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Differential Correlates of Autobiographical Memory Specificity to Affective and Self-
Discrepant Cues

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Abstract

According to the CarFAX model (Williams et al., 2007), several processes may result in overgeneral autobiographical memory. The present study examined whether the type of cue used in the Autobiographical Memory Test (AMT) is important for illuminating relationships between autobiographical memory specificity and variables pertinent to the Functional Avoidance (FA) and Capture and Rumination (CaR) aspects of the model. Sixty-one women varying in their experience of a potentially traumatic event and previous depression completed two versions of the AMT: one containing affective cues and the other containing cues representing idiosyncratic self-discrepancies. Consistent with the FA hypothesis, avoidance of the potentially traumatic event was associated with fewer specific memories on the affective, but not the self-discrepant AMT. Furthermore, in line with the CaR hypothesis, performance on the self-discrepant, but not the affective AMT was related to ruminative self-reflection in women reporting previous depression, even after controlling for current depression and education levels. Together the results suggest that varying cue-type may increase the sensitivity of the AMT, depending on the aspect of the CarFAX model of overgeneral memory that is to be addressed.

Keywords: Autobiographical Memory Specificity, CarFAX model, avoidance, self-discrepancies, reflective rumination, Centrality of Event Scale.

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Differential Correlates of Autobiographical Memory Specificity to Affective and Self-Discrepant Cues

Overgeneral memory refers to the phenomenon of being relatively unable to come up with memories of specific, personally experienced events (Williams et al., 2007). Specific events are tied to a particular place and time. Since the first demonstration of the phenomenon in suicide attempters (Williams & Broadbent, 1986), research on reduced autobiographical memory specificity (rAMS) has been accumulating rapidly. In this literature, rAMS is typically assessed with the Autobiographical Memory Test (AMT). The AMT provides participants with cue words (e.g., happy, angry) and participants have to respond with specific memories. rAMS has been found to be a characteristic of patients suffering from depression and posttraumatic psychopathology (Williams et al., 2007). Importantly, rAMS does not seem to be a mere epiphenomenon of psychopathology, but is predictive of its course (Sumner, Griffith, & Mineka, 2010) and may even constitute a premorbid vulnerability factor (e.g., Bryant, Sutherland, & Guthrie, 2007; Hauer, Wessel, Engelhard, Peeters, & Dalgleish, 2009; van Minnen, Wessel, Verhaak, & Smeenk, 2005).

Explanations (Williams et al., 2007; see also Sumner, 2012) for rAMS rest on assumptions specified in Conway's general account of autobiographical memory (i.e., Self-Memory System theory; Conway & Pleydell Pearce, 2000). Conway's account conceptualises autobiographical knowledge as a hierarchical cognitive structure, with layers running down from a highly abstract level of self-knowledge (e.g., life-time periods, such as "When I was a university student") through general event knowledge (e.g. "Holidays abroad") to the level of specific episodic details (e.g. "That spectacular sunset at the beach in X"). The experience of remembering (i.e., episodic recall) involves a spreading of activation throughout all levels of this autobiographical knowledge base. A further assumption is that a specific memory may be retrieved by navigating through the autobiographical knowledge base in different ways. Direct

retrieval occurs when a cue (e.g., a stunning sunset) activates specific features at the episodic detail level (white sand, palm trees, sound of waves breaking). Activation of these details would then spread upwards to the more abstract knowledge levels (→ That particular holiday abroad in X; → when I was a university student), thus providing a context for the event details, resulting in the emergence of a full-blown recollective experience. This cue-driven, bottom-up retrieval is relatively automatic and effortless. By contrast, generative retrieval is a deliberate memory-search, which is effortful and draws on cognitive resources. It is this kind of retrieval that is thought to be instantiated by cues in the AMT (Williams et al., 2007). A word cue (e.g., happy) would activate a semantic associate (holiday), which would trigger a categoric descriptor at the intermediate level containing general event knowledge (holidays abroad). The search would then be completed by reconstructing a specific instance at the episodic detail level (that spectacular sunset). According to this account, overgeneral memories arise when the top-down search stops at the intermediate level (Conway & Pleydell Pearce, 2000; Williams et al., 2007).

In their CaRFAX model, Williams and colleagues (2007) summarize three main factors that relate to rAMS. Two factors of this model, Functional avoidance (FA) and Capture and Rumination (CaR), are relevant for the present purpose. The FA hypothesis has its origins in the relation of rAMS with trauma-related psychopathology. It assumes that recalling general events (the intermediate level of the hierarchy) elicits less intense affect than recalling specific memories of traumatic events, and thus that aborting the search process at the intermediate level enables people to cognitively avoid strong negative affect accompanying a specific episodic memory. This avoidant retrieval style is thought to generalize, resulting in rAMS observable across a broad range of cues. Capture and rumination (CaR) refers to the idea that a memory search may fail to produce a specific memory when attention is captured by task-irrelevant information at the intermediate level of the autobiographical knowledge hierarchy.

Moreover, it is suggested that attentional capture will be particularly likely when this irrelevant information reflects abstract self-descriptors. The idea is that in depressed patients, such abstract self-related information in the autobiographical memory knowledge base is often well-rehearsed and highly interconnected, and therefore easily activated.

Especially with regard to the notion of CaR, self-discrepancy theory (Higgins, 1987) is relevant. According to this theory, peoples' cognitive representations of their selves incorporate self-guides. These self-guides are relatively stable cognitive structures reflecting norms or standards that motivate behaviour. A crucial feature of this theory is that a perceived discrepancy between one's present characteristics and a particular type of self-guide would be related to a specific type of negative affect, depending on the availability and accessibility of the discrepant representation. Indeed, there is evidence (see Higgins, 1987; Strauman, 1992) that depressed mood is associated with a perceived gap between current characteristics and ideal self-guides ("how I ideally want to be") whilst anxiety is linked to a perceived inconsistency between the current self and ought self-guides ("how I think I ought to be, or others think I ought to be"). As for autobiographical memory, Strauman (1992; 1996) found that childhood memories were more efficiently retrieved in response to cues that mapped on to an individual's self-guides than self-descriptive control cues (including guides not relevant to the particular participant). These results suggest that abstract self-referent cues have a significant capacity to activate mnemonic content, and potentially speak to the idea of 'capture' during generative retrieval processes. However, this early work did not examine the specificity of retrieved memories or explicitly differentiate between cue words that represented discrepant self-guides from those that represented self-concordant self-guides. Later studies addressing these issues indicated that cues reflecting self-discrepancies or dysfunctional schematic content are more likely to produce retrieval of overgeneral memories in depressed or formerly depressed individuals (Crane, Barnhofer, & Williams, 2007;

Schoofs, Hermans, & Raes, 2012; Van den Broeck, Claes, Pieters & Raes, in press; Barnhofer, Crane, Spinhoven, & Williams, 2007; Spinhoven, Bockting, Kremers, Schene, & Williams, 2007).

The CaRFAX model posits multi-causality of overgeneral memory, assuming that different processes may interact or may be relevant to different degrees in different groups of individuals. The above findings indicate that different cue words may be used to preferentially tap into FA or CaR processes. In general, research on rAMS employs cues that are mainly affective (positive /negative; Williams et al., 2007). Such cues would be particularly suitable to elicit avoidance of negative affect (FA) in traumatized people. In contrast, for studies investigating CaR in (formerly) depressed individuals, self-discrepant cues might be more appropriate. Varying cue type should enhance the sensitivity of the AMT for detecting the differential processes as specified by the CARFAX model and associations with related variables (rather than show absolute differences in terms of presence or absence of overgenerality).

The present study examined the use of different cues and their potential to tap into different processes underlying rAMS in a sample of women who varied in their experience of a potentially traumatic event and previous depressive episodes. More specifically, part of the sample had a history of (pre)eclampsia, which is a complication of pregnancy that is potentially life-threatening to both the mother and (unborn) child (Steegers, von Dadelszen, Duvekot, & Pijnenborg (2010)¹. We administered two versions of the AMT: one consisting of (typical) affective cues and the other containing idiosyncratic self-discrepant descriptors as cues. These self-discrepant descriptors pertained to actual-ideal and actual-feared self-discrepancies. Although initially anxiety was found to be associated with ideal-ought discrepancies (e.g., Higgins, 1987; Strauman, 1992), later work introduced the concept of the feared self to capture avoidant motives. Discrepancies between feared and actual selves have

been found to be a better predictor of anxiety and guilt than discrepancies between ought and actual selves, which seem to become relevant only when avoidant motives are low (Carver, Lawrence, & Scheier, 1999). The current study therefore focused on ideal and feared self-discrepancies assuming that both of these were likely to be important in our group of participants. We explored correlations between performance on either AMT and different variables pertinent to either the FA or CaR hypotheses.

As for variables conceptually related to FA, we included a measure of avoidance of memories of the target pregnancy and related affect. In addition, we were interested in seeing how overgenerality would relate to the centrality of this event to the participants' life-story or identity. The centrality of adverse events is associated with posttraumatic stress responses (Berntsen & Rubin, 2006; Brown, Antonius, Kramer, Root, & Hirst, 2010) and prolonged grief (Boelen, 2009; 2012). Although there is some evidence that ratings of centrality and specificity are negatively related (Rubin, Dennis, & Beckham, 2011), to the best of our knowledge no study to date has examined whether high centrality of one particular event is linked to a reduced number of specific memories in general. It has been suggested that a preoccupation with the memory of a single central event interferes with the accessibility of memories of other autobiographical events, resulting in rAMS (Boelen, 2012). Furthermore, there is evidence that the centrality of adverse events is related to avoidance of reminders (Berntsen & Rubin, 2006; Boelen, 2009). Apart from exploring a straightforward relationship with event centrality, we were therefore also interested in examining whether event centrality moderated the relation between avoidance and rAMS, i.e. whether this relation would be more evident in those showing stronger preoccupation with a central event.

Pertinent to CaR, we looked at the relationship of rAMS with trait rumination. In itself, rumination can be viewed as self-discrepant processing (e.g., Crane et al., 2008). Trait ruminators frequently focus on discrepancies between actual and desired states and this would

strengthen a network of global self-descriptors in memory. Thus, trait ruminators would be especially prone to capture errors during retrieval, resulting in rAMS, when exposed to self-discrepant content. Although this hypothesis has not been tested directly before, there is some evidence addressing related issues that is broadly supportive. For example Papadakis, Prince, Jones, and Strauman (2006) explored the combined effect of self-discrepancy and ruminative coping on prediction of depressive symptoms in adolescent girls and found that ideal self-discrepancy was only closely associated with depression in the context of high brooding, the more detrimental form of rumination. Similarly Jones, Papadakis, Hogan, and Strauman, (2009) found that ideal-self discrepancy was associated with greater mood disturbance only in individuals with high rumination and / or low reflection (i.e., the more adaptive form of rumination). Since negative mood is thought to result from an individual's ineffective attempts to resolve discrepancies these findings suggest that maladaptive preoccupation with self-discrepancies is more pronounced in habitual ruminators. There is also direct evidence that such capture, indexed directly by rAMS, is more pronounced in those high in rumination. For example, whilst a relationship between trait rumination and rAMS has rarely been found in nonclinical samples (see Raes, Schoofs, Griffith, & Hermans, 2012; Smets, Griffith, Wessel, Walschaerts, & Raes, 2012), nonclinical participants with a history of depression appear to be an exception. For example, Raes and colleagues (2012) showed that in remitted depressed patients, trait rumination was related to memory specificity after a self-discrepancy induction. Similarly, Crane and colleagues (Crane, Barnhofer, Visser, Nightingale, & Williams, 2007) demonstrated that previously depressed patients who reported high levels of trait rumination showed an increase in rAMS after an analytical rumination induction, whereas those who were low in trait rumination showed no change. Finally, Crane, Barnhofer, and Williams (2007) found that cues reflecting self-discrepancies elicited overgeneral memories in remitted depressed patients, but not in never-depressed persons. Taken together,

it may be that in previously depressed patients, an elaborated network of general self-descriptors needs to be reactivated either by thinking about self-discrepancies, by rumination or by a close match of AMT cues with those descriptors in memory. Therefore, we also investigated whether the relationship between AMT performance and rumination differed between previously depressed and never-depressed participants. In addition, evidence is accumulating that rumination may have maladaptive and more adaptive forms (Schoofs, Hermans, & Raes, 2010; Treynor, Gonzalez, & Nolen-Hoeksema, 2003; Watkins, 2008). Specifically, brooding is thought to involve unproductive focusing on one's current undesired state whereas reflection is thought to involve active cognitive problem solving strategies intended to change that state. We explored the association of both types of rumination with AMT performance.

In summary, the current study examined the idea that varying the type of memory cue used to assess rAMS may increase sensitivity of the AMT to different factors of the CaRFAX model of overgeneral memory. Pertinent to FA, we anticipated that performance on the standard affective AMT would be especially related to the sequelae of an adverse experience, that is, the avoidance of memories and the centrality of the event. Germane to CaR, we anticipated that performance on an AMT containing self-discrepant cues would be associated with ruminative tendencies, especially in people who reported previous depression.

Method

Participants

The present sample included sixty-four women who participated in a larger project examining the sequelae of the serious pregnancy complication of (pre)eclampsia at the Department of Obstetrics and Gynecology of the University Medical Center Groningen (UMCG). For selection and exclusion criteria, see Postma, Wessel, Aarnoudse and Zeeman (2010). The project was approved by the UMCG Institutional Review Board, and all

participants signed informed consent. Participation was voluntary and travel expenses were reimbursed.

Assessment

Variables referring to target pregnancy. The *Impact of Event Scale* (IES, Horowitz, Wilner, & Alvarez, 1979) was used to measure the frequency and avoidance of intrusions of a stressful event during the past 7 days. Again, the instructions explicitly referred to the target pregnancy. The IES consists of 15 items that are scored on a 4-point scale (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*; total score 0 – 75, Cronbach's $\alpha = .84$). The IES has two subscales; intrusion (7 items, range 0 – 35, Cronbach's $\alpha = .80$) and avoidance (8 items, range 0 – 40, Cronbach's $\alpha = .73$).

The *Centrality of Event Scale* (CES, Berntsen & Rubin, 2006) measures the extent to which the memory of an event is a reference point for personal identity. We used the short, 7-item scale and rewrote the instruction such that it explicitly referred to the target pregnancy. Items are scored on a 5 point scale (anchors 1 = *totally disagree*, 5 = *totally agree*). Total scores range from 7 to 35, with higher scores indicating higher event centrality. Internal consistency was high (Cronbach's $\alpha = .91$).

Rumination and Self-discrepancies. The *Ruminative Response Scale* (RRS) measures trait rumination. Participants are asked how they typically respond when they feel depressed. We used the Dutch translation (Raes, Hermans, & Eelen, 2003) of the original version (Nolen-Hoeksema & Morrow, 1991), that includes 22 items scored on a 4-point scale (0 = *almost never* – 3 = *almost always*; range total score 0 – 66, Cronbach's $\alpha = .87$). Later versions of the RRS (Treyner et al., 2003, see also Schoofs et al., 2010) were slightly altered and incorporate a Brooding and a Reflection subscale. The original version of the RRS used in the present study contains all 5 Reflection items of the adapted scale. Reflection refers to “cognitive problem solving” (Treyner et al., 2003, p. 256) and the scale contains items such as

“*I analyze recent events to try to understand why I am depressed*”. The original version of the RRS used here contains 3 out of 5 Brooding items (e.g., *I think “Why do I always react this way?”*). Hence, in the current study, RRS-Reflection scores range from 0 – 15 (Cronbach’s $\alpha = .65$) and RRS-brooding scores range from 0 – 9 (Cronbach’s $\alpha = .61$).

The *Self-Description Questionnaire* (Adapted from Carver, Lawrence, & Scheier, 1999; Crane, Barnhofer, & Williams, 2007) was used for identifying self-guides. Participants were instructed to write down 7 traits that they would like to ideally possess (ideal self) and 7 traits that they would not like to have or would be afraid of acquiring (feared self). Next, these traits were scored on a 7 point scales with respect to similarity to their actual self (i.e., to what extent participants thought they possessed that trait right now; 1 = *I am the opposite* - 7 = *I am exactly like*).

Autobiographical Memory. Two versions of the *Autobiographical Memory Test (AMT)* were used to assess autobiographical memory specificity. The first version used a Dutch translation of the 5 positive (*happy, safe, interested, successful, surprised*) and 5 negative words (*sad, angry, clumsy, hurt, lonely*) that are typically employed in overgeneral memory studies (e.g., Williams & Broadbent, 1986). Because these frequently used words predominantly pertain to affect, we refer to this version as affective AMT. The second version (self-discrepant AMT) was constructed for each participant separately and used idiosyncratic words from their own self-description questionnaire. A research assistant selected the 5 ideal-self traits with the lowest and the 5 feared-self traits with the highest ratings of similarity with participants’ actual self.

The two AMT-versions were administered in counterbalanced order. Participants were shown the cue-words one by one on separate cards and were instructed to recall a specific memory in response to each of them within 30 s. In the instruction, no explicit reference was made to the target pregnancy. Prior to testing, it was explained to them that a specific memory

refers to a personally experienced event that happened on a specific place and time (i.e., within 1 day). In addition, participants were told that the event in the memory should have happened more than one week ago. There was an extensive practice phase using 10 neutral cues (e.g., grass, car) during which the experimenter and participant discussed why responses were specific or not. The actual test was started after the participant had responded with 3 specific memories to neutral practice cues in a row. A research assistant coded the responses as specific, extended (i.e., events that lasted longer than a day), categorical (i.e., series of events), no memory (i.e., a semantic association) or as an omission. Specific memories that referred to an event that happened less than one week ago or to an event that was already mentioned, were counted as omissions. The number of first responses to the cue words on either AMT that were specific memories was used as the dependent variable. A second rater (IW) coded the memories of 25 participants (i.e., 250 memories for each AMT version). Inter-rater reliability was excellent for coding memories as specific or not (affective AMT: $\kappa = .87$; self-discrepant AMT: $\kappa = .89$).

In order to construct *Cue-word Self-discrepancy ratings*, participants rated the extent to which the 20 cue-words from both AMT versions fit with the person they were now (actual self), and with the person they wanted to be (ideal self) on a 7 point scale (1 = *totally* – 7 = *not at all*). Scores for negative (affective AMT) and feared self (self-discrepant AMT) words were reversed. Next, for each cue-word self discrepancy scores were calculated by subtracting the actual self-scores from the ideal self-scores. Thus, higher scores indicate higher self-discrepancy, that is, a larger distance between one's present state and how one would like to be. Finally, self-discrepancy scores were summed to obtain total scores on the affective and self-discrepant AMT, as well as negative, positive, feared and ideal subscores.

Background and psychopathology questionnaires. Information on *background variables* was obtained with a questionnaire asking for age and educational level. Highest

level of completed education was rated using a 7 point scale ranging from 1 = *elementary school* to 7 = *university* (Engelhard, van den Hout, & Schouten, 2006). In addition, participants completed two screening questions for remitted depression (Was there ever a time when...1) ... you felt depressed for most of the day?; 2) ... you were not interested in activities that you usually enjoy?") based on the SCID-I (First, Spitzer, Gibbon, & Williams, 1997). These questions were answered with yes/no.

The *Beck Depression Inventory II* (BDI-II, Beck, Steer, Ball, & Ranieri, 1996; van der Does, 2002) measures symptoms of depression in the past two weeks. It consists of 21 items containing 4 statements indicating increasing severity (range 0 -3). Total scores range from 0 to 63 (Cronbach's $\alpha = .86$), with higher scores indicating more severe depressive symptoms.

Procedure

Participants received a questionnaire package in the mail, containing an informed consent form, the self-description questionnaire and background questions. After completion, they returned the package in the mail. They were invited to visit the university for an individual assessment session. In addition, they received another questionnaire package (containing the BDI-II, PSS-SR, CES, IES and RRS) by mail to complete at home on the evening prior to their visit. At the university, all participants were tested individually. First, participants engaged in unrelated neurocognitive tests (see Postma et al., 2010). Next, they completed both the affective and self-discrepant AMT (in counterbalanced order) and provided AMT cue word ratings. Finally, participants were debriefed.

Statistical Analysis

The data from three participants were excluded from the analyses. Due to experimenter failure, one participant had missing data on crucial variables (educational level and previous depression screening questions) in the regression analyses (see below). Two participants emerged as multivariate outliers from the regression analyses. Inspection of the

experimenter's notes revealed that in one case, the participant had become upset and tearful during the AMT and produced 0 specific memories. For the other multivariate outlier, inspection of the background variables suggested that she was an atypical participant in this sample because that she had had her target pregnancy at age 16. In all, the final sample consisted of 61 women.

As for obstetric diagnosis, the final sample consisted of 24 formerly eclamptic, 19 formerly preeclamptic and 18 parous women who had uncomplicated pregnancies. Initial analyses revealed no significant differences between the obstetric diagnostic groups on any of the variables (highest $F(2, 58) = 2.33, p = 0.11$) other than pregnancy duration, birth weight and impact of the delivery at the time of the event. These differences are to be expected given the nature of the complication of (pre)eclampsia. Controlling for patient status in the regression analyses (see below) did not affect the outcome. Therefore, correlational analyses are reported for the group as a whole.

For simple correlations, we computed Spearman's rank correlations as some of the variables showed non-normal distributions. For purpose of Hierarchical Multiple Regression (HMR) analyses, IES-avoidance scores were square root transformed because of skewness of the distribution. After this transformation, inspection of residual plots suggested that assumptions were adequately met.

Results

Avoidance and Event Centrality of Target Delivery

Mean age in the present sample was 39.4 years (range 24 -64 years). Overall, time since the target pregnancy was $M = 8.64$ years ($SD = 4.83$). Table 1 provides the descriptives of the variables concerning the target delivery and AMS, as well as their intercorrelations. Overall, participants generated more specific memories to affective cues than to self-discrepant cues, $t(60) = 4.68, p < .001, d = 0.60$. Level of education correlated positively with the number of

specific memories to both affective and self-discrepant cues, i.e. higher educational levels were associated with more specific memories. IES-avoidance was significantly and negatively related to memory specificity to affective cues, but not self-discrepant cues. The centrality of the target delivery, as reflected by CES scores, did not display significant correlations with AM specificity.

In order to see whether event centrality would moderate the association between IES-avoidance and memory specificity, separate Hierarchical Multiple Regression (HMR) analyses were conducted with affective and self-discrepant AMT performance as dependent variables. First, all relevant predictors were centered (West, Aiken, & Krull, 1996). Next, the predictors were entered in three steps in the HMR. The first step controlled for level of education. On the second step, IES avoidance and CES scores were entered as predictors. The final step contained the product of the centered IES-avoidance and CES scores.

Table 2 summarises the HMRs with the number of specific memories to affective as well as self-discrepant cues as dependent variables. It can be seen in this table that the control variable of educational level explained a borderline significant portion of the variance in performance on the affective AMT. The next step added a significant 11% to explained variance. This was predominantly due to IES avoidance and not CES scores. The third step, containing the interaction between IES avoidance and CES, did not significantly contribute to explained variance. For the HMR of self-discrepant AMT performance, only the first step containing level of education explained a significant portion of the variance.

Overall, then, the HMR analyses for affective and self-discrepant cues differed in that avoidance of reminders of the target pregnancy was related to fewer specific memories in response to affective but not self-discrepant cues. Centrality of the target pregnancy to the life-story did not moderate this effect nor did it contribute to variance in memory specificity, irrespective of cue type.

Past Depression and Rumination

Next, we turn to correlates of memory specificity that are related to depression and rumination. Crane, Barnhofer, & Williams (2007) reported that correlational patterns differed in previously depressed and never depressed participants. Therefore, we created groups based on the screening questions for remitted depression. Participants who answered one of the two questions affirmatively, were allocated to the Previously Depressed group (PD, $n = 28$). The Never Depressed group (ND, $n = 33$) consisted of women who answered no to both questions.

Table 3 summarizes both background and variables related to self-discrepant processing for both the PD and ND groups. It can be seen in this table that the PD group had lower education levels and reported more depressive symptoms and total rumination than the ND group. There were no differences between the groups with respect to discrepancy ratings and memory specificity.

Tables 4 and 5 show Spearman's rank correlations between depression, rumination, cue self-discrepancy ratings and AMT performance for PD and ND participants separately. In the ND group, there were no significant correlations between memory specificity and any of the other variables. In PD participants, there was a significant positive correlation between RRS reflection and memory specificity in response to self-discrepant cues. Thus, the higher their ruminative reflection scores, the more specific memories PD participants retrieved. For affective cues, this correlation showed a trend towards significance. There was also a significant negative correlation between BDI-II scores and memory specificity following self-discrepant cues. Therefore, we subjected memory specificity to self-discrepant cues to a HMR analysis controlling for BDI-II and education level on the first step. This step explained a borderline significant 19% of the variance $F(2, 24) = 2.85, p = .08$, with BDI-II scores as the only significant predictor, $\beta = -.41, p = .04$. The second step containing RRS reflection scores added a significant 15% to explained variance, $F(1, 23) = 5.02, p = .04$. A similar analysis

with the number of specific memories to affective cues as the dependent variable yielded no significant results, $\Delta R^2 = .11$, $F(2, 24) = 1.41$, $p = .026$, and $\Delta R^2 = .08$, $F(1, 23) = 2.18$, $p = .15$. Thus, it appears that in participants reporting previous depression more ruminative reflection was associated with more specific memories to self-discrepant cues, even after controlling for current depressive symptoms and educational level. This relation was not found for memory specificity in response to affective AMT cues.

Discussion

The main results of the present study can be summarized as follows. To begin with, in line with expectations, rAMS elicited by affective AMT cues was related to the avoidance of memories of an adverse event. The association between avoidance and memory specificity in response to self-discrepant cues was less evident. However, with regard to discrepancy-based processing, a different picture emerged. That is, more specific memories to self-discrepant cues were related to more ruminative reflection in previously depressed participants, even after controlling for current depression. With regard to affective cues, this pattern of results was less pronounced.

By and large, the current findings are consistent with the idea that varying cue-type may increase the sensitivity of the AMT, depending on what aspect of the CaRFAX model of overgeneral memory is to be tested. The finding that avoidance of memories was predominantly associated with specificity of the affective AMT fits well with the empirical literature on functional avoidance (FA, see Sumner, 2012; Williams et al., 2007) for overviews). Most of the research in this area was done with these typical AMT-cues (Williams & Broadbent, 1986), which mainly are cues indexing affective states. It is assumed that rAMS originates from the avoidance of the negative affect associated with recalling adverse experience, generalizing in the longer run to the avoidance of affect in general. To the extent that affective cues increase the probability of triggering memories associated with

affective states, employing this type of cues should maximize the sensitivity of tests of FA-related hypotheses.

Our results also provide further insights regarding the effects of self-discrepant cues (e.g., Crane, Barnhofer, & Williams, 2007; Spinhoven et al., 2007; Van den Broeck et al., in press). In previous research, rAMS in response to self-discrepant cues has been found to be tied to (past) depression (Crane, Barnhofer, & Williams, 2007; Van den Broeck et al., in press). The present finding that ruminative reflection was associated with better performance on the self-discrepant AMT in formerly depressed, but not in never-depressed participants is consistent with these results. Specifically, we found that the more formerly depressed participants habitually engage in purposeful self-analysis in response to sad mood, the more specific memories they retrieved. This finding fits nicely with accumulating evidence that reflection may be an adaptive form of rumination. For example, Jones et al. (2009) found that higher self-reflection decreased the link between ideal self-discrepancies and depressive symptoms in college students. Other evidence includes results from Treynor et al. (2003), who found that, although reflective rumination was associated with more concurrent depression in community volunteers, it predicted fewer symptoms in the long run. Moreover, Arditte and Joormann (2011) found that in currently depressed participants, reflection predicted recovery from that episode 6 months later. The idea is that reflection represents a concrete, instrumental problem-solving approach rather than a repetition of abstract “why me?” type of questions (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Interestingly, better social problem-solving skills have also been related to more autobiographical memory specificity (e.g., Goddard, Dritschel, & Burton, 1996). The idea is that retrieval of specific memories helps the problem solving process, e.g., by facilitating the generation of various alternative solutions. Based on the present finding it may be speculated that the habitual use of a relatively concrete self-analytic problem-solving approach provides ample opportunity for

practicing the retrieval of specific memories that are relevant to self-descriptors. In terms of CaR, an increasing ability to exit the abstract level of self-descriptors or self-discrepant representations in the autobiographical knowledge base would prevent further elaboration of those abstract self-labels and instead, strengthen links between those self-descriptors and episodic detail. Of course, the present finding is correlational and we cannot be sure about the causal direction of this association. It may be that the use of reflective strategies in response to sad mood promotes the retrieval of specific memories, that a tendency to be specific enhances habitual reflective rumination or that some other process during the lifting of a depressive episode (e.g., increasing executive capacity to override capture of attention) might be responsible.

Other findings may also be relevant to studies on depression, rumination and self-discrepancies. For example, there was a correlation between depression severity and memory specificity to self-discrepant cues in formerly depressed participants, but not in never-depressed participants. For standard affective cues, this correlation was nonsignificant in both groups. In the literature, a direct link between rAMS and depression severity appears to be an elusive phenomenon (see Williams et al., 2007). The present pattern of results suggests that the self-discrepant AMT may be more sensitive in detecting relationships with clinical variables that are relevant to CaR, such as depressive symptoms. This also fits with suggestions that rAMS needs to be activated in nonclinical populations, for example by cues that closely match perceived self-discrepancies, or by the induction of state rumination (Crane, Barnhofer, Visser, et al., 2007; Raes et al., 2012; Smets et al., 2012). Another finding that is of interest is that, overall, self-discrepant cues elicited fewer specific memories than affective cues, irrespective of depression history. This is reminiscent of findings that abstract cues elicit more overgenerality than concrete, highly imageable cues (Hauer, Wessel, Geraerts, Merckelbach, & Dalgleish, 2008; Williams et al., 1996). By definition, self-

discrepancies would be abstract – at least to the rememberer. Thus, this finding indicates that regardless of (past) depression, using self-discrepant cues might provide a more suitable method to elicit overgenerality in non-clinical samples than affective cues (Schoofs et al., 2012).

Some findings raise further questions. To begin with, we did not find a correlation between rAMS and either trait rumination in general or brooding in particular. Although such a relationship would be expected given the CaRFAX model and findings in clinically depressed samples, the evidence in samples that are not clinically depressed is scarce (Raes et al., 2012). Thus, our findings are consistent with the broader literature. However, some studies (Crane, Barnhofer, Visser, et al., 2007; Raes et al., 2012) demonstrated that higher trait rumination was linked to less memory specificity in formerly depressed participants after a rumination induction. Hence, Raes and colleagues (2012) argued that overgeneral memory may need to be reactivated by state rumination its association with rAMS to become visible. Apparently, by themselves, our self-discrepant AMT cues were not powerful enough to induce such a state. Future studies might determine whether using a state-rumination induction on top of self-discrepant AMT cues reveals a stronger association between trait rumination and rAMS than using standard affective cues in combination with such an induction.

Furthermore, discrepancy ratings of the cue words were not associated with memory specificity in an important way. At first glance, this seems to be at odds with findings that cues with higher discrepancies were negatively correlated to memory specificity (Van den Broeck et al., in press). However, this earlier study used the same cues for all participants, leaving room for cues that may not have been self-relevant at all to a particular participant. By contrast, we selected people's most self-discrepant cues. Thus, all cues would be self-

discrepant to our participants, rendering the actual degree of self-discrepancy less important for memory retrieval. Self-discrepancy ratings were associated with depressive symptoms.

As for the variables pertinent to FA, the suggestion that the centrality of the event to the participants' life stories would be associated with memory specificity was not confirmed. In addition, we did not find an interaction between event centrality and avoidance of reminders of the target pregnancy. We explored the possible involvement of event centrality because a preoccupation with the memory of a single event might interfere with the retrieval of other autobiographical memories (Boelen, 2012), and because of previous evidence for relations between centrality of adverse events and avoidance. From this latter perspective, our results are somewhat surprising given positive correlations between event centrality and intrusion and avoidance subscales of the IES, which replicate previous findings in this literature (e.g. (Berntsen & Rubin, 2006; Boals, 2010; Boelen, 2009)). However, it could be argued that the birth of a child is a transitional event, which would be judged as identity-changing by almost everyone. Thus, high scores on the CES would come from various sources, obscuring any impact on memory specificity. To our knowledge, this is the first study to look into the relation between centrality of one target event and specificity of memories for other events, and it will be interesting to see whether significant associations emerge in other populations and for unambiguously negative events.

The present study looked at the value of using different types of cues for exploring autobiographical memory specificity in relation to adverse experience (FA) and rumination (CaR) in a rather separate fashion. However, these correlates would be relevant to different types of psychopathology (i.e., PTSD and depression) that have a high comorbidity (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). In addition, the conceptual framework adopted in the present paper would predict that the mechanisms linked to one type of vulnerability would apply to the other type as well. For example, the idea that some sort of highly

accessible actual - ideal self-discrepant representations (Higgins, 1987) capture memorial processes might apply to both depression and posttraumatic psychopathology. Perhaps the content of such actual-ideal self-discrepancies would differ slightly for each disorder. It is plausible that depressed people would perceive a discrepancy between an actual and some unattainable future self, whereas PTSD might be characterized by a perceived discrepancy between a posttraumatic self and their lost undamaged self from the past (see also Berntsen & Rubin, 2006; Conway, 2005 and Dalgleish, 2004, for related ideas). In addition, the present study employed actual-ideal and actual-feared self-discrepancies because we thought these would both apply to our particular sample. Since actual-feared self-discrepancies are predominantly affectively negative words, incorporating them along with (positive) actual-ideal self-descriptors in the AMT would provide an appropriate parallel to the more commonly used positively and negatively valenced words in the affective AMT. However, because the AMTs contained only 5 words of each self-descriptor type and thus would provide rather insensitive measures, we refrained from analyzing them separately. Yet, using larger sets of self-discrepant words as AMT cues may shed light on the relative role of discrepancy type (i.e., actual-ideal, actual-feared and actual-ought; e.g., Carver et al., 1999) in capturing memory retrieval processes in depression and PTSD, respectively. Future studies might explore these issues further.

There are some limitations to note. The present study was exploratory and relied on a relatively small sample. In addition, we used suboptimal measures of brooding and past depression. Nevertheless, it is encouraging that the groups obtained with such a crude measure of depression history displayed correlational patterns that were in line with both the theoretical and empirical literature. If these patterns hold in larger and more carefully selected groups of previously and never-depressed people is for future studies to determine. Additionally women were assessed on average several years after their target pregnancy and it

is possible that we would have identified different or stronger patterns of association, especially with the trauma-related variables, if we had sampled closer to the time of occurrence of the target pregnancy.

In sum, the current findings show that reduced AMS to affective cues was related to avoidance of reminders of an adverse event, whereas *more* memory specificity to self-discrepant cues was related to reflective rumination in formerly depressed participants. Especially the latter finding raises important new questions as to the role of memory specificity in reflective rumination and ultimately, recovery from depression. In general, the present results suggest that varying cue-type may increase the sensitivity of the AMT, depending on the aspect of the CaRFAX model of overgeneral memory that is addressed.

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Footnote

¹ Preeclampsia is a complication of pregnancy or the direct postpartum period. It is characterized by new onset high blood pressure and protein in the urine, and is potentially life-threatening as it may involve several organ systems, such as kidneys, liver or brain. When the brain is involved and a woman develops seizures, the condition evolves into eclampsia. The only way to reverse this condition is delivery of the baby, often resulting in the birth of a premature infant.

Table 1.

Descriptives and Spearman's Rank Correlations between Number of Specific Memories and Variables Related to the Target Pregnancy (N = 61)

	Education	CES	IES intrusion	IES avoidance	IES total	# Specific affective AMT	# Specific self-discrepant AMT
Mean (SD)	4.90 (1.43)	20.47 (7.6)	4.72 (5.29)	1.92 (3.44)	6.64 (7.73)	6.9 (2.03)	5.7 (2.35)
Median (Range)	5 (1-7)	21 (7-35)	3 (0-23)	0 (0-15)	4 (0-30)	7 (2-10)	6 (1-9)
CES	-.05						
IES intrusion	-.05	.48**					
IES avoidance	.10	.40**	.67**				
IES total	-.02	.47**	.97**	.80**			
# Specific affective AMT	.27*	-.10	-.12	-.26*	-.18		
# Specific self-discrepant AMT	.40**	-.10	-.08	-.18	-.12	.56**	-

† p < .10. * p < .05. ** p < .01

CES = Centrality of Events Scale; IES = Impact of Events Scale; AMT = Autobiographical Memory Test

Table 2.

Summary of Hierarchical Multiple Regression Analyses for Pregnancy-related Predictors of Specific Memories

Dependent Variable	Set of predictors	ΔR^2	<i>DF</i>	<i>F</i> – change	<i>B</i>	<i>SE</i>	β	<i>t</i>
Affective AMT	1.	.06	1, 59	3.88†				
	Education				0.35	0.18	.25	1.97†
	2.	.11	2, 57	3.58*				
	SqIES-av				-0.61	0.25	-.33	-2.51*
	CES				-0.01	0.04	-.02	-0.16
	3.	.03	1, 56	1.72				
	CES * SqIES-av				-0.05	0.04	-.18	- 1.31
Self-discrepant AMT	1.	0.12	1, 59	8.38**				
	Education				0.58	0.20	.35	2.89**
	2.	0.05	2, 57	1.72				
	SqIES-av				-0.45	0.28	-.21	-1.60
	CES				-0.01	0.04	-.03	-0.21
	3.	0.00	1, 56	0.03				
	CES * SqIES-av				0.01	0.04	.02	0.17

† $p < .10$; * $p < .05$; ** $p < .01$

Table 2, Continued

AMT = Autobiographical Memory Test, sqIES-av = Impact of Event Scale, avoidance subscale, square-root transformed; CES = Centrality of Event Scale

Table 3.

Comparisons between Previously Depressed (PD) and Never Depressed (ND) participants of Background Variables, Self-Discrepant Processing and Autobiographical Memory Specificity

	PD (<i>n</i> = 28)	ND (<i>n</i> = 33)	Test statistic
Age	38.71 (7.23)	40.0 (7.70)	$t(59) = 0.67$
Education	4.5 (1.55)	5.24 (1.25)	$t(59) = 2.07^*$
BDI-II	9.89 (7.29)	5.17 (3.89)	$t(39.64)^2 = -3.08^{**}$
RRS			
Reflection ¹	3.37 (2.54)	2.55 (2.22)	$t(58) = -1.34$
Brooding ¹	2.74 (1.81)	2.09 (1.74)	$t(58) = -1.41$
Total ¹	14.81 (8.0)	9.94 (7.40)	$t(58) = -2.45^*$
Discrepancy affective Cues			
Positive	4.86 (5.16)	4.34 (4.80)	$t(59) = -0.40$
Negative	6.18 (4.34)	5.85 (4.96)	$t(59) = -0.27$
Total	11.04 (8.43)	10.19 (7.05)	$t(59) = 0.67$
Discrepancy self-discrepant Cues			
Ideal self ¹	5.96 (5.53)	5.67 (3.57)	$t(58) = -0.25$
Feared self ¹	5.93 (4.84)	5.67 (4.98)	$t(58) = -0.20$
Total ¹	11.89 (9.14)	11.61 (6.41)	$t(58) = 0.89$
Specificity affective AMT			
Positive	3.18 (1.36)	3.64 (1.06)	$t(59) = 1.48$
Negative	3.54 (1.20)	3.42 (1.15)	$t(59) = -0.37$
Total	6.71 (2.32)	7.06 (1.77)	$t(59) = 0.66$

Table 3 – continued

	PD	ND	<i>Test statistic</i>
	(<i>n</i> = 28)	(<i>n</i> = 33)	
Specificity self-discrepant AMT			
Ideal self	2.71 (1.46)	3.18 (1.26)	<i>t</i> (59) = 1.34
Feared self	2.68 (1.39)	2.79 (1.34)	<i>t</i> (59) = 0.31
Total	5.39 (2.42)	5.97 (2.28)	<i>t</i> (59) = 0.96

† *p* < .10; * *p* < .05; ** *p* < .01; ¹Data for one participant missing; ² Adjusted DF due to unequal variances.

PD = Previously Depressed; ND = Never Depressed; CES = Centrality of Events Scale; IES = Impact of Events Scale; PSS-SR = Posttraumatic Symptoms Scale, Self-Report; BDI-II = Beck Depression Inventory, second edition; RRS = Ruminative Responses Scale; AMT = Autobiographical Memory Test

Table 4.

Spearman's Rank Correlations between Number of Specific Memories and Variables Related to Self-Discrepant Processing in Previously Depressed Women (n = 28)

	BDI-II	Discrepancy Affective Cues	Discrepancy Self- guides ¹	RRS ¹	RRS reflection ¹	RRS brooding ¹	# Specific Affective AMT
Discrepancy affective cues	.39*						
Discrepancy self-guides ¹	.38*	.47*					
RRS ¹	.43*	.07	.25				
RRS reflection ¹	.05	.04	.04	.68**			
RRS brooding ¹	.42*	.07	.28	.72**	.26		
# Specific Affective AMT	-.19	-.09	.10	.10	.34†	.08	
# Specific Self-discrepant AMT	-.40*	.01	.04	.05	.39*	-.04	.60**

† $p < .10$; * $p < .05$; ** $p < .01$

¹ Data for 1 participant missing

RRS = Ruminative Responses Scale; AMT = Autobiographical Memory Test

Table 5.

Spearman's Rank Correlations between Number of Specific Memories and Variables Related to Self-Discrepant Processing in Never Depressed

Women (n = 33)

	BDI-II	Discrepancy affective cues	Discrepancy self-guides	RRS	RRS reflection	RRS brooding	# Specific Affective AMT
Discrepancy affective cues	.36*						
Discrepancy self-guides	.33†	.48**					
RRS	.48**	.35*	.20				
RRS reflection	.29†	.02	.00	.71**			
RRS brooding	.36*	.37*	.27	.82**	.52**		
# Specific affective AMT	.11	-.09	.10	.05	.04	-.06	
# Specific self-discrepant AMT	-.02	-.28	-.17	-.16	.08	-.28	.51**

† $p < .10$; * $p < .05$; ** $p < .01$

RRS = Ruminative Responses Scale; AMT = Autobiographical Memory Test