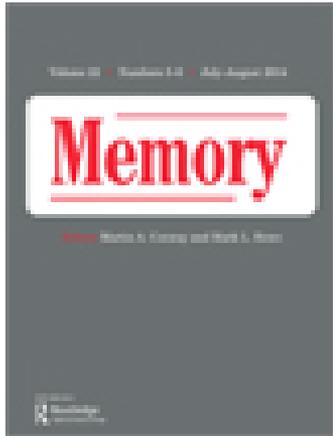


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### Memory and coping with stress: The relationship between cognitive-emotional distinctiveness, memory valence, and distress

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# Memory and coping with stress: The relationship between cognitive–emotional distinctiveness, memory valence, and distress

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Cognitive–emotional distinctiveness (CED), the extent to which an individual separates emotions from an event in the cognitive representation of the event, was explored in four studies. CED was measured using a modified multidimensional scaling procedure. The first study found that lower levels of CED in memories of the September 11 terrorist attacks predicted greater frequency of intrusive thoughts about the attacks. The second study revealed that CED levels are higher in negative events, in comparison to positive events and that low CED levels in emotionally intense negative events are associated with a pattern of greater event-related distress. The third study replicated the findings from the previous study when examining CED levels in participants' memories of the 2004 Presidential election. The fourth study revealed that low CED in emotionally intense negative events is associated with worse mental health. We argue that CED is an adaptive and healthy coping feature of stressful memories.

The experiencing of emotions plays an adaptive role in our lives; they help us identify rewarding endeavours, alert us to potential dangers, and give us a sense of urgency in times of distress. However, emotions can sometimes be overwhelming, and it would be advantageous to be able to control such emotions. Unwanted emotional reactions can lead to undue distress and be manifested in psychological disorders such as anxiety disorders and post-traumatic stress disorder.

One source of unwanted emotional reactions is memories of stressful or traumatic events. Past research has found that highly emotional memories can be difficult to forget (Brown & Kulik, 1977; LeDoux, 2000) and can be frequently brought into conscious awareness without volition (Horowitz, 1975). Stressful memories may be well remembered due to unique structural and organisation features in memory. Whether such memories lack proper organisation and coherence (Barclay, 1995; van der Kolk & Fisler, 1995) or

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are overly integrated into the life story (Berntsen & Rubin, 2006; Berntsen, Willert, & Rubin, 2003), stressful memories appear to differ from everyday memories in their structural and organisational features (Porter & Birt, 2001). Degree of aberration in structural organisation has been linked with both mental health outcomes (Foa, Molnar, & Cashman, 1995a; Harvey & Bryant, 1999) and physical health outcomes (Pennebaker, Mayne, & Francis, 1997). Hence, once a stressful experience has ended, the experience can continue to affect an individual through his/her memory of the event.

Despite the ongoing controversy surrounding how the organisational aspects of stressful and traumatic memories differ from those of non-trauma memories, most researchers agree that emotion is a central organisational aspect of trauma memories (Brewin & Holmes, 2003; Stein, Trabasso, & Albro, 2001). We argue that investigations concerning unique structural and organisational features of stressful memories would benefit from the exploration of the role of emotion in the cognitive representation of such memories. Specifically, we believe that an important organisational feature of stressful memories is the strength of the links between nodes representative of the event and nodes representative of the associated emotions. In comparison to non-trauma memories, trauma memories are linked with strong feelings of fear, anger, helplessness, and guilt (Grey, Holmes, & Brewin, 2001), contain more sensory features (Brewin, 2001; Hellawell & Brewin, 2004; Rubin, Feldman, & Beckham, 2003a), and have a greater sense of reliving (Pillemer, Desrochers, & Ebanks, 1998; Rubin et al., 2003a). The presence of negative emotions associated with a trauma memory is predictive of future psychopathology (Ehlers, Mayou, & Bryant, 1998; Talarico & Rubin, 2003) and may undermine subsequent attempts at therapy (Foa, Riggs, Massie, & Yarczower, 1995b).

The idea that representations of events have separate cognitive and emotional features has a history in the field of psychology in such areas as attitudes (Crites, Fabrigar, & Petty, 1994) and information processing (Lazarus, 1984; Zajonc, 1984) and a distinction between cognitive and affective information is prominent in many models of memory structure (Bower, 1981; Brewin, 2001; Conway & Pleydell-Pearce, 2000; Lang,

1979). Strong links between event stimuli and affective responses that are difficult to extinguish are believed to be an integral cause of post-traumatic stress disorder (PTSD; Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 1998; see Dalgleish, 2004, for a recent review) that lead to subsequent hyperarousal symptoms and emotion-laden intrusive thoughts about the traumatic event.

One such model that emphasises the links between representations of the trauma event and affective responses is Foa, Steketee, and Rothbaum's (1989) fear network model of trauma memory. The model posits that trauma memories form an associative network in which stimuli related to the trauma automatically trigger a fear response. Stimuli that were encoded as part of the trauma become linked with a fear response such that activation of a trauma stimulus (e.g., "bald man") results in a meaning response (e.g., "he is therefore dangerous") and a physiological response (e.g., "fear and anxiety"). Hence activation of stimuli associated with the trauma event results in an automatic fear response. Through techniques such as exposure therapy, the links between the trauma events and fear become weakened, and new, less anxiety-provoking affective responses are integrated into the network (Foa & Kozak, 1986). Hence a core feature of stressful and traumatic memories appears to be the strong affective associations with the memory of the event (see also Brewin & Holmes, 2003; Conway & Pleydell-Pearce, 2000).

One methodology that can be used to empirically explore the role of emotions in the cognitive representation of a stressful event is multidimensional scaling (MDS). MDS is a mathematical tool that can also be used to reveal organisational associations between items related to a particular domain (Schiffman, Reynolds, & Young, 1981). MDS has been used to measure a variety of psychological stimuli such as judgements of affect (Reisenzein & Schimmack, 1999) and the structure of self-concepts (Breckler, Pratkanis, & McCann, 1991; DeSteno & Salovey, 1997). In MDS, participants make dissimilarity ratings between stimuli related to a particular event or concept. The dissimilarity ratings are then used to determine the underlying organisation and representation of the concepts within the context of the event. If emotions are included as stimuli in the MDS procedure, the manner in which the

emotions are organised with event stimuli in the cognitive representation of an event can be explored. For instance, the extent to which the related emotions cluster closely with or are represented as more separate from stimuli related to the event can be measured.

Boals and Klein (2005a) used MDS to explore the extent to which stimuli related to a recently failed romantic relationship clustered together with associated emotional stimuli. Participants who had experienced a recent romantic break-up gave dissimilarity ratings to stimuli representative of romantic relationships that were either event-oriented (non-emotional) or emotional. The resulting MDS model revealed an emotional/non-emotional dimension in the participants' cognitive representation of the relationship. Individual differences in the extent to which emotional stimuli were linked with non-emotional stimuli in participant's cognitive representation of the relationship were measured by a comparison of the mean dissimilarity ratings of stimulus pairs either matched on the dimension of emotionality (i.e., an event-oriented/non-emotional stimulus paired with another event-oriented/non-emotional stimulus or an emotional stimulus paired with an emotional stimulus) or mismatched (i.e., an event-oriented/non-emotional stimulus paired with an emotional stimulus). Boals and Klein refer to this concept as cognitive-emotional distinctiveness (CED), the extent to which an individual evidences a separation between an event and its associated emotions in the resulting MDS model. Higher ratings of dissimilarity between mismatched pairs reflect higher levels of CED; that is, a greater separation of the emotions from the event.

Conceptually, an MDS model depicting high levels of CED would include an event/emotion dimension in which stimuli representative of the event are located on one end of the model, while the stimuli representative of the associated emotions are located on the opposing end. In this situation activation of event nodes has a relatively low likelihood of activating associated emotion nodes. In a model depicting low levels of CED the event stimuli and the emotion stimuli are intermixed. In such situations of low CED activation of the event nodes has a relatively high likelihood of activating the associated emotion nodes. We would argue that if the associated emotions are negative and of high intensity, then recall of the

event leads to a high likelihood of subsequent stress-related symptoms. Boals and Klein found that participants who reported high levels of stress and low levels of recovery associated with the break-up demonstrated the least amount of CED in their memories for the past relationship. Hence more stressful break-ups were associated with lower levels of CED. Several other studies comparing dissimilarity ratings of stimuli pairs matched and mismatched on the dimension of event/emotion have yielded corroborating results such that a lack of separation of emotional from non-emotional features is correlated with higher levels of associated stress and anxiety (Cavanagh & Davey, 2001; Pury & Mineka, 2001; Schutz, Davis, & Schwanenflugel, 2002). A lack of CED may be a central feature of stressful memories and a source of difficulty for coping with stress.

Although Boals and Klein (2005a) have provided some support for the concept of CED, its measurement, and its relationship to recovery from a stressful experience, their study was limited in a number of important ways. First, the study dealt with only one type of memory, the break-up of a romantic relationship, which calls into question whether CED levels are predictive of distress in other types of negative memories. Second, the emotional stimuli used in the study were not emotions such as happy or angry, but rather were stimuli that were rated as high in emotionality (i.e., "feeling jealous about your ex-partner"). Hence the specific role of emotions in cognitive representations was measured using highly emotional concepts as opposed to using an actual emotion label as a stimulus. Third, the use of mean dissimilarity ratings as a measure of CED has not been directly compared to measures of dimension importance conventionally derived from MDS procedures such as dimension weights. If event/emotion is a significant dimension in a MDS model, dimensional weights can be used to measure the extent to which the emotions are represented separately from the event. Fourth, CED levels in memories of positive events have yet to be explored. Although Boals and Klein found that high CED levels are preferable for negative events, levels of CED for positive events should be benign because there is no need to separate emotional and cognitive aspects of the event. Finally, further correlates of CED such as its relationship to the frequency of intrusive thoughts about the event and mental health

have not been explored. Whereas we would expect that high CED levels in negative events would be related to fewer intrusive thoughts about the event, we have no reason to believe that CED levels for positive events should be predictive of phenomenological features of the memory.

We conducted four related studies. In the first study we examine CED levels for memories of the terrorist attacks of September 11, 2001. In the second study we compare CED in participant-nominated positive and negative events. The third study examines memories of the 2004 Presidential election and compares CED levels in the memory for this event between those who viewed the election as positive (Bush voters) and those who viewed the election as negative (Kerry voters). The fourth study examines the relationship between CED levels in memories of negative events and a measure of overall mental health.

## STUDY 1

### Overview

The first study extends the measurement of CED to participants' memories for the September 11 terrorist attacks (referred to as 9/11). These attacks are presumed to be highly negative events and had a significant impact on our participants. Based on the findings from Boals and Klein (2005a) we hypothesise that one dimension participants will use in rating stimuli related to the terrorist attacks in a MDS procedure is an event/emotion dimension.

In addition we hypothesise that individual differences in the extent to which the event/emotion dimension is important in participants' cognitive representation of the event will be associated with psychological adjustment. Individual differences will be measured using the traditional measure of dimension weights derived from MDS and the mean dissimilarity ratings of mismatched pairs used by Boals and Klein (2005a). A comparison can then be made to test whether the mean dissimilarity ratings measure is correlated with the traditional dimension weights measure. This comparison can be made for each dimension in the resulting MDS model. If the two measures are highly correlated with each other,

then we can argue that both dimension weights of an event-emotion dimension and mean dissimilarity ratings of pairs mismatched on the dimension of event-emotion can be used as an individual difference measure of CED. Based on previous evidence that low levels of CED are related to higher levels of stress and anxiety, and the link between negative affect and intrusive thoughts (Horowitz & Becker, 1971; Rachman, 2001), we hypothesise that lower levels of CED involving negative emotions in the cognitive representation of the terrorist attacks will be correlated with higher levels of intrusive/avoidant thinking about the attacks. CED levels involving positive emotions associated with the terrorist attacks should be unrelated to intrusive/avoidant thoughts.

## METHOD

### *Participants*

A total of 131 volunteers from Introduction to Psychology courses at North Carolina State University participated for partial course credit. Of these, 94 participants completed the study in November 2001, approximately 2 months after the events of September 11. The remaining 37 participants completed the study in February 2002, approximately 5 months after the events of September 11.

### *Materials*

*Multidimensional Scaling (MDS).* A set of stimuli that represent the events and emotions of the terrorist attacks was informally nominated by a group of undergraduate and graduate students working in our research lab. We selected 12 of these stimuli that we judged to be most central to the cognitive representation of the terrorist attacks. Eight stimuli related to the 9/11 events were chosen that included events, conditions, or persons associated with the terrorist attacks and its aftermath ("Planes crashing into the World Trade Center", "Airport security", "Plane crash in Queens, NY", "Freedom", "The Taliban", "Terrorism", "George W. Bush", and "Anthrax"). The remaining four stimuli were emotional labels associated with terrorist attacks, two of which were negative ("Fear" and

“Disbelief”) and two that were positive (“Hope” and “Pride”). A smaller number of emotion stimuli than event stimuli were used because the total number of emotions a person associates with a particular event is often limited. All possible non-repeating pairs of the 12 stimuli ( $n=66$ ) were presented in a questionnaire packet. Using a procedure recommended by Schiffman et al. (1981), participants were asked to rate the dissimilarity between each pair of stimuli, using a continuous scale running from 0 (exactly same) to 50 (completely different). Participants were given six practice trials at the start of the MDS procedure in which they gave dissimilarity ratings to types of fruit.

*Impact of Events Scale (IES).* The IES (Horowitz, Wilner, & Alvarez, 1979) is a 15-item questionnaire that we used to measure the frequency of intrusive and avoidant thoughts associated with the September 11 terrorist attacks during the previous 7 days. The IES consists of two subscales: intrusiveness (i.e., “I thought about it when I didn’t mean to”) and avoidance (i.e., “I tried not to talk about it”). Participants responded from 0 “not at all” to 5 “often”.

*Manipulation check of emotional association.* A manipulation check was used to verify that participants associated more affect with the four emotion stimuli, in comparison to the eight event stimuli. We recruited 57 participants from North Carolina State University who were asked, “In the context of the September 11 terrorist attacks, when thinking about [stimulus], I *associate a lot of emotion* with this stimulus”, “. . . , the emotions I feel are *extremely intense*”, “. . . , I feel my *heart* pound or race”, and “. . . , I feel knot, cramps, or *butterflies* in my stomach”. Participants responded on a scale from 1 (not at all) to 7 (very much). Consistent with our argument that the emotion stimuli represent emotional representations, participants gave higher ratings to the four emotion stimuli, in comparison to the eight event stimuli for “*associate a lot of emotion*” ( $m = 3.86$ ,  $SD = 1.43$  versus  $m = 3.42$ ,  $SD = 1.20$ ),  $t(56) = 3.18$ ,  $p < .01$ , “*extremely intense*” ( $m = 3.77$ ,  $SD = 1.62$  versus  $m = 3.29$ ,  $SD = 1.20$ ),  $t(56) = 3.56$ ,  $p < .001$ , “*heart*” ( $m = 3.42$ ,  $SD = 1.72$  versus  $m = 3.00$ ,  $SD = 1.33$ ),  $t(56) = 3.72$ ,  $p < .001$ , and “*butterflies*” ( $m = 2.91$ ,  $SD = 1.75$  versus  $m = 2.59$ ,  $SD = 1.35$ ),  $t(56) = 2.70$ ,  $p < .01$ . Although the mean differences are not large, they are reliable and consistent with the intended manipulation.

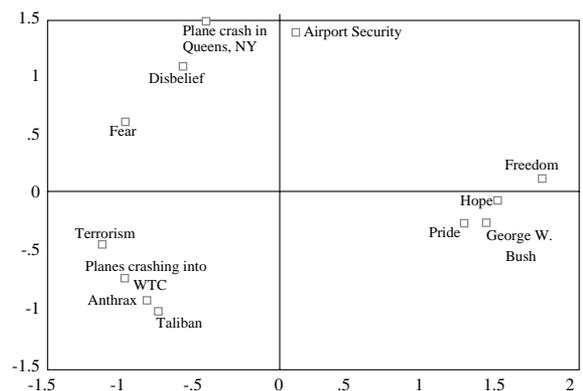
### Procedure

After receiving oral and written instructions from the researcher, participants completed the MDS procedure and then completed the IES.

## Results and discussion

To test for any effects of the semester in which the study took place (November 2001 vs February 2002), semester was included as an independent variable in all analyses. No significant effects of semester emerged and hence will be excluded from the analyses reported here.

To determine whether participants perceived a difference between the four emotion stimuli and the stimuli representing the terrorist attack events and its aftermath (event stimuli), we first created an MDS model based on the dissimilarity ratings. We chose a two-dimensional fit because the two-dimensional solution (stress = .369,  $R^2 = .36$ ) provided a better fit than the one-dimensional solution (stress = .529,  $R^2 = .32$ ). We did not consider more than a two-dimensional solution because Kruskal and Wish (1978) recommend that a minimum of 13 stimuli are required to create an accurate three-dimensional solution. As can be seen in Figure 1, Dimension 1 appears to be a valence dimension. Stimuli on the left side of the solution are negative in valence, whereas the stimuli on the right side are generally positive. Consistent with our hypothesis that it is desirable to separate emotions from non-emotional details in negative but not positive events, dimension 2 appears to be an event/emotion dimension, but only for negatively valenced stimuli. On the negative side of valence dimension the stimuli in



**Figure 1.** Two-dimensional MDS solution for participants' cognitive representation of the 9/11 terrorist attacks.

the bottom half of the solution are all stimuli representative of the events, whereas the stimuli consisting of emotion labels are found in the top half of the solution (leaving aside “plane crash in Queens, NY”)<sup>1</sup>. On the positive side of the valence dimension the stimuli are tightly clustered together, except for “airport security”. It should be noted that although “freedom” is not an emotion, it is an abstract concept that is similar to the emotion “hope”, which may have contributed to the clustering. Despite this limitation, Dimension 2 appears to represent the extent to which individuals separate the negative emotions from the event stimuli but have strong associations between the positive emotions and the event stimuli in their cognitive representation of the 9/11 terrorist attacks. The strong connections between the positive event stimuli and positive emotions likely mirror the strong sense of nationalism in the United States that emerged in the aftermath of the attacks.

We next examined individual differences in the importance of the event–emotion dimension. Individual differences in CED were measured using two different techniques: (1) Individual Difference Scaling (INDSCAL), and (2) mean dissimilarity ratings of stimuli that were used by Boals and Klein (2005a). The measurement of individual differences in CED using these two techniques will allow us to examine whether the use of mean dissimilarity ratings of stimuli has similar predictive validity to the more traditional measure using INDSCAL.

INDSCAL is a variation of MDS modelling that yields dimension weights for each participant. The higher a dimension weight for an individual participant, the greater emphasis that participant places on that dimension in the cognitive representation (Kruskal & Wish, 1978). However, as Schiffman et al. (1981) point out, the use of raw dimension weights is inappropriate for standard statistical procedures because the dimension weight is defined by a vector rather than a point. The length of the vector for

each participant reflects goodness of fit, while the direction represents each dimension’s importance. Hence, raw dimension weights from INDSCAL were normalised by a procedure recommended by Schiffman et al. that equates the lengths of all of the vectors, resulting in a measure in which all variance is due to differences in direction.

The second method we used to assess individual differences in CED was to examine the dissimilarity ratings for pairs of stimuli matched or mismatched on the dimension of event–emotion. The pairs of stimuli rated in the MDS procedure were categorised as: (1) Event–event: both stimuli in the pair to be rated were event stimuli related to the 9/11 events (e.g., The Taliban – Anthrax), or (2) Event–emotion: one of the stimuli in the pair is an event stimulus and the other is an emotion label (e.g., The Taliban – Fear). Event–emotion pairs were also separated into pairs with either a positive emotion (e.g., Terrorism – Pride) or a negative emotion (e.g., Terrorism – Fear). Dissimilarity ratings of event–emotion are presumed to be an indicator of CED levels such that lower ratings of dissimilarity reflect lower levels of CED. Conceptually, dissimilarity ratings of event–event pairs are presumed to not be indicative of CED because emotion is not involved. Ratings of emotion–emotion pairs are not included in any analyses because dissimilarity ratings of two emotions tell us little about the integration of emotions with the event stimuli. A mean dissimilarity rating for each of the four types of stimulus pairs of interest (Event–Event, Event–emotion, Event–Positive Emotion, and Event–Negative Emotion) was calculated for each participant. There were a total of 28, 32, 16, and 16 ratings for each type of stimulus pair, respectively.

As stated earlier, we believe that for negative emotions there should be a separation between event and emotions, whereas for positive emotions there should be more integration of event and emotion. If Dimension 2 reflects a separation of negative emotions from event stimuli but an integration of positive emotions with event stimuli, then we would expect Dimension 2 weights to be positively correlated with event–negative emotion dissimilarity ratings but negatively correlated with event–positive emotion dissimilarity ratings. Consistent with this logic, Dimension 2 weights were positively correlated with dissimilarity ratings of event–negative emotion pairs,  $r(129) = .40$ ,  $p < .0001$  and negatively correlated

<sup>1</sup> Although “Plane crash in Queens, NY” received a very high score on the emotion dimension, this aberration may be an artefact of the fact that, at the time of stimulus selection, the plane crash was thought to be terrorist related and hence was selected as one of the stimuli. In the subsequent days terrorism was ruled out as a cause of the crash and this event quickly became unrelated to the September 11 terrorist attacks. Hence participants did not include this event with the other terrorist-related events.

with dissimilarity ratings of event-positive emotion pairs,  $r(129) = -.30, p < .001$ . This pair of correlations supports our interpretation that greater Dimension 2 weights reflect the combination of a greater separation between event and emotions for negative stimuli and a greater integration between event and emotion for positive stimuli.

To further demonstrate that the dimension weights and mean dissimilarity ratings are related, we conducted a similar comparison between dimension weights and dissimilarity ratings for Dimension 1 which was interpreted as a valence dimension. To create an individual differences measure of the importance of the valence dimension using the mean dissimilarity ratings method, all pairs that were mismatched on the dimension of valence (a positive stimulus paired with a negative stimulus, regardless of whether the stimuli were events or emotions) were used to calculate a mean positive-negative dissimilarity rating. The resulting mean positive-negative dissimilarity ratings were correlated with normalised Dimension 1 weights,  $r(129) = .40, p < .0001$ . This finding suggests that the method of using mean dissimilarity ratings can be used as a substitute individual differences measure for the more conventional measure of dimension weights. When measuring CED, the dissimilarity ratings method has an advantage in that the links involving negative emotions and positive emotions can be examined separately.

To test whether Dimension 2 weights and the event-emotion pairs would predict IES scores, whereas the event-event pairs would be unrelated, correlational analyses were conducted. As can be seen in Table 1, ratings of event-emotion pairs were negatively correlated with total IES scores, whereas Dimension 2 weights fell just

short of significance,  $p < .10$ . Both measures of CED significantly predicted the intrusiveness subscale of the IES, but were uncorrelated with the avoidance subscale. When event-emotion pairs were examined as pairs involving either negative or positive emotions, pairs containing negative emotions were significantly correlated with total IES scores and the intrusiveness subscale, while pairs that involved positive emotions were unrelated to IES scores. Hence higher levels of CED involving negative emotions in the cognitive representation of the terrorist attacks were associated with less September 11-related distress.

Contrary to hypothesis, dissimilarity ratings of the event-event pairs did predict total IES scores and both the intrusiveness and avoidance subscales. Higher dissimilarity ratings of event-event pairs predicted greater levels of distress concerning the terrorist attacks. This result is contrary to the findings of Boals and Klein (2005a) in which dissimilarity ratings of event-event pairs were unrelated to measures of distress in a similar study concerning romantic relationship break-ups. A possible explanation for this finding is that Boals and Klein measured the cognitive representation of a recently failed romantic relationship, which differs from the September 11 terrorist attacks along several dimensions. For example, romantic relationships are more personal and contain more episodic features, which could have caused the observed differences in the predictive validity of event-event pairs. We will revisit the role of event-event pairs in the subsequent studies.

In summary, use of mean dissimilarity scores from stimulus pairs mismatched on a dimension appear to be a valid substitution for the more traditional measure of dimension weights. Mean dissimilarity scores are advantageous because a relatively small number of participants are needed (traditional MDS modelling requires a minimum of 100 participants), positive and negative emotion links can be examined separately, and it opens the possibility that each participant can nominate their own event and associated stimuli, whereas in traditional MDS modelling all participants rate the same set of stimuli. We also found that lower levels of CED involving negative emotions in participants' memories of the September 11 attacks predicted greater frequency of intrusive thoughts about the attacks.

**TABLE 1**  
Correlations between measures of CED and distress from Study 1

	<i>IES</i>	<i>Intrusion</i>	<i>Avoidance</i>
Dim2 weights	-.15	-.18*	-.07
Event-emotion	-.17*	-.23**	-.07
-Negative only	-.18*	-.28**	-.02
-Positive only	-.09	-.08	-.08
Event-event	-.31**	-.32**	-.22**

\* $p < .05$ , \*\* $p < .01$ .

## STUDY 2

### Overview

Although based on correlational data, a possible explanation as to why high levels of CED for negative emotions are associated with less distress is that CED is a coping strategy to protect against anxiety and maintain positive mental health. The idea that individuals consciously or unconsciously employ strategies to protect themselves against anxiety dates back to Freud (1894/1962) and, as Cramer (2000) recently pointed out, is still pervasive in modern research under such labels as dissonance reduction, selective attention, avoidant attachment styles, and positive illusions. When an individual thinks about or activates a negative event, it is useful for the links between nodes representative of the event and nodes representative of associated emotions to be relatively weak. In this manner the individual can think about the event without having the associated emotions automatically activated. Psychologically healthy individuals will want to separate the negative emotions from the cognitive representation of negative events to help maintain positive schemas and reduce negative affect. Under these conditions the individual has some control over whether he or she also recalls the associated negative emotions.

In contrast, when an individual recalls a past positive event the automatic recall of the associated emotions may promote psychological well-being. Because positive events are by definition associated with positive emotions, there is no reason or motivation for an individual to dissociate the positive emotions in the memory. If high levels of CED are adaptive for negative events, relative to positive events, then we would expect to find higher levels of CED in negative events in comparison to positive events. In addition, individual differences in CED levels for negative, but not positive, events should be related to individual differences in levels of distress associated with the event.

Negative events and positive events differ along a number of important features (Schaefer & Philippot, 2005; Talarico, LaBar, & Rubin, 2004), any one or a combination of which could confound any potentially observed valence differences in CED scores. For instance, Talarico et al. (2004) found that, in comparison to negative events, participant-nominated positive events

tend to be more recent, recalled with more confidence in memory accuracy, and associated with less intense visceral reactions. In addition, there is a culturally defined life script for positive events (general belief that during a typical lifetime, people go to school, get married, have a career, etc.), but not for negative events (Rubin & Berntsen, 2003). Measures of such properties of each memory would need to be obtained to explore whether any potentially observed differences in CED between negative and positive events is a function of valence, or some other phenomenological feature.

Although the results of Study 1 revealed that CED level in a stressful memory is related to levels of distress, CED was only examined in memories of the September 11 terrorist attacks, which was not necessarily a major stressful event for all participants in the study. In addition, many aspects of participants' memory for the September 11 attacks may be semantic based. Allowing participants to self-nominate a very stressful event from their life would make it more likely that the memories being examined are both stressful and episodic. This manipulation would also allow us to explore whether the utility of CED generalises across a variety of stressful events.

In addition, one could question whether the dissimilarity ratings from Study 1 actually reflect the idiosyncratic associative links of each individual participant. An alternative explanation is that the dissimilarity ratings represent general similarity between semantic concepts (e.g., terrorism and fear), rather than one's own memory structure. Allowing each participant to nominate his/her own set of stimuli that he or she believes best represents his/her own unique memory structure and make dissimilarity ratings between these stimuli will likely result in a measure that reflects each individual participant's idiosyncratic organisation. Further, the event and emotion stimuli in Study 1 were selected by the experimenters, which left open the possibility that the participants did not similarly view the selected events as an "event" (e.g., "freedom"). Allowing participants to nominate their own set of events and emotions will ensure that each stimulus is categorised by the participant as event or emotion.

Higher levels of CED in memories of negative events may have adaptive value in that they help protect the individual from the repeated re-experiencing of the negative emotions associated with the event. However, CED may only be

important in negative memories that are high in emotional intensity. If the emotion nodes used in the CED measurement include a physiological reaction only if they are emotionally intense, then activation of emotion nodes in either negative events low in emotional intensity or positive events should have little to no effect on the level of distress associated with the event because there is no need for individuals to protect themselves against a re-experiencing of benign negative or positive emotions. However, activation of emotion nodes in negative events high in emotional intensity may result in a physiological stress reaction leading to greater levels of distress being associated with recall of the event. In this sense, emotion nodes in memories of low emotional intensity may be “cold” and merely represent semantics of the emotion; emotion nodes in memories of high emotional intensity may be “hot” and trigger an emotional reaction. Hence not only do we hypothesise that negative events will have higher CED levels in comparison to positive events, but we also hypothesise that emotional intensity will moderate the relationship between CED and levels of distress for negative events. In addition, we do not expect to find any relationship between CED levels and distress in memories of positive events.

## Method

### *Participants*

A total of 158 volunteers (65 males) from Duke University participated for either partial course credit ( $n = 83$ ) or were recruited from campus flyers and paid \$12 ( $n = 75$ ). The average age was 20.9 years and ranged from 18 to 55 years old.

### *Materials*

*Cognitive-emotional distinctiveness (CED)*. To measure the extent to which an individual separates the emotions from the event in the cognitive representation of that event, a modified multidimensional scaling procedure was employed (Boals & Klein, 2005a). Participants nominated a “very positive personal event” and a “very negative personal event” from their life. After nominating each memory, participants were instructed to

... think about items (such as persons, places, thoughts, and events) that you believe are central to your memory for this event. Then,

in the spaces provided below, please list eight of these items and four emotions that you believe are most central to your memory for this event.

The 12 stimuli the participants generated were then used in a multidimensional scaling procedure in which participants gave dissimilarity ratings between pairs of stimuli. After completing four practice ratings, all possible non-repeating pairs of the eight stimuli ( $n = 66$ ) were presented on a computer screen. Participants were then instructed:

Listed below are pairs of the pieces of the event that you listed for us. We are interested in how these pieces of the event fit together to form your memory for this event. Below we ask you to rate the difference between each pair. The more different you believe a pair of items is (in the context of this event), the higher the rating you should give it.

As in Study 1, participants were asked to rate the dissimilarity between each pair of stimuli, using a continuous scale running from 0 (exactly same) to 50 (completely different).

CED was measured by calculating a mean dissimilarity rating of event-emotion pairs for each participant. Higher dissimilarity ratings of event-emotion pairs reflect a greater separation between event nodes and associated emotion nodes, hence higher CED levels; lower dissimilarity scores reflect greater integration between the event and the associated emotions, hence lower CED levels. Mean dissimilarity ratings of event-event and emotion-emotion pairs were calculated for comparison purposes. The modified MDS procedure resulted in 28 event-event pairs, 32 event-emotion pairs, and six emotion-emotion pairs to be rated for each memory. Since each participant rated a different set of stimuli, a full MDS model is not possible.

*IES*. As in Study 1, the IES was used to measure the number of intrusive and avoidant thoughts associated with each nominated memory.

*Autobiographical Memory Questionnaire (AMQ)*. We used an abbreviated version of the AMQ (Rubin, Schrauf, & Greenberg, 2003b) to measure phenomenological properties of each memory. The questionnaire asked participants two more cognitive questions. One concerned recollective properties: while remembering the event “I feel as though I am *reliving* the event.”

The second concerned narrative: “the event comes to me as a *coherent story*.” There were two questions concerning cognitive emotions. One was about valence: “the emotions are extremely *positive*” and “the emotions are extremely *negative*” which were combined into a single measure of emotional valence by reverse scoring the negative emotion question, adding the score for the positive emotion question, and divided by two. The other was about intensity: while remembering the event “the emotions are extremely *intense*.” Finally, there were four questions concerning visceral reactions associated with the event: While remembering the event “I feel my *heart pound*”, “I feel *tense* all over”, “I feel *sweaty*”, and “I feel knots, cramps, or *butterflies* in my stomach”. All questions were answered using 7-point rating scales. In addition, the AMQ includes a question concerning the age of the event.

### Procedure

After completing an informed consent form, participants nominated an event, completed the AMQ and IES, generated the eight stimuli associated with that event, and then completed the multidimensional scaling procedure. This procedure was repeated twice, once for each memory type (positive and negative). Order presentation of the negative or positive event was counterbalanced.

## Results and discussion

The participants in the study nominated a wide variety of events. Some of the more common positive events include academic/athletic achievements, vacations, and successes in dating; common negative events include academic/athletic failures, conflicts with friends/dating partners, parents divorcing, and family deaths. Event stimuli that participants nominated were typically persons (e.g., “my boyfriend”), places (e.g., “my dorm room”), and events (“scoring the winning shot”). Emotion stimuli were generally common emotion labels such as “angry”, “sad”, “happy”, and “joy”. The fact that participants nominated items from events that were unique to their own experiences (“my dorm room”) makes it likely that the dissimilarity ratings participants made involving these stimuli reflect episodic memory

**TABLE 2**  
Differences in CED, pair types, IES, and phenomenological properties as a function of memory valence from Study 2

	<i>Negative</i>	<i>Positive</i>	<i>t</i> (149)
<i>CED</i>			
Event–emotion	19.62 (7.3)	17.32 (7.2)	3.37***
Event–event	23.39 (7.0)	24.78 (7.1)	–1.95
Emotion–emotion	16.41 (11.8)	15.89 (11.4)	0.50
<i>IES</i>			
Total	21.36 (16.2)	11.37 (9.6)	7.52***
Intrusiveness	10.03 (8.7)	9.22 (7.7)	0.86
Avoidance	11.33 (9.3)	2.16 (3.3)	12.29***
<i>AMQ</i>			
Reliving	3.88 (1.5)	4.47 (1.6)	–3.93***
Coherent Story	4.52 (1.9)	4.82 (1.8)	–1.52
Positive Valence	–5.11 (1.7)	1.79 (1.1)	–45.82***
Emotional Intensity	4.87 (1.5)	4.64 (1.4)	1.49
Visceral Emotions	10.52 (5.9)	7.83 (4.4)	5.47***
Age of Event (months)	46.74 (54.6)	24.73 (32.9)	5.29***

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

structures, as opposed to general semantic associations.

Due to a computer error, MDS ratings for the positive event were lost for two participants, the ratings for the negative events were lost for two other participants, and the ratings for both the positive and negative event were lost for one participant. Additionally, the data from three other participants were excluded because they failed to follow instructions.

As can be seen in Table 2, participants gave higher dissimilarity ratings to event–emotion pairs for negative events, in comparison to positive events. No significant valence differences in ratings of event–event and emotion–emotion pairs were obtained; however, valence differences for event–event pairs approached significance ( $p < .10$ ). Hence consistent with our prediction, negative events evidenced higher levels of CED in comparison to positive events, whereas dissimilarity ratings of event–event and emotion–emotion pairs did not significantly differ between negative and positive events.

We next examined valence differences in the phenomenological properties of the nominated events. Visceral reaction scores were computed by adding the scores from the four visceral reaction questions on the AMQ ( $\alpha = .87$ ). As can be seen in Table 2, IES scores were higher for negative events than positive events, but this difference appears to be driven by the avoidance subscale. As rated on the AMQ, participants

rated negative events as having less of a sense of reliving, less positively valenced emotions, greater visceral emotional responses and, consistent with Talarico et al. (2004) and Berntsen and Rubin's (2004) finding for this age group, that occurred longer ago. Negative and positive events did not differ in ratings of emotional intensity nor that the event comes as a coherent story.

Because negative and positive events differed along a number of phenomenological properties, we next tested whether any of the reported differences between negative and positive events could account for the previously observed valence differences in CED. Difference scores for the IES, the intrusiveness subscale, the avoidance subscale, and all of the measured properties (reliving, coherent story, emotion valence, emotional intensity, visceral emotions, and age of the event) were calculated for each participant by subtracting the score for their negative event from the score for their positive event. A similar difference score between negative and positive events was calculated for CED. If valence differences in one or more of the memory properties are causing the observed valence differences in CED scores, we would expect a large correlation between the difference score of the property and the difference score in CED. This analysis resulted in nine separate correlations. Valence differences in emotional intensity of the event were correlated with valence differences in CED,  $r(149) = -.17, p < .05$ . None of the other eight correlations was significant.

Because valence differences in emotional intensity were correlated with valence differences in CED, we next tested for valence differences in CED when controlling for valence differences in emotional intensity. A regression analysis was conducted in which we predicted valence differences in CED by valence differences in emotional intensity. If the intercept of the resulting regression model, which represents the CED valence difference, is significantly greater than zero, then a significant valence difference in CED remains when controlling for valence differences in emotional intensity. The results revealed that the intercept was significant,  $t(145) = 3.34, p < .01$ . Thus CED differences between negative and positive events remained significant when controlling for valence differences in emotional intensity.

We next examined the relationships between CED scores and levels of distress associated with the event (IES) and phenomenological properties of the event (AMQ). Separate correlations were computed for negative events and positive events, resulting in 18 correlations. We predicted a negative relationship between CED and IES for negative events; the rest of the correlations are exploratory in nature. As can be seen under the "All" columns in Table 3, for negative events, five of the nine correlations were significant. Higher CED scores for negative events were correlated with lower total IES scores, fewer intrusive thoughts, less reliving, more related positive emotions, and less emotional intensity. For posi-

**TABLE 3**  
Correlations between CED and variables of interest for positive and negative events from Study 2

	<i>Positive events</i>		<i>Negative events</i>	
	<i>All</i>	<i>All</i>	<i>Emotional intensity</i>	
			<i>High</i>	<i>Low</i>
<i>IES</i>				
Total	.08	-.19*	-.33*	-.02
Intrusiveness	.01	-.19*	-.28*	-.05
Avoidance	.20*	-.14	-.31*	.01
<i>AMQ</i>				
Reliving	-.04	-.18*	-.10	-.12
Coherent Story	-.09	-.03	-.02	-.02
Positive Valence	-.17*	.26**	.31*	.19
Visceral Emotions	.19*	-.12	-.16*	.05
Emotional Intensity	-.03	-.20*	—	—
Age of Event (months)	.19*	.02	.10	-.06

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

tive events, four of the nine correlations involving CED were significant. Higher CED scores for positive events were associated with higher scores on the avoidance subscale of the IES, fewer related positive emotions, greater visceral reactions, and age of the event. Only 2 of the 36 correlations involving event–event or emotion–emotion pair ratings across both negative and positive events were significant, the same number of correlations that would be expected to occur by chance: For positive events: Event–Event and Age of the Event,  $r(149) = .21, p < .01$ ; for negative events: Emotion–Emotion and Coherent Story,  $r(149) = .19, p < .05$ .

Although the above correlational analyses found that higher CED scores for negative events were associated with less distress, less reliving, and greater positive emotional valence, the correlation sizes were modest. This lack of association strength may be because low levels of CED in negative events only result in high levels of distress when the negative events are of high emotional intensity. We tested whether emotional intensity of negative events moderated the relationship between CED and IES scores and phenomenological memory properties. Using ratings of emotional intensity from the AMQ, we conducted a median split on emotional intensity scores (median = 5.5). This split resulted in  $n = 93$  negative events low in emotional intensity ( $m = 3.70$ ) and  $n = 57$  negative events high in emotional intensity ( $m = 6.29$ ). As can be seen in Table 3, for negative events low in emotional intensity there were no significant correlations between CED scores and any of the eight measures. However, for negative events high in emotional intensity, lower CED scores were correlated with greater levels of distress associated with the event, including both subscales of the IES, less positive emotions associated with the event, and greater ratings of visceral emotion. Hence for negative events, the relationship between CED and distress appears to be limited to events high in emotional intensity. For positive events, correlations between CED and IES scores and phenomenological memory properties were unaffected by ratings of the event's emotional intensity. The lack of such relationships may be because for negative events low in emotional intensity, the emotion nodes represent a cold semantic representation of the emotion, which does not result in any physiological reaction. For example, a person may closely associate "sad" with a past romantic break-up, but this memory

may or may not evoke a physiological stress response, depending on the emotional intensity of the memory.

In summary, the results from Study 2 revealed that negative events have higher naturally occurring levels of CED, in comparison to positive events. Additionally, a low level of CED in an emotionally intense negative event is associated with a greater pattern of event-related distress. Hence CED may be a coping mechanism to help an individual manage a stressful experience.

## STUDY 3

### Overview

Although in Study 2 we found higher CED levels in negative events in comparison to positive events, the methodology contained a notable limitation. The nominated negative events and nominated positive events in the study differed. The current study is designed to examine CED levels in voters' cognitive representation of the 2004 Presidential election. The 2004 Presidential election is a rare emotionally charged event in which the event is positive for some people and negative for others. Hence we can explore valence differences in CED while holding the objective properties and time of the event constant. The use of a single event to measure differences in memory constructs as a function of event valence is rare, but has been used by past memory researchers (see Baker-Ward, Eaton, & Banks, 2005).

Measuring CED levels in individuals' memories of the election will allow us to achieve three main objectives. First, we can explore potential valence differences in phenomenological properties of a memory while holding the memory event constant. Second, we can test for valence differences in CED while holding the event itself along with potentially confounding phenomenological properties of the event (such as emotional intensity) constant. Third, by examining individual differences in participants' emotional intensity ratings of the election, we can replicate the finding from Study 2 that the relationship between CED and measures of intrusive and avoidant thoughts about the event is strongest in negative events high in emotional intensity, while keeping the event itself constant.

## Method

### *Participants*

A total of 111 participants from North Carolina State University (52 males; mean age = 20.0) participated for partial course credit.

### *Materials*

*Voting behaviour.* Participants were asked “Did you vote in the 2004 Presidential election?” and “Which candidate did you vote for?”.

*CED.* A set of stimuli that represent the persons, events, and emotions of the election was informally nominated by a group of undergraduate and graduate students working in our research lab. We selected 12 of these stimuli that we judged to be most central to the cognitive representation of the election. We purposely selected two stimuli that were positive for Kerry (“Early exits polls showing Kerry lead” and “Bush losing key swing state of PA”); two stimuli that were positive for Bush (“Bush winning key swing states of FL and OH” and “Kerry conceding the election”); two potentially neutral stimuli (“American people” and “News coverage”); and the two candidates themselves (“George W. Bush” and “John Kerry”). Lastly we selected four emotions; two positive (“happy” and “proud”) and two negative (“angry” and “disappointed”).

All possible non-repeating pairs of the 12 stimuli ( $n = 66$ ) were presented in a questionnaire packet. After reading a list of the 12 stimuli, the instructions read:

We are interested in how these items fit together to form your memory for this event. Below we ask you to rate the difference between each pair of items. The more different you believe a pair of items is in the context of 2004 Presidential election results, the higher the rating you should give it.

As in the first two studies, participants were asked to rate the dissimilarity between each pair of stimuli, using a continuous scale running from 0 (exactly same) to 50 (completely different).

In the present study we included both negative and positive event stimuli and negative and positive emotions. Of course, whether an event stimulus was negative or positive depended on which candidate the participant endorsed. Hence

for Kerry voters, the event-emotion pairs consisted of event stimuli that were appropriately negative or neutral for Kerry voters (“George W. Bush”, “Kerry conceding the election”, “Bush winning key swing states of FL and OH”, “American people”, and “News coverage”) and the negative emotions (“angry” and “disappointed”). For Bush voters, the event-emotion pairs consisted of the same five event stimuli (which are presumably positively valenced for Bush voters) and the positive emotions (“happy” and “proud”).

*Centrality of Event Scale (CES).* The CES (Berntsen & Rubin, 2006) is a seven-item scale that measures how central an event is to a person’s identity and life story (e.g., “I feel that this event has become part of my identity”). The CES was used to measure how important the election was to each participant. The CES has a range of 7–35. The reported Cronbach alpha is  $\alpha = .88$ .

*IES and AMQ.* The IES (described in Study 1) and AMQ (described in Study 2) were used to measure intrusive/avoidant thoughts and phenomenological properties of participants’ memories of the election.

### *Procedure*

All participants first completed the MDS ratings, then the IES, then the AMQ, then the two voting questions, and lastly the CES. This study took place in January 2005, approximately 1.5 months after the election.

## Results and discussion

Of the 111 participants, 99 indicated that they had voted in the election. This high percentage is likely a result of the fact that students who voted in the election were more likely to sign up for a study concerning the election than students who did not care enough about the election to vote. Of the 99 who voted, 50 indicated that they voted for Bush, 47 voted for Kerry, and 2 participants voted for a third party candidate. Data from the latter two participants were excluded from all analyses.

The reliability score for the 10 event-emotion pair ratings for Kerry voters was  $\alpha = .79$ , for Bush voters it was  $\alpha = .51$ , and for all participants it was  $\alpha = .71$  for the 28 event-event ratings. In order to

make the reliabilities on the crucial event–emotion pairs more similar to allow for a fairer comparison, we removed the event–emotion pair ratings for Bush voters that correlated the least with the overall factor until the removal of further pairs produced minimal gains in reliability. The removal of three pairs (“news coverage” – “proud”, “news coverage” – “happy”, and “Bush winning key swing states of FL and OH” – “proud”) resulted in a reliability rating of  $\alpha = .64$ . Hence a total of 10 event–emotion pair ratings were used for the Kerry voter CED scores, seven event–emotion pair ratings for the Bush voter CED scores, and 28 event–event pair ratings for the event–event scores.

We first tested whether positive and negative events differ along a number of phenomenological features, while holding the event constant (the election varied in valence across participants). As can be seen in Table 4, in comparison to Bush voters, Kerry voters reported a greater frequency of intrusive and avoidant thoughts about the election and stronger visceral reactions, rated the election as more emotionally intense and more emotionally negative, and reported that the election was more central to their identity. Bush and Kerry voters did not differ in ratings of reliving. Hence, in comparison to Bush voters who generally viewed the election results as positive, Kerry voters reported a pattern of greater negative distress associated the event.

We next tested whether Bush and Kerry voters differed in their levels of CED in their memory of the election. CED was measured by computing a mean dissimilarity rating of event–emotion pairs for each participant. Because our previous analy-

sis revealed differences between Bush and Kerry voters along numerous memory properties, an ANCOVA was conducted controlling for these phenomenological differences (IES, emotional intensity, visceral ratings, and CES scores). Kerry voters evidenced significantly higher levels of CED (*adjusted mean* = 19.3, *SD* = 10.1) than did Bush voters (*adjusted mean* = 13.9, *SD* = 8.1),  $F(1, 91) = 6.82, p < .05, MSE = 76.7$ . The finding that Kerry voters evidenced higher levels of CED than did Bush voters replicates our earlier findings of higher CED scores for negative events, in comparison to positive events. This effect was significant when the event and several potentially confounding memory properties were held constant.

A similar ANCOVA controlling for the phenomenological differences was conducted on event–event pair ratings. The results revealed that Kerry voters rated event–event pairs as significantly less dissimilar ( $m = 25.2, SD = 4.4$ ) than did Bush voters ( $m = 27.7, SD = 3.7$ ),  $F(1, 91) = 6.60, p < .05, MSE = 16.06$ . In Study 2 we found a trend in which event–event pairs were rated as more dissimilar in personal positive events in comparison to personal negative events. The finding that Kerry voters rated event–event items as less dissimilar replicates this effect when holding the event and several suspect memory properties constant. One explanation for this finding is that we have detailed scripts and understanding of positive events, but not of negative events. The lack of a complex script and/or understanding of negative events is reflected in participants rating items related to negative events as highly similar. Consistent with this argument, participants use a larger percentage of cognitive mechanism words, which are typically employed when there is relatively little understanding or narrative construction of an event, when they write expressively about a negative personal event, in comparison to writing about a positive personal event (Klein & Boals, 2008) or when they write about a stressful topic, in comparison to a less-stressful topic (Boals & Klein, 2005b). Thus negative events can be characterised as having less of a clear script and are more difficult to integrate and understand, in comparison to positive events.

Next we examined whether individual differences in CED was associated with IES scores, event memory properties from the AMQ, and CES scores. As can be seen under the “All” column in Table 5, higher CED levels if the event was negative (Kerry voters’ CED) was signifi-

TABLE 4

Differences between Bush and Kerry voters on phenomenological properties of their memory of the election from Study 3

	<i>Bush</i>	<i>Kerry</i>	<i>t</i> (95)
<i>IES</i>			
Total	9.0	19.0	−5.08**
Intrusiveness	5.1	8.0	−2.75**
Avoidance	3.8	11.0	−5.35**
<i>AMQ</i>			
Reliving	2.2	2.5	−1.07
Positive Emotions	6.1	1.9	22.51**
Emotional Intensity	3.1	4.3	−3.51**
Visceral	5.6	8.6	−3.88**
<i>CES</i>	16.1	19.8	−3.02**

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**TABLE 5**  
Correlations between CED and variables of interest for Bush and Kerry voters from Study 3

	<i>Bush voters</i>		<i>Kerry voters</i>	
	<i>All</i>	<i>All</i>	<i>Emotional Intensity</i>	
			<i>High</i>	<i>Low</i>
<i>IES</i>				
Total	.13	-.35*	-.46*	-.05
Intrusiveness	-.07	-.27	-.36	.01
Avoidance	.29*	-.31*	-.41*	-.06
<i>AMQ</i>				
Reliving	-.30*	-.39**	-.41*	-.26
Positive Valence	-.27	.30*	.23	.34
Visceral Emotions	.05	-.15	-.16	-.06
Emotional Intensity	-.09	-.27	—	—
<i>CES</i>	-.33*	-.31*	-.31	-.24

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

cantly correlated with smaller total IES scores, less avoidance, less reliving, more positive emotional valence, and lower CES scores. There was also a trend ( $p < .10$ ) such that higher CED levels were associated with fewer intrusive thoughts and less emotional intensity. Higher CED levels if the event was positive (Bush voters' CED) was related to more avoidance, less reliving, and lower CES scores. Hence we replicated findings from Studies 1 and 2 that for negative events, higher levels of CED are related to a pattern of less distress associated with the event. For Bush voters, higher CED levels seemed to only be related to a pattern of disinterest in the election (greater avoidance, less reliving, and less importance to their personal identity). In comparison, ratings of stimulus pairs that did not include an emotion (event-event pairs) were not significantly correlated with any of the memory properties.

Lastly we attempted to replicate the finding that the relationship between CED for a negative event and IES scores are stronger for negative events high in emotional intensity, in comparison to negative events low in emotional intensity. Examining only participants who had voted for Kerry, a median split was conducted on emotional intensity ratings of the election (median = 4.5). This split resulted in  $n = 20$  participants who rated the election as low in emotional intensity ( $m = 2.37$ ) and  $n = 23$  participants who rated the election as high in emotional intensity ( $m = 5.48$ ). As can be seen in Table 5, for Kerry voters who rated the election as high in emotional

intensity, CED was significantly negatively correlated with total IES scores, the avoidance subscale, reliving, and the intrusive subscale approached significance ( $p < .10$ ). For Kerry voters who rated the election as low in emotional intensity, CED was not significantly correlated with any of the measured properties. Thus we successfully replicated the finding from Study 2 that CED is more strongly related to a pattern of distress in emotionally intense negative events. For Bush voters, correlations between CED and the IES and AMQ measures were equivalent for those who rated the election as high in emotional intensity. Thus it appears emotional intensity does not play a moderator role between CED and the included measures for positive events.

In summary, the results from Study 3 revealed that when controlling for potentially confounding phenomenological memory characteristics, Kerry voters evidenced higher levels of CED in the memory of the 2004 Presidential election, in comparison to Bush voters. Low levels of CED for Kerry voters were associated with greater levels of distress concerning the election. This pattern of distress was much stronger for participants who rated the election as high in emotionally intensity. Hence we successfully replicated the findings of (1) higher CED levels in negative events, in comparison to positive events, and (2) low levels of CED in emotionally intense negative events being associated with a greater pattern of event-related distress.

## STUDY 4

### Overview

A possible causal explanation for the results from Studies 2 and 3 is that higher levels of CED in negative events may serve as a buffer against anxiety and distress. If this causal explanation were true, we would expect that individuals who evidence higher levels of CED in negative events will tend to have better overall mental health, highlighting the adaptive value of CED. Past research has demonstrated that the occurrence of stressful life events can lead to mental health problems (Andrews & Wilding, 2004; Monroe & Harkness, 2005) and this effect can be exacerbated by poor subsequent coping strategies (Hankin, Fraley, & Abela, 2005). The purpose of Study 4 is to replicate the finding that individual differences in CED levels of negative events are related to levels of distress associated with the event and to test the hypothesis that higher levels of CED in a negative event are related to better overall mental health.

#### Participants

A total of 60 participants (24 males, mean age = 18.8) from Duke University volunteered to participate in the current study. Participants were originally recruited for a study on trauma and memory. All participants had scored either high or low on a measure of trauma symptoms (PCL; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996) during a group testing session that took place approximately 2 months prior to the current study. A total of 42 participants participated for partial course credit. The remaining 18 participants had already completed their course research requirements at the time of the study, hence they were paid \$10 for participation.

#### Materials

*CED.* Participants nominated “a very negative event” from their life. This event did not have to be the same event they nominated during group testing. They then nominated eight event items (persons, places, thoughts, or events) and four emotions that they believed were most central to their memory of the event. The 12 stimuli the participants generated were then used in the same modified MDS procedure as in the previous

studies in which participants gave dissimilarity ratings for each pair.

*SCL-90-R.* The SCL-90-R (Derogatis, 1977) is a widely used 90-item self-report measure of mental health. Participants are instructed to indicate how much they were bothered by symptoms such as “crying easily” on a scale from 0 (“not at all”) to 4 (“extremely”). The questionnaire contains nine subscales: somatisation, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Scores for each subscale are calculated by computing a mean response across subscale items. In addition, there is a global severity index that is the average response across all 90 items.

*IES, AMQ, and CES.* The IES, AMQ, and CES were administered the same as in Study 3, except that participants referred to their nominated negative event when completing the questionnaires.

#### Procedure

All participants completed the materials in the following order: CED, IES, AMQ, CES, and the SCL-90-R.

### Results and discussion

Since the participants were originally selected because they had scored either high or low on a measure of trauma symptoms, we first examined the distribution of IES scores to determine if the scores were bimodal and therefore not appropriate for correlational analyses. A histogram of the IES scores revealed that the scores were not bimodal, but rather were uniform across the range of scores with skewness and kurtosis scores close to zero (0.32 and  $-0.72$ , respectively).

CED was once again calculated by computing a mean dissimilarity rating of event–emotion pairs for each participant. The correlations between CED and event–event pair ratings and the measures of memory features (IES, items from AMQ, and CES) and mental health (global severity rating from SCL-90-R and its subscales) are shown in Table 6. As can be seen in Table 6, CED was not significantly correlated with ratings of event valence from the AMQ or CES scores. The lack of a correlation with valence is likely due to limited variability in the valence ratings. Since

**TABLE 6**  
Correlations between CED and phenomenological memory properties and mental health from Study 4

	<i>CED</i>	<i>Event-Event</i>
<i>IES</i>		
Total	-.36**	.11
Intrusiveness	-.38**	.11
Avoidance	-.26*	.08
<i>AMQ</i>		
Reliving	-.37**	-.18
Positive Valence	-.10	-.16
Emotional Intensity	-.29*	.21
Visceral Emotions	-.27*	.14
<i>CES</i>	-.18	.08
<i>SCL-90-R</i>		
Global Severity	-.29*	.17
Obsess – Compul	-.26*	.16
Somatisation	-.13	.24*
Intersensitivity	-.22	.13
Depression	-.25*	.17
Anxiety	-.30*	.10
Hostility	-.17	.21
Phobic	-.24	.22
Paranoia	-.27*	-.01
Psychoticism	-.28*	.06

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

the events participants nominated were “a very negative event”, the positive valence ratings only had a range of 2–5 on a possible scale of 2–14. However, as predicted, CED was significantly negatively correlated with levels of distress associated with the event (both subscales of the IES and total IES scores) and ratings of reliving, emotional intensity, and visceral reactions. This set of correlations replicates the pattern of findings from the previous three studies that greater levels of CED in negative events are related to lower levels of distress associated with the event. CED was also significantly negatively correlated with five of the nine subscales of the SCL-90-R (obsessive-compulsiveness, depression, anxiety, paranoia, and psychoticism) and the overall global severity index (the sum of the nine subscale scores). Hence, consistent with our predictions, higher levels of CED in a negative event was related to a pattern of better overall mental health. In contrast to the event–emotion ratings, only 1 of the 18 correlations involving event–event pair ratings was significant, equal to the number of significant correlations that would be expected to occur by chance.

Lastly we attempted to replicate the finding from Studies 2 and 3 that the relationship between individual differences in CED of nega-

tive events and the frequency of intrusive/avoidant thoughts about the event is moderated by the emotional intensity of the event. An ANOVA based on a median split of emotional intensity (median = 5) failed to indicate a significant interaction ( $F < 1$ ) between CED and ratings of emotional intensity on IES scores. The lack of a moderating effect of emotional intensity in the current study can be explained by a lack of variability in the emotional intensity ratings. Only 7 of the 60 participants (12%) rated the emotional intensity as a 4 or less on a 7-point scale compared to 37% and 64% in Studies 2 and 3, resulting in very few nominated “very negative events” that could be considered as low in emotional intensity.

In summary, the results from Study 4 replicated the previous findings that low levels of CED in a negative event are related to a greater pattern of event-related distress and worse self-reports of mental health.

## GENERAL DISCUSSION

The combined results of the four studies suggest that the extent to which a person separates emotion nodes from event nodes in the cognitive representation of an event, which we call CED, is one way in which negative memories differ from positive memories and may be an effective mechanism for coping with stress. Using a variety of negative events, we found that negative events evidence higher CED levels in comparison to positive events. Although we were not able to experimentally manipulate valence or CED levels, we argue that higher CED levels in negative events serve an adaptive function. To the extent that a dissociation exists between a negative event and its related emotions, recalling the event produces less experiencing of negative affect and distress becomes less likely. It is advantageous to be able to think about a negative experience without the associated negative emotions being automatically activated. In contrast, such a separation between event and emotion nodes for positive memories was not associated with any of our measures of distress. It is possible that low CED levels in positive events may yield adaptive motivational influences, but only negative outcomes were examined in the current studies.

In addition to higher CED levels in negative events, in comparison to positive events, the

results from the current studies suggest that the triple combination of an event being (1) negative, (2) high in emotional intensity, and (3) low in CED levels is particularly toxic. In memories of emotionally intense negative events, low CED was associated with a pattern of greater event-related distress, including intrusive and avoidant thoughts, a key marker of PTSD. In addition, low CED levels in a negative event were associated with a widely used measure of mental health. One possible explanation for this set of findings may be that in emotionally intense negative events, a strong link between stimuli representative of the event and its associated emotions leads to an automatic priming of those emotions whenever one thinks about the event. The assumption is that participants will rate event–emotion pairs as less dissimilar if the emotions are strongly linked in the cognitive representation of the event. This does not necessarily mean that, in memories with low CED, activation of nodes related to the event will lead to a stress reaction. If the related emotions are of low intensity, these emotion nodes may be “cold” semantic representations of emotion. Activation of such emotion nodes likely does not elicit a physiological response. Indeed, correlations between dissimilarity ratings of event–emotion pairs and visceral reactions were non-significant and one can think of events in which emotions are strongly associated with a particular event, but the emotions are not intense (e.g., for our undergraduates, the Kennedy assassination). A low CED simply means that an event and its associated emotion nodes are strongly linked in the cognitive representation of the event. However, if the personal negative event is of high emotional intensity, the emotion nodes may be “hot” and activation of such nodes triggers an emotional response. Hence low CED in negative events is only detrimental when the negative event is high in emotional intensity. Indeed, Halberstadt and Niedenthal (1997) found that participants in emotional states give stronger weight to emotional dimensions of stimuli. For positive events, low CED appears to have no negative consequences, which may be a reason why we find comparatively lower naturally occurring levels of CED in positive events in comparison to negative events.

The results of the current study have potential applications in the area of trauma recovery. High levels of emotion associated with a memory can disrupt the individual’s ability to process and organise information about the memory (Conway

& Pleydell-Pearce, 2000). Brewin et al. (1996) argue that a failure to verbally encode the emotional aspects of a trauma memory can result in an inability to recall the factual aspects of the trauma memory without the simultaneous, automatic recall of its associated emotions. Alternatively, verbally coding a traumatic memory, but integrating the cognitive details too well with the emotions, could be at fault. Thus a key to coping with stress may lie in the appropriate integration of emotions into the cognitive representation of the event. An individual with low CED levels for a stressful experience may lack the ability to recall this event without the flood of associated emotional and sensory information, which in turn hinders the recovery process. Therapeutic techniques designed to help individuals cope with and recover from stressful events may involve helping the individual be able to think about the stressful event without being flooded with associated emotions. High levels of CED may afford an individual the vantage point necessary to effectively process, integrate, make causal connections, and form a narrative concerning the negative experience, resulting in more successful coping with a stressful experience.

Because events that contain all three features of negative valence, high emotional intensity, and low CED levels are associated with distress, coping techniques that focus on changing any one of these features may lead to reductions in distress. Cognitive therapies focus on changing the first feature, attempting to re-evaluate negative events as positive. Exposure therapies focus on the second feature, reducing the emotional intensity of an event through extinction procedures. But the results from the current paper suggest another possibility: increasing CED levels for an emotionally intense negative event may also result in reductions in levels of distress. The personal events in the current studies that were (1) negative and (2) emotionally intense, but had relatively high CED levels, were not associated with a pattern of elevated distress. For example, a person who experienced a bitter divorce years ago, but has since remarried and moved on, may still view the divorce as negative and, if asked to really focus on how they felt when the divorced happened, will experience intense emotions. But because the link between the event and the emotion nodes became separated over the years, the distress levels associated with this event on a regular basis are low. Future studies that can experimentally ma-

nipulate CED levels for negative memories are needed to test such a hypothesis.

The studies presented in this paper are methodologically limited due to the correlational design of the studies. Although we found higher CED levels in negative events in comparison to positive events, we also found that negative and positive events differ along a number of other phenomenological properties. By exploring CED in memories of the election we examined CED in a single event that varied in valence across participants. However, participants who viewed the event as negative also viewed the event as more stressful, emotionally intense, and more important to their identity, and had stronger visceral reactions to the event. Although we were able to statistically control for these confounds to valence, an experimental manipulation of the valence of an event is needed to examine causal explanations. In addition, the data demonstrating that low CED levels in emotionally intense negative events are associated with a pattern of greater event-related distress and poorer mental health were also correlational, making causal inferences difficult. Experimentally induced manipulations of CED levels are needed to clarify potential causal links between CED, stress, and mental health.

Another concern is the use of dissimilarity ratings to measure individual memories. Dissimilarity ratings in MDS are most often used to explore semantic organisations. However, the use of dissimilarity ratings to measure non-semantic memory structures has been used by a variety of researchers (Cavanaugh & Davey, 2001; DeSteno & Salovey, 1991; Schutz et al., 2002). In the first study, an alternative explanation is that the dissimilarity ratings were a reflection of semantic associations (terrorism and fear), as opposed to individual memory structures. However, in the subsequent studies each participant nominated their own set of stimuli that represented their memory of the event. These stimuli were often specific events unique to the experiences of each individual participant (e.g., "Mark yelling at me"), which were unlikely to be primarily semantic associations. In addition, the instructions for the dissimilarity ratings finished by stating, "One thing we would like you to remember is that different people judge things in different ways ... we are interested in finding how you as an individual compare these stimuli." Hence the dissimilarity ratings in the current

studies likely reflect individual memory structures as opposed to general semantic structures.

Once an event has ended, it is the memory of the event that continues to cause psychological harm (Rubin, Berntsen, & Johansen, in press) and individuals have little control over the suppression of such thoughts (see Wegner, 1994). One possibility as to why trauma memories are difficult to suppress is because trauma memories may contain unique organisational and structural features. However, most of the empirical evidence exploring the structural and organisational features of trauma memories has relied on self-report methodology, which makes it vulnerable to a number of potential biases that threaten the validity of such research. Such methodological barriers have made it difficult to directly address the debate surrounding whether trauma memories are more "fragmentary and poorly organised" as has been suggested by some researchers (Barclay, 1995; Dalgleish, 2004; van der Kolk & Fisler, 1995; but see Porter & Birt, 2001; Shobe & Kihlstrom, 1997). Although examination of CED does not speak directly to the issue of memory fragmentation, the studies presented in this paper do suggest that trauma memories may indeed have special organisational characteristics (see Porter & Birt, 2001; Rubin et al., 2003a; Shobe & Kihlstrom, 1997), and these characteristics may extend to stressful but non-PTSD memories, albeit to a lesser degree. The data from the present studies suggest that stressful memories do differ from non-stressful memories in regard to the role of emotion in the cognitive representation of the event and this memory feature may be an important coping strategy against the unwanted experiencing of distress. Considering that high levels of CED in emotionally intense negative events predicted less event-related distress and better mental health outcomes, CED appears to be an adaptive and healthy coping mechanism.

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