functional avoidance mechanism
Schönfeld & Ehlers (2006)	Adult trauma survivors with (*n* = 29) and without (*n* = 26) PTSD	Measures of cognitive strategies linked to avoidance	Standard and pictorial AMTs	Y: consistent with functional avoidance mechanism
Schönfeld et al. (2007)	Adult assault survivors with (*n* = 14) and without (*n* = 28) PTSD	Measures of cognitive strategies linked to avoidance	AMT	Y: consistent with functional avoidance mechanism
Sinclair et al. (2007)	Adults with a history of deliberate self-harm (*n* = 68)	Reported history of CPA and CSA	AMT	Y: consistent with functional avoidance mechanism
Valentino et al. (2009)	Maltreated (*n* = 77) and non-maltreated (*n* = 115) children	History of abuse (CSA or CPA) or neglect from Department of Human Services reports	AMT	Y: consistent with functional avoidance mechanism
Impaired Executive Control				
Birch & Davidson (2007)	Dysphoric (*n* = 17) and non-dysphoric (*n* = 17) older adults	WMS III working memory index subtests	AMT	Y: consistent with executive control mechanism
Dalgleish et al. (2007)	7 studies, one with adults with eating disorders, and others with adult community volunteers[b]	Various measures of executive control; AMT manipulations that vary the role of executive control in OGM associated with depression	AMT	Y: consistent with executive control mechanism
Heeren et al. (2009)	Healthy adults who completed a mindfulness training (*n* = 18) and matched controls (*n* = 18)	Measures of cognitive and motor inhibition, and cognitive and behavioral flexibility	AMT	Y: consistent with executive control mechanism
Neshat-Doost et al. (2008)	Adult community volunteers (*N* = 50)	Color Stroop task vs. control tasks prior to the AMT	AMT	Y: consistent with executive control mechanism
Piolino et al. (2010)	Younger (*n* = 50) and older (*n* = 50) healthy adults	Measures of updating, inhibition, shifting, and feature binding in working memory	VAF task; TEMPau task	Y: consistent with executive control mechanism
Raes et al. (2010)	Primary school children (*N* = 135)	Inhibitory Control subscale of the EATQ-R	AMT	Y: consistent with executive control mechanism
Ros et al. (2010)	Younger (*n* = 50) and older (*n* = 46) healthy adults	Measures of working memory	AMT	Y: consistent with executive control mechanism

Authors (year)	Participants (*N*)	Measure of CaR-FA-X Mechanism(s)	Assessment of OGM[a]	Overall Findings Consistent with the CaR-FA-X Model
Rutherford (2010)	Undergraduate students (*N* = 80)	Digit recall task during the AMT vs. control	AMT	Y: consistent with executive control mechanism
Yanes et al. (2008)	Undergraduate students (*N* = 134)	Assessed memory for task instructions	AMT	Y: consistent with executive control mechanism
Multiple Mechanisms				
Barnhofer et al. (2007)	Adults with (*n* = 16) and without (*n* = 19) past MDD	Extent to which cues on the AMT were self-relevant; dual vs. single task conditions (AMT with and without random generation task)	AMT	Interaction between capture phenomenon and executive control mechanism
Dalgleish et al. (2007)	Adult community volunteers with depressed mood (*N* = 32; Study 8)	Performance on AMT-R can reflect functional avoidance or impaired executive control	AMT-R	Consistent with executive control mechanism
Dalgleish et al. (2008)	Adult community volunteers with a trauma history (*N* = 36)	Performance on AMT-R can reflect functional avoidance or impaired executive control	AMT-R	Consistent with functional avoidance mechanism
Raes, Hermans, Williams, Brunfaut et al. (2006)	Adults with current MDD(*N* = 28)	RRS measure of rumination; history of trauma on the TEC	AMT	Interaction between rumination and functional avoidance mech.
Raes, Hermans, Williams Demyttenaere et al. (2006)	Adults with current MDD (*N* = 26)	RSS measure of rumination; measure of working memory (letter-number sequencing)	AMT	Main effects of rumination and executive control mechanisms
Sumner, Griffith, & Mineka (2011)	Undergraduate students (*N* = 109)	RRS measure of rumination; extent to which cues on the AMT were self-relevant; measures of verbal fluency and inhibition	AMT	Main effects of capture and rumination, and executive control mechanisms

[a] OGM reflects either fewer specific memories or more overgeneral memories.

[b] See *Multiple Mechanisms* section for Study 8. AMT = Autobiographical Memory Test; MDD = major depressive disorder; RRS = Ruminative Responses Scale; RSS = Rumination on Sadness Scale; SCEPT = Sentence Completion for Events from the Past Test; CSA = childhood sexual abuse; CG = complicated grief; BMT = Biographical Memory Test; IES-R = Impact of Events Scale – Revised; PDS = Posttraumatic Stress Diagnostic Scale; PTSD = posttraumatic stress disorder; CPA = childhood physical abuse; WMS = Wechsler Memory Scale; VAF task = Verbal Autobiographical Fluency task; TEMPau task = Test Episodique de Mémoire du Passé autobiographique; EATQ-R = Revised Early Adolescent Temperament Questionnaire; AMT-R = Reversed Autobiographical Memory Test; TEC = Traumatic Experiences Checklist.