



# Examining Cognitive Impairments in Bereaved Adults With and Without Complicated Grief

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Examining Cognitive Impairments in Bereaved Adults With and Without Complicated Grief

A dissertation presented

by

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to

The Department of Psychology

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

in the subject of

Psychology

Harvard University

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Examining Cognitive Impairments in Bereaved Adults With and Without Complicated Grief

**Abstract**

Grief is a syndrome of cognitions, emotions, and behaviors that commonly arise together following the death of a loved one. It includes intense pangs of emotional pain, yearning for the deceased, emotional numbness, subjective difficulty imagining the future without the deceased, and preoccupation with thoughts related to the death and the deceased. In the initial months following loss, the majority of bereaved adults will experience some or even many elements of this syndrome. For most, the frequency and severity of these elements diminishes over time. However, for some, grief persists for years after the loss; a condition known as complicated grief (CG). These distinct grief trajectories raise a critically important question for grief research: why does grief persist in some individuals, but not others?

In this dissertation, I aimed to take an initial step toward answering this question. I first review recent advances in our understanding of the nature of CG and discuss the implications of these advances for research examining the etiology of CG. Most notably, I review how vulnerability factors that render bereaved adults susceptible to experiencing specific elements of the CG syndrome may contribute to the development or maintenance of CG. I then present three studies in which I examined cognitive impairments that may act as vulnerability factors for the core cognitive elements of CG and, thereby, may contribute to the broader CG syndrome.

In Paper 1, I examined the ability to resist distracter information and the ability to resist proactive interference; two types of cognitive inhibition that, if impaired, may render bereaved adults vulnerable to experiencing intrusive grief-related cognitions and, thus, the broader CG

syndrome. Contrary to my hypotheses, I found no evidence that bereaved adults with CG exhibit deficits in either type of cognitive inhibition for either emotional or non-emotional information relative to a bereaved comparison group without CG. In Paper 2, I examined another type of cognitive control: the ability to shift between mental representations. Contrary to my hypotheses, bereaved adults with CG did not exhibit deficits in cognitive set shifting for either emotional or non-emotional information. In Paper 3, I examined the ability to engage in episodic simulation of novel future events. Consistent with my hypotheses, bereaved adults with CG produced event simulations with fewer episodic details, less perceptual richness, less emotion/thought content, and less episodic richness than did the bereaved comparison group.

Together, these studies provide a small step toward identifying cognitive vulnerabilities that may contribute to the development or maintenance of CG. Papers 1 and 2 suggest that general deficits in cognitive control are unlikely to feature prominently in the etiology of CG. Accordingly, in future studies, it will be important for researchers to examine alternative factors that may contribute to the preoccupying grief-related cognitions observed in CG, including cognitive control for more specific types of information than were assessed in this study (e.g., attachment- or grief-related information) and higher-order cognitive variables such as perceived explicability of the loss. Paper 3 provides further evidence that prospection is impaired in bereaved adults with CG and identifies impaired constructive episodic simulation of novel future events as a potential cognitive vulnerability that may contribute to the etiology of the broader CG syndrome.

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## **Chapter 1: General Introduction**

Bereavement is a ubiquitous experience. There are nearly 2.5 million deaths each year in the United States (Kochanek, Xu, Murphy, Minino, & Kung, 2011) and more than 56 million deaths each year world-wide (Population Reference Bureau, 2010). With an average of four survivors per death (Prigerson, Vanderwerker, & Maciejewski, 2008), there are an estimated 10 million individuals who experience this potent stressor every year in the United States alone.

For the majority of bereaved adults, the pain and disruption associated with loss will subside over the initial weeks and months following loss (Bonanno, 2004). However, for a subset of those who experience the death of a loved one (10-15%), the pain and disruption associated with loss persists for years after the loss (Bonanno & Kaltman, 2001; Bonanno et al., 2002). This maladaptive reaction to loss may include a wide range of mental disorders (Keyes et al., 2014), including depression (Zisook & Kendler, 2007), post-traumatic stress disorder (Breslau et al., 1998), and complicated grief (Horowitz et al., 1997; Shear et al., 2011).

### **What Is Complicated Grief?**

CG<sup>1</sup> is a syndrome of cognitions, emotions, and behaviors that arise together following the death of a loved one and persist over time at sufficient intensity to cause significant distress and impairment. CG occurs in approximately 6.7% of bereaved adults (Kersting, Braehler, Glaesmer, & Wagner, 2011) and is associated with functional impairment and increased risk for adverse psychosocial outcomes, including increased risk for suicidal thoughts and behaviors

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<sup>1</sup> The bereavement-specific syndrome I will refer to as complicated grief (CG) has also been called prolonged grief, chronic grief, traumatic grief, pathological grief and, most recently, persistent complex bereavement disorder. In the interest of producing a more readable overview of the literature on this syndrome, I refer to it only as CG regardless of the term used in the work being referenced. However, it should be noted that the diagnostic criteria used to assess this disorder may differ both between and within its various incarnations.

(Latham & Prigerson, 2004; Mitchell, Kim, Prigerson, & Mortimer, 2005; Prigerson et al., 1999; Szanto, Prigerson, Houck, Ehrenpreis, & Reynolds, 1997).

As will be discussed in greater detail later in this chapter, a complete understanding of the CG syndrome requires an understanding of its constituent elements. Accordingly, I will review several of the core elements of this syndrome, with particular emphasis on the cognitive elements that will be the focus of this dissertation.

**Cognitive elements.** From the earliest clinical descriptions of grief, researchers have noted that the mental life of bereaved adults is frequently bound up with thoughts related to the deceased (Lindemann, 1994; Parkes, 1972, p. 48). Grief-related hallucinations (e.g., hearing the voice of the deceased; Grimby, 1993; Yates & Bannard, 1988) and perceptual illusions (e.g., mistaking strangers for the a lost loved one; Parkes, 1972) are common following loss and are more common in those with CG than those without CG (25% and 2%, respectively; Simon et al., 2011). Similarly, attention in bereaved adults is frequently directed toward aspects of the environment associated with the deceased (e.g., a picture on the wall or a favorite chair; Archer, 1999), a tendency frequently described as “searching” behavior in the grief literature (e.g., “I can’t help looking for him everywhere”; Parkes, 1972, p. 44).

Together, the findings on perception and attention suggest that bereaved adults with CG may exhibit bias or impairment in their interpretation of and attention to information in their *external* environment. Consistent with this possibility, Maccallum and Bryant (2010) assessed attention bias for grief-related stimuli in bereaved individuals with and without CG using the emotional Stroop paradigm and found that bereaved adults with CG were slower to name the ink color of grief-related words than were those without CG. These findings suggest that bereaved adults with CG may have difficulty resisting distraction from grief-related information.

Grief researchers have similarly found evidence that suggests the possibility of bias or impairment in attention to *internal* information (i.e., information already in long-term or working memory; Chun, Golomb, & Turk-Browne, 2011) in those with CG. Memories and images of the deceased are common in bereaved adults. In a study of bereaved adults who had lost a child or spouse in a motor vehicle accident (MVA), Lehman, Wortman, and Williams (1987) found that most bereaved adults (96% of bereaved parents and 90% of bereaved spouses) continued to have memories of the deceased come to mind at least once in the past month even 4-7 years after the death. Horowitz and colleagues (1997) found that 72% and 42% of bereaved adults experienced unbidden memories of the deceased at 6-months and 14-months post-loss, respectively. Similarly, Robinaugh, LeBlanc, Vuletich, and McNally (2014) found that 58% and 36% of conjugally bereaved adults reported thinking about the deceased at least several times per day at 6-months and 18-months post-loss. Although these findings suggest that memories related to the deceased are common following loss, intrusive memories about both the deceased and the death occur more frequently in those with elevated CG symptoms (Boelen & Huntjens, 2008). These memories may reflect “haunting thoughts” (Horowitz, Bonanno, & Holen, 1993, p. 269), but they may also be positive memories. Indeed, positive intrusive memories related to the deceased are more common than memories of events surrounding the death in bereaved adults and are moderately positively correlated with CG severity (Boelen & Huntjens, 2008).

Using data from the studies described in this dissertation, LeBlanc et al. (2015) examined the content and characteristics of the most frequently retrieved grief-related intrusive memories in bereaved adults. Relative to those without CG, individuals with CG reported that their intrusive memories occurred more frequently, persisted for longer, and were associated with more negative emotions and physical reactions. Interestingly, the largest between-group effect

was for the persistence of the memories, with individuals in the CG group reporting that, when memories come to mind, they persist for hours. These findings are consistent with Horowitz's description of "hard to dispel images" in those with CG (Horowitz et al., 1993, p. 269).

Similarly, rumination (i.e., a style of perseverative thought on negative emotions and the meaning of those emotions; Nolen-Hoeksema, Parker, & Larson, 1994) is associated with greater overall CG severity following the death of a loved one (Boelen, 2012; Stroebe et al., 2007; van der Houwen, Stroebe, Schut, Stroebe, & van den Bout, 2010). Together, these findings suggest that persistence may be an especially important characteristic of the grief-related cognitions in those with CG.

***Difficulty imagining and planning for the future.*** Individuals with CG report a subjective sense of having a hopeless or foreshortened future (Horowitz et al., 1997; Shuchter & Zisook, 1993). Consistent with this self-reported subjective difficulty, bereaved adults with CG exhibit difficulty imagining specific autobiographical future events in a laboratory task assessing prospection (Maccallum & Bryant, 2011; Robinaugh & McNally, 2013). In this task, subjects are presented with a cue-word and asked to imagine a specific future event (i.e., a single event that occurs at specific time and place and lasts for less than 24 hours). Relative to bereaved adults without CG, those with CG exhibit difficulty generating specific events, instead either failing to generate an event or responding with general representations of events that occur repeatedly (e.g., Friday classes) or over an extended period of time (e.g., during my summer vacation). Consistent with these findings, the DSM-5 identifies difficulty planning for the future as a symptom of CG (American Psychiatric Association, 2013).

**Emotional elements.** There are at least three core emotional components of the CG syndrome: yearning, emotional pain, and emotional numbness. Yearning is an unsatisfied,

intense, and future-oriented appetitive desire (Davis, 1984). It is not merely missing something from the past (i.e., being aware of its absence), but rather entails actively desiring it now. Importantly, yearning is experienced in reference to an object (Kavanagh, Andrade, & May, 2005). One yearns *for* something. In CG, the object of yearning is the presence of the deceased loved one (Robinaugh et al., 2015). Grief researchers consider yearning a hallmark clinical feature of CG (Prigerson et al., 2009; Shear et al., 2011), both because it is the most commonly reported grief-related affective experience following loss (Maciejewski, Zhang, Block, & Prigerson, 2007; Robinaugh et al., 2014) and because it is absent in other syndromes triggered by the death of a loved one, such as depression or PTSD (Prigerson et al., 1995). Indeed, the DSM identifies yearning as one of four symptoms essential for diagnosing CG (American Psychiatric Association, 2013).

*Emotional pain* refers to pain affect (i.e., the felt unpleasantness of pain; Price, 2000) that arises in response to loss or potential loss of social connection or social value, such as the death of a loved one (Eisenberger, 2012). Pangs, waves, or spells of painful emotion are common in grief (Horowitz et al., 1997; Zisook & Shear, 2009). Lindemann (1994, p. 155) described these experiences as “waves of somatic distress” and “intense... mental pain.” Parkes (1972, p. 39) defined these pangs of grief as episodes of “severe anxiety and psychological pain.” Moreover, he suggested that these episodes are “the most characteristic feature of grief.” Similarly, Freud (1917, p. 244) identified “a profoundly painful dejection” as one of the distinguishing mental features of the maladaptive grief response he termed melancholia. Interestingly, despite the focus it received in this early descriptive research, emotional pain has played a diminishing role in proposed diagnostic criteria sets for CG. Indeed, to my knowledge, the DSM-5 CG criteria are the first to explicitly include emotional pain as a symptom of the disorder.

*Emotional numbness* is identified as symptom of CG in all major diagnostic criteria for this syndrome (American Psychiatric Association, 2013; Horowitz et al., 1997; Prigerson et al., 2009; Shear et al., 2011). However, the precise nature of this emotional numbness is unclear. In diagnostic criteria sets, it is often conflated with feelings of being shocked or stunned by the loss (American Psychiatric Association, 2013; Shear et al., 2011) or social detachment (Horowitz et al., 1997). In the most precise definition, Prigerson and colleagues defined emotional numbness as an “absence of emotion” (Prigerson et al., 2009, p. 9). However, given the elevated frequency of intense negative emotional experiences in CG, emotional numbness may be better characterized as a deficit in the capacity to experience positive affect rather than as a general deficit in emotional responding (cf. Litz, 1992).

**Behavioral elements.** There are at least three core behavioral elements in the CG syndrome: grief-related approach behavior, grief-related avoidance behavior, and behavioral inactivity. *Grief-related approach behavior* denotes any behavior initiated with the aim of beginning or increasing engagement with stimuli related to the deceased (e.g., spending time with the deceased’s possessions or looking at photographs of the deceased; Parkes, 1996). Greater grief-related approach behavior prospectively predicts greater CG severity (Boelen, Stroebe, Schut, & Zijerveld, 2006; Field, Nichols, Holen, & Horowitz, 1999).

*Grief-related avoidance behavior* denotes any behavior aimed at preventing or reducing engagement with stimuli related to the death or the deceased. The bereavement literature is replete with descriptive accounts of grief-related avoidance, ranging from putting away photographs and avoiding driving by the cemetery to moving to a new home or city (Harkness, Shear, Frank, & Silberman, 2002; Parkes, 1996; Sireling, Cohen, & Marks, 1988). Grief-related avoidance features prominently in cognitive-behavioral theories of CG, in which theorists have

hypothesized that avoidance of grief-related reminders prevents (a) the extinction of reinforcement contingencies connected to the deceased and (b) acceptance of the finality of loss, and, thereby, maintains both the frequency of grief-related thoughts and emotional reactivity to those thoughts (Boelen, van den Hout, & van den Bout, 2006; Brasted & Callahan, 1984; Ramsay, 1977). Consistent with these theories, grief-related avoidance is positively associated with overall CG symptom severity (Boelen & van den Bout, 2010; Boelen, van den Bout, & van den Hout, 2006) and reductions in avoidance are associated with overall reductions in CG severity during a CBT treatment trial (Boelen, de Keijser, van den Hout, & van den Bout, 2011).

Finally, *behavioral inactivity* refers to the tendency to refrain from social, occupational, recreational, or other activities (cf. depressive withdrawal or depressive avoidance; Boelen, 2006; Boelen, van den Hout, et al., 2006; Kavanagh, 1990). Behavioral inactivity is associated with greater severity of the broader CG syndrome, even after controlling statistically for grief-related avoidance (Boelen et al., 2011), suggesting that broadly refraining from previously meaningful or enjoyable activities is distinct from refraining from activities with the aim of avoiding reminders of the deceased.

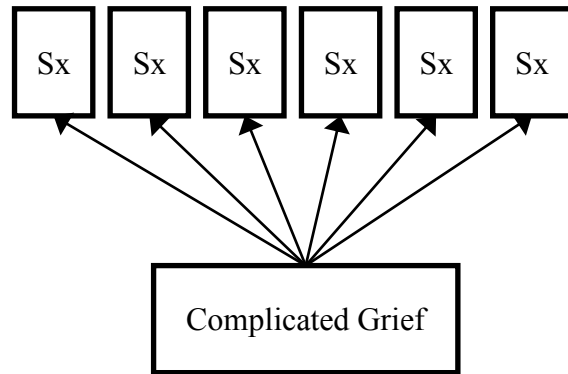
### **The Latent Construct Approach to Understanding CG**

Most research on CG has tacitly operated from a latent construct perspective in which there is a distinction between CG and the elements of the CG syndrome (which are typically referred to as CG symptoms<sup>2</sup>). CG is viewed as a latent disease entity that gives rise to the elements of the CG syndrome (see Figure 1.1). For example, a widow experiences frequent intense yearning and emotional pain *because* she has CG in the same way that one coughs and

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<sup>2</sup> Indeed, the latent construct framework is the reason that we typically refer to the elements of the CG syndrome as CG *symptoms*; a term which denotes a “phenomenon... arising from and accompanying a disease or affection, and constituting an indication or evidence of it” (“Symptom”, 2015).

spits up blood *because* one has a lung tumor (Borsboom, 2008; Borsboom & Cramer, 2013). The elements of the CG syndrome, in turn, act as indicators of the presence of the underlying CG disease entity. From this perspective, the relationship between CG and the elements of the CG syndrome is one of reflective measurement (Markus & Borsboom, 2013). The latent CG entity is the common cause that produces the co-variance of CG elements. It is the reason these elements hang together as a coherent syndrome.



**Figure 1.1.** A model depicting the latent construct approach to understanding CG. *Sx* denotes a symptom of CG. That is, an element of the CG syndrome which, from a latent construct perspective, is viewed as arising from and acting as an indicator of the underlying latent disease entity.

From the latent construct perspective, CG cannot yet be measured directly (Borsboom, 2008; Borsboom, Mellenbergh, & van Heerden, 2003). Researchers and clinicians

must infer the presence of CG by assessing the individual elements of the CG syndrome that are presumed to arise from and indicate its presence. For example, a diagnostic interviewer must determine whether the elements of the CG syndrome are sufficiently present to indicate the presence of the underlying latent entity. The aim of psychiatric and psychological research, from this perspective, is to identify the physical referent of the latent entity. That is, researchers endeavor to identify the common underlying cause that gives rise to the CG syndrome.

There are both statistical and ontological limitations to the latent construct approach. First, the symptoms of CG violate a basic assumption required for this approach: the assumption that the indicators of the latent construct are independent of one another (i.e., the axiom of local independence; Borsboom, 2008). This axiom is required so that covariance of the indicators can



be attributed to the influence of the latent construct (i.e., the common cause) rather than to the influence of one indicator on another. However, grief theorists have explicitly hypothesized that there are causal relations among the symptoms of CG (e.g., thoughts about the death evoke emotional pain which, in turn, prompts efforts to avoid reminders of the death; Boelen, van den Hout, et al., 2006; Shear et al., 2007) These hypothesized and highly plausible causal relations are inconsistent with a latent construct approach.

Second, the latent construct approach rests on the unfounded assumption that a common underlying disease entity gives rise to the CG syndrome. From this perspective, the latent construct acts a placeholder as researchers search for its physical referent. This approach has not been without success. For example, in the nineteenth century, psychiatrists identified general paresis of the insane (GPI) as a coherent syndrome comprising a variety of symptoms including delusions, fatigue, apathy, and, during later stages of the disorder, paralysis (Brown, 1994). The syndrome was common (e.g., 17% of admissions in the Charenton asylum in 1828; Kragh, 2010) and almost uniformly fatal (Brown, 2000). After decades searching for the common underlying cause that gave rise to these diverse symptoms, Noguchi and Moore (1913) identified the spirochete bacterium that causes syphilis, *Treponema pallidum*, in the brains of those who had died from GPI, thereby identifying the physical referent for the conjectured latent entity.

The identification of *Treponema pallidum* is one of the great successes of psychiatric research. However, similar successes have been rare (Kendler, 2005). Indeed, in the century of research following this discovery, researchers have uncovered "systematic complexity, rather than reductionist simplicity" (Bolton, 2012, p. 6). As the psychiatrist Kenneth Kendler has noted, "it is highly unlikely that spirochete-like big explanations remain to be discovered for major psychiatric disorders." (Kendler, 2005, p. 434). As a result, scholars are increasingly moving

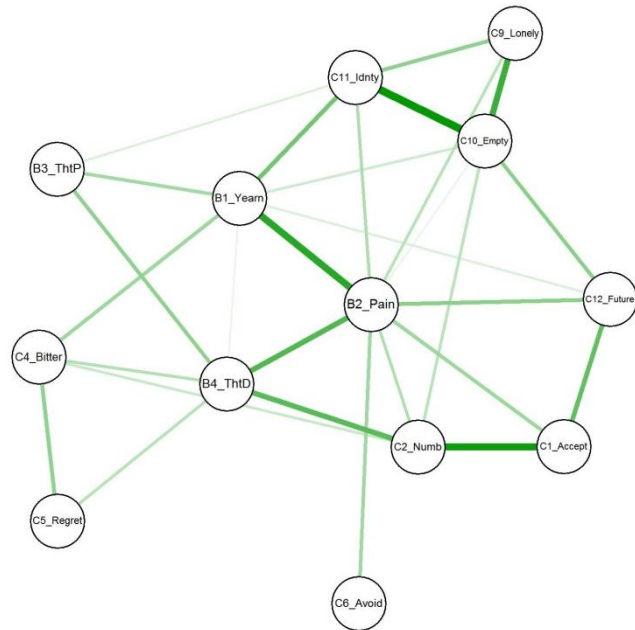
away from approaches that attribute the presence of mental disorders to a common underlying cause (Zachar & Kendler, 2007) in favor of a recognition that the etiology of mental illness is complex and massively multifactorial (Kendler, 2005, 2012; Nolen-Hoeksema & Watkins, 2011; Zachar & Kendler, 2007). Accordingly, it is unlikely that there is a common underlying disease entity that gives rise to the CG syndrome.

**The network approach to understanding CG.** There is an alternative conceptual framework for understanding mental disorders, known as the network (or causal system) approach, that does not suffer from the limitations inherent in the latent construct approach (Borsboom & Cramer, 2013; Kendler, Zachar, & Craver, 2011; McNally, 2011, pp. 203-207). On the basis of this alternative conceptual framework, I recently proposed that the CG syndrome is best conceptualized as a network of mutually reinforcing cognitions, emotions, and behaviors that arise together following loss and settle into a state of pathological equilibrium (Robinaugh et al., 2014). From this perspective, the elements of the CG syndrome do not cohere because they arise from a common underlying cause. They cohere because of the causal relations among them. The elements of the CG syndrome do not reflect or result from an independent latent entity. Rather, the elements and the relations among them constitute the disorder.

### **The Complicated Grief Network**

Recently, I conducted the first examination of the CG network (Robinaugh et al., 2014). An example of these network analyses appears in Figure 1.2. In these network analyses, the elements of the CG syndrome are represented by nodes in the network. The relationships among the elements of the CG syndrome are represented by the lines that connect the nodes (known as edges). The results of the study supported the syndromic integrity of the CG network, identified emotional pain and thoughts about the death as central elements to the network (i.e., elements

with strong associations to other network elements), and, perhaps most importantly, provided initial insight into the relationships that may structure the CG syndrome. For example, I found that emotional pain predicted grief-related avoidance, whereas yearning did not. The strong associations among emotional pain, thoughts about the death, and grief-related avoidance suggest a possible feedback loop in which thoughts related to the death trigger emotional pain, which leads to efforts to avoid thoughts of the death, which, in turn, may have the ironic effect of heightening the accessibility of grief-related cognitions (Wegner, 1994). The self-sustaining nature of this feedback loop may then contribute to the maintenance of the broader CG network.

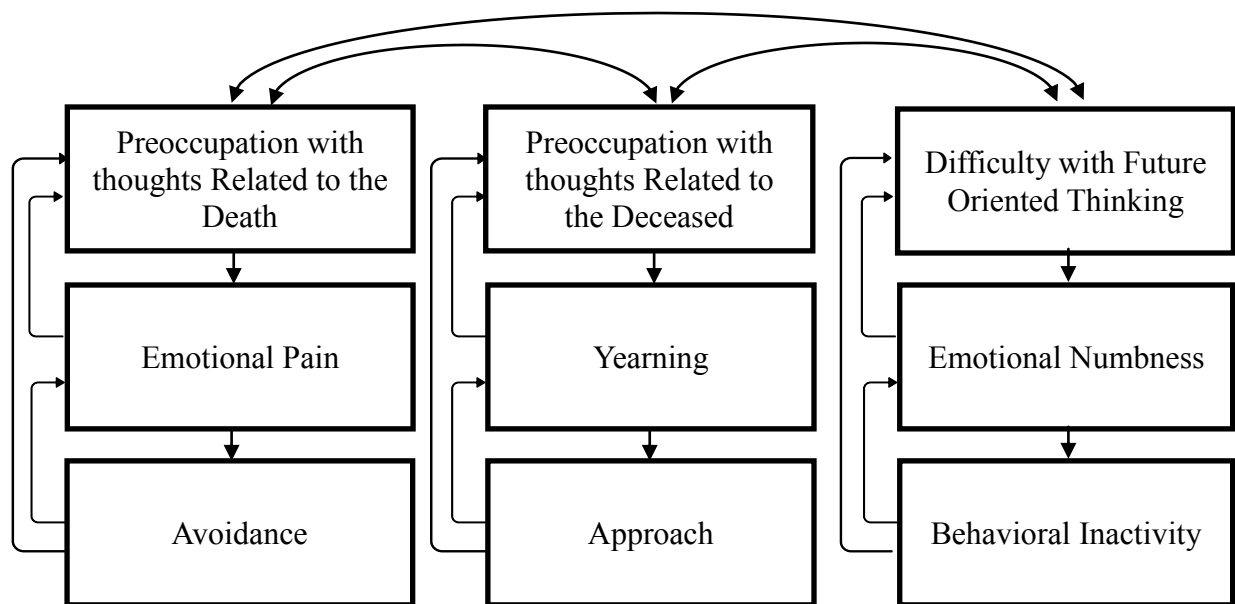


**Figure 1.2.** IsingFit model of the complicated grief network at 18 months post-loss. Nodes represent elements of the CG syndrome. Edges represent the association between those elements. Elements with more and stronger edges appear in the center for the network.

These analyses provided a first look at the structure of the CG network. However, they were limited by the decision to select the set of network elements based on the most recently proposed diagnostic criteria for CG (i.e., the DSM-5 criteria; American Psychiatric Association, 2013). Although these criteria include many of the core clinical features of CG, they were not intended to provide a comprehensive list of elements operative in the CG network. Decisions about which items to include in that diagnostic criteria set were made with motivations irrelevant to or inconsistent with the network approach (e.g., excluding criteria that overlap with other mental disorders). Consequently, I may have

omitted important elements of the syndrome in our analyses. Most notably, I did not include a plausible behavioral correlate of either yearning or emotional numbness despite the identification of clear candidate behaviors in the CG literature (i.e., grief-related approach behavior and behavioral inactivity, respectively). Accordingly, our network may have omitted symptoms that may play a prominent role in the maintenance of the CG syndrome.

Including these omitted behavioral elements into the network suggests a plausible conceptual model of the core complicated grief syndrome (see Figure 1.3) that is consistent with cognitive-behavioral models of CG (Boelen, 2006; Szanto et al., 1997). This conceptual model is built around three cognitive, emotional, and behavioral feedback loops. The first loop comprises preoccupying thoughts about the death, emotional pain, and grief-related avoidance. As noted above, because efforts to avoid thoughts related to the death may have the ironic effect of heightening their accessibility (Wegner, 1994), these symptoms may constitute a positive feedback loop (i.e., thoughts about the death → emotional pain → avoidance → thoughts about the death) that contributes to the maintenance of the syndrome. The second loop comprises



**Figure 1.3.** A conceptual model of the core elements of the CG syndrome comprising three clinically plausible cognitive, emotional, and behavioral feedback loops.

thoughts related to the deceased, yearning, grief-related approach behavior. Thoughts related to the deceased are a critical precursor to the affective experience of yearning because they provide the mental representation of the object for which bereaved adults are yearning. As noted above, grief-related approach behavior is a plausible consequence of this yearning, and excessive grief-related approach behavior may, in turn, increase the accessibility of thoughts related to the deceased (Field et al., 1999), thereby creating a second positive feedback loop (i.e., thoughts about the deceased → yearning → approach → thoughts about the deceased).

Finally, the third potential feedback loop comprises difficulty imagining positive future events, emotional numbness, and behavioral inactivity. Difficulty imagining positive future events is associated with anhedonia (Dunn, 2012; Sherdell, Waugh, & Gotlib, 2012) and interventions that improve the ability to vividly imagine pleasurable future events increase both anticipatory pleasure and behavioral activity (Favrod, Giuliani, Ernst, & Bonsack, 2010). Because anhedonia is closely related to, and arguably synonymous with, the emotional numbness reported in those with CG (cf. Litz, 1992), there should be similarly close relationships among prospection, emotional numbness, and behavioral activity, including a potential feedback loop in which greater ability to imagine future events increases anticipatory pleasure, anticipatory pleasure increases the likelihood of behavioral activity, and greater behavioral activity facilitates the ability to imagine other future events.

Notably, in each of these feedback loops, cognitive elements of the network play the critical role of being both the precursor to the emotional element (e.g., death-related cognitions acting as a precursor to emotional pain) and a plausible consequence of the behavioral element (e.g., avoidance leading to increased frequency of grief-related cognitions). Moreover, the cognitive elements of this syndrome may also be caused by the emotional elements (e.g.,

thinking about the deceased to satiate intense and persistent yearning for the deceased).

Accordingly, these cognitive elements are likely to feature prominently in the self-sustaining nature of the CG network and, thus, its persistence over time.

### **Examining the Etiology of the Complicated Grief Network**

In the initial weeks and months following the death of a loved one, the majority of bereaved adults will experience some or even many elements of the CG network. For most, the frequency and severity of most or all of these elements diminishes over time (Bonanno, 2004; Horowitz et al., 1997; Robinaugh et al., 2014). However, for a minority of individuals (6.7%; Kersting et al., 2011), these elements persist and the network reaches a self-sustaining state of equilibrium. These distinct trajectories of network activation raise a critically important question for grief research: why does the CG network reach a self-sustaining state of equilibrium in some individuals but not others?

The answer to this question lies in understanding the factors that produce a more vulnerable network (i.e., a network in which the activation of a given element is more likely to trigger the activation of neighboring elements, leading to emergence and maintenance of the broader syndrome). There are two ways in which a risk factor can influence network vulnerability. First, risk factors may affect the CG network by modifying the relationship between two or more elements. For example, an individual with a predisposition to avoid distressing emotions (i.e., experiential avoidance; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996) may be more likely to engage in grief-related avoidance in the context of elevated emotional pain (Shear, 2010). In this case, experiential avoidance influences the network by strengthening the association between emotion pain and grief-related avoidance, making it more likely to experience the latter when experiencing the former.

The second way in which risk factors may influence the CG network is through their direct influence on a particular network element. For example, greater dependence on one's spouse prior to the loss may directly contribute to difficulty imagining the future after their death (Robinaugh et al., 2014). Because of the plausible causal relations among CG symptoms, this vulnerability to experiencing a given CG symptom may, in turn, contribute to emergence of the broader CG syndrome. Accordingly, a complete understanding of the etiology of CG requires an understanding of the risk factors that (a) cause or lower the threshold of activation for specific elements of the CG syndrome or (b) strengthen the relationships among the elements of the elements of the CG syndrome.

### **The Current Studies**

In this dissertation, I aimed to take a first step toward identifying vulnerability factors that might contribute to the development or maintenance of the CG syndrome. To do so, I examined cognitive impairments that may contribute to the three cognitive elements in my proposed conceptual model of the core CG network (i.e., preoccupation with thoughts related to the death, preoccupation with thoughts related to the deceased, and difficulty imagining the future), and, thereby, may contribute to the emergence or maintenance of the broader CG syndrome. If these cognitive factors play a noteworthy role in the development or maintenance of the CG syndrome, bereaved adults with CG should exhibit greater impairment in these cognitive factors relative to bereaved adults without CG. Accordingly, in each of the studies reported in this dissertation, I examined whether bereaved adults with CG exhibited impairment in the cognitive factor of interest relative to a comparison group of bereaved adults without CG.

In paper 1, I assessed cognitive inhibition in bereaved adults with CG and a bereaved comparison group without CG. I examined two types of cognitive inhibition: resistance to

distracter information and resistance to proactive interference. I hypothesized that individuals with CG would exhibit deficits in both types of inhibition relative to the bereaved comparison group. I further hypothesized that both types of inhibition would be negatively associated with a measure of intrusive grief-related thoughts in those with and without CG.

In paper 2, I examined another type of cognitive control: the ability to shift between mental representations. I hypothesized that individuals with CG would exhibit deficits in the ability to shift between mental representations relative to a comparison group of bereaved adults without CG. I further hypothesized that shifting would be negatively associated with measures of rumination in those with and without CG.

Finally, in paper 3, I examined the ability to engage in episodic simulation of novel future events. I hypothesized that, relative to a comparison group of bereaved adults without CG, bereaved adults with CG would produce simulations with fewer internal details and less episodic richness. I further hypothesized that more episodic details and greater episodic richness would be associated with less hopelessness in bereaved adults with and without CG.



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## **Chapter 2**

### Paper 1: Cognitive Inhibition in Bereaved Adults With and Without Complicated Grief

## Abstract

**Background:** Bereaved adults with complicated grief (CG) experience frequent intrusive thoughts and memories about the death and the deceased. Deficits in cognitive control may underlie intrusive cognitions, such as those observed in CG. In this study, we examined the possibility that deficits in cognitive inhibition may render bereaved adults more vulnerable to experiencing intrusive grief-related cognitions and, in turn, the broader CG syndrome.

**Method:** To examine this aim, we recruited 40 bereaved adults with CG and 40 bereaved adults who did not exhibit CG, depression, or post-traumatic stress disorder. Subjects completed a Flanker Task to assess the ability to resist distracter information (i.e., distraction from task-irrelevant stimuli in the external environment) and a Proactive Interference Task to assess the ability to resist proactive interference (i.e., distraction from previously relevant but currently irrelevant information).

**Results:** Contrary to our hypotheses, bereaved adults with CG did not exhibit deficits in the ability to resist distracter information relative to the bereaved comparison group in either the emotional,  $t(76) = 1.52, p = .133, d = 0.35$ , or non-emotional  $t(76) = .93, p = .356, d = 0.21$ , conditions of the Flanker Task. Bereaved adults with CG exhibited a marginally significant trend toward more frequent intrusions from previously relevant but currently irrelevant information in the Proactive Interference Task,  $F(1, 76) = 3.51, p = .065, \eta_p^2 = 0.04$ . However, they did not exhibit any deficits in resistance to proactive interference in our accuracy,  $F(1, 76) = 1.35, p = .248, \eta_p^2 = 0.02$ , or response time indices,  $F(1, 76) = 1.24, p = .269, \eta_p^2 = 0.02$ .

**Discussion:** Our results fail to support the hypothesis that bereaved adults exhibit deficits in cognitive inhibition. Accordingly, in future studies it will be important for researchers to examine alternative factors that contribute to greater risk for intrusive grief-related cognitions and, thereby, the broader CG syndrome.

### **Cognitive inhibition in bereaved adults with and without complicated grief**

There are nearly 2.5 million deaths each year in the United States (Kochanek, Xu, Murphy, Minino, & Kung, 2011) and more than 56 million deaths each year world-wide (Population Reference Bureau, 2010). For the millions of loved ones who survive the deceased, these deaths may be among the most painful and disruptive events they will experience in their life (Bowlby, 1980, p. 8). For most, the pain and disruption of loss will subside over the initial weeks and months following loss (Bonanno, 2004). However, a significant subset (10-15%) of those who experience the death of a loved one continue to show marked distress and impairment years after the loss (Bonanno & Kaltman, 2001; Bonanno et al., 2002). This persistent elevation of distress may include symptoms of numerous mental disorders (Keyes et al., 2014), including depression (Zisook & Kendler, 2007), post-traumatic stress disorder (PTSD; Breslau et al., 1998), and complicated grief (Horowitz et al., 1997; Shear et al., 2011).

CG (also called traumatic grief, prolonged grief disorder, and persistent complex bereavement disorder) is a syndrome of cognitions, emotions, and behaviors that arise together following the death of a loved one and persist over time at a level sufficient to cause significant distress and impairment. The elements of this syndrome include yearning for the deceased, emotional pain, emotional numbness, preoccupation with thoughts related to the death and the deceased, difficulty with future-oriented cognition, grief-related approach behavior, grief-related avoidance behavior, and behavioral inactivity (Horowitz et al., 1997; Shear et al., 2011). CG occurs in approximately 6.7% of bereaved adults (Kersting, Braehler, Glaesmer, & Wagner, 2011) and is associated with functional impairment and increased risk for adverse psychosocial outcomes, including increased risk for suicidal thoughts and behaviors (Latham & Prigerson,

2004; Mitchell, Kim, Prigerson, & Mortimer, 2005; Prigerson et al., 1999; Szanto, Prigerson, Houck, Ehrenpreis, & Reynolds, 1997).

Bereaved adults with elevated CG severity report more frequent intrusive memories about both the deceased and the death (Boelen & Huntjens, 2008). These memories may include “haunting thoughts” (Horowitz, Bonanno, & Holen, 1993, p. 269), but they may also be positive memories. Indeed, positive intrusive memories related to the deceased are more common than memories of events surrounding the death in bereaved adults and are positively correlated with CG severity (Boelen & Huntjens, 2008). Bereaved adults with CG also report grief-related hallucinations (e.g., hearing the voice of the deceased; Grimby, 1993; Yates & Bannard, 1988) and perceptual illusions (e.g., mistaking strangers for the a lost loved one; Parkes, 1972) more frequently than those without CG (25% and 2%, respectively; Simon et al., 2011) and attention in bereaved adults CG is frequently directed toward grief-related stimuli (e.g., a picture on the wall or a favorite chair; Archer, 1999). Together these findings suggest that the mental life of bereaved adults with CG remain strongly tied to internally and externally-cued intrusive grief-related cognitions.

Grief theorists have long emphasized the importance of intrusive and preoccupying grief-related cognitions to the CG syndrome. In the first set of diagnostic criteria developed to assess this syndrome, Horowitz and colleagues identified unbidden and distressing memories associated with the loss as the core symptom of CG (Horowitz et al., 1997). Shear and colleagues (Shear et al., 2011) later identified intrusive memories of the loss or of the deceased as one of several symptoms reflecting persistent and intense separation distress, a core element of CG in their conceptualization of the syndrome. Consistent with these proposed criteria, the authors of the DSM-5 identified preoccupation with thoughts related to the death and preoccupation with

thoughts related to the deceased as two of four primary symptoms of the CG syndrome, at least one of which must be present in order to meet diagnostic criteria for CG (American Psychiatric Association, 2013).

Recently, we proposed that preoccupation with thoughts related to the deceased and thoughts related to the death may play an important role in the maintenance of the CG syndrome by acting as the cognitive precursors of two emotional experiences at the core of the complicated grief syndrome: yearning and emotional pain (Robinaugh, LeBlanc, Vuletich, & McNally, 2014). Yearning is an unsatisfied, intense, and future-oriented appetitive desire (Davis, 1984). Importantly, yearning is experienced in reference to an object. One yearns *for* something. In CG, the object of yearning is the deceased loved one. Accordingly, preoccupying thoughts related to the deceased may act as the cognitive basis for the experience of yearning. Similarly, preoccupying thoughts related to the death may act as the cognitive precursor to emotional pain (i.e., pain affect that arises in response to loss or potential loss of social connection or social value; Eisenberger, 2012). Together, these plausible cognition-emotion associations suggest that grief-related cognitions may contribute to the core emotional experiences in CG and, thus, may help maintain the network of thoughts, feelings, and behaviors that constitute the syndrome.

Given the prominence of grief-related cognitions in diagnostic criteria for CG and their potential importance to the maintenance of the CG syndrome, there is a clear impetus for further studying grief-related cognitions and, in particular, the etiological factors that give rise to these symptoms. In this study, we will examine impaired cognitive inhibition as one factor that may render bereaved adults vulnerable to experiencing intrusive grief-related cognitions and, in turn, the broader CG syndrome.



## **Inhibition**

Inhibition, or interference control, entails suppressing a stimulus that pulls for a competing response so as to carry out an alternative response (Nigg, 2000, p. 221). Although often discussed as a unitary concept, inhibition comprises a collection of related processes. In one taxonomy, Nigg (2000) posited four types of inhibition-related processes: interference control (i.e., suppression of a competing stimulus), cognitive inhibition (i.e., suppression of material in working memory), behavioral inhibition (i.e., suppression of prepotent behavioral responses), and oculomotor inhibition. Friedman and Miyake (2004) subjected this theoretical classification of inhibition-related processes to a latent variable analysis and found evidence for two classes of inhibition-related processes: a) resistance to proactive interference and b) response-distracter inhibition. *Resistance to proactive interference* denotes the ability to resist intrusions from previously relevant but currently irrelevant information (cf. Nigg's cognitive inhibition). That is, it entails resisting memory intrusions from information that was previously relevant but has since become irrelevant to successful task completion (Friedman & Miyake, 2004, p. 105). Response-distracter inhibition includes the conceptually distinct processes of prepotent response inhibition and resistance to distracter information. Resistance to prepotent response inhibition refers to the ability to suppress automatic or dominant responses (Friedman & Miyake, 2004, p. 104; cf. Nigg's behavioral inhibition). *Resistance to distracter information* refers to the ability to resist distraction from irrelevant information in the external environment (Friedman & Miyake, 2004, p. 105; cf. Nigg's interference control).

Deficits in either resistance to distracter information or resistance to proactive interference may render bereaved adults more vulnerable to experiencing intrusive grief-related cognitions and, in turn, the broader CG syndrome. Poor resistance to distract information would

allow distraction from grief-related reminders in the external environment. Similarly, impaired resistance to proactive interference would leave one vulnerable to experiencing intrusive memories of the death or the deceased. Because of the plausible causal relations among symptoms of CG, these grief-related cognitions may, in turn, contribute to the maintenance of the CG syndrome.

In this study, we examined resistance to distracter information and resistance to proactive interference for both emotional and non-emotional information in bereaved adults with CG. We hypothesized that individuals with CG would exhibit deficits in both types of cognitive inhibition for both emotional and non-emotional information relative to a comparison group of bereaved adults without CG. We further hypothesized that both types of inhibition would be negatively correlated with a measure of intrusive grief-related cognitions.

## **Method**

### **Subjects**

Subjects were bereaved adults who had experienced the death of a loved one at least 1 year ago. Exclusion criteria included non-English speaking status, current mania, current psychosis, and any other factor that would render the individual unable to provide informed consent, understand the computer tasks or assessment questions, or adequately ensure their safety during the study visit. Subjects were required to be between the ages of 21 and 65 years old. Subjects were assigned to the complicated grief group if they exhibited elevated CG symptom severity (i.e., a score of 30 or higher on the Inventory of Complicated Grief; ICG; Prigerson et al., 1995). Subjects were assigned to the bereaved comparison group if they did not exhibit elevated CG symptom severity (i.e., a score of 29 or lower on the ICG), depression or PTSD. We restricted the bereaved comparison group to those without depression and PTSD because

individuals with both disorders exhibit intrusive and preoccupying thoughts and memories comparable to those experienced by those with CG (Brewin, Watson, McCarthy, Hyman, & Dayson, 1998; McNally, 2003) and, thus, may exhibit the same cognitive deficits we were interested in examining in this study. Accordingly, inclusion of bereaved adults with depression or PTSD would have reduced our ability to detect between-group differences in cognitive inhibition.

### **Recruitment**

We recruited subjects through online and print advertisements, flyering, and word of mouth. Among the 95 individuals who participated in our first study visit, 1 met an exclusion criterion and 9 did not meet inclusion criteria for either the CG or bereaved comparison group. In addition, 5 subjects failed to return for the second study visit and were lost to follow-up. The final sample included 80 subjects.

### **Cognitive Tasks**

**Flanker Task.** To assess resistance to distracter information, we administered a modified Flanker Task (FT; Ochsner, Hughes, Robertson, Cooper, & Gabrieli, 2009) on a desktop computer with OpenSesame software (Mathot, Schreij, & Theeuwes, 2012). In the FT, subjects responded to a centrally presented target word while ignoring words that appeared directly above and below it. Subjects were instructed to respond with a button press by using their dominant hand to indicate the category of the target stimulus as quickly and accurately as possible. Subjects completed two conditions of the task. In the first, subjects categorized words as being either negative or positive. In the second, subjects categorized words as being either fruits or metals. We will refer to these emotional and non-emotional conditions, respectively (cf. affective flanker task and cognitive flanker task; Ochsner et al., 2009). Subjects were instructed to respond

with a button press indicating the category of the target stimulus as quickly and accurately as possible. On some trials, the flanker stimuli were from the same category as the target stimulus (e.g., a negative target word flanked by two negative words) whereas, for others, the flanker stimuli were from a different category (e.g., a negative target word flanked by two positive words). These trials are referred to congruent and incongruent trials, respectively. In the incongruent trials, the flanker stimuli pull for a competing response and, thus, subjects must resist distraction from the flanker words in order to successfully complete the task. The difference in response time between congruent and incongruent trials provides an index of the ability to resist this distracting information.

In both conditions, subjects first completed 12 practice trials in which flankers were not present and, subsequently, 12 practice trials in which flankers were present. Following the practice trials, subjects completed 2 blocks of 120 trials. Each block contained 40 congruent trials (i.e., trials in which the flanker words are in the same category as the target word), 40 incongruent trials (i.e., trials in which the flanker words are not of the same category as the target word) and 40 filler trials (i.e., trials in which the target word is flanked by 5 lower-case x's). The filler trials are included to prevent subjects from adapting to the conflict from incongruent trials (Mayr, Awh, & Laurey, 2003). The trial types were intermixed and displayed in random order. On each trial, a 2,000-ms fixation cross appeared on the screen prior to the simultaneous appearance of the target and flankers. The target and flankers remained on the screen until the subject responded and for no longer than 2,000 ms.

***Stimuli for non-emotional condition.*** The final stimulus set for the non-emotional condition comprised 10 metals and alloys (i.e., iron, gold, zinc, brass, steel, copper, silver, aluminum, magnesium, and platinum) and 10 fruits (i.e., kiwi, lime, pear, apple, grape, banana,

cherry, blueberry, pineapple, and raspberry). There was no difference in mean word length between metals ( $M = 5.90$ ,  $SD = 1.76$ ) and fruits ( $M = 6.10$ ,  $SD = 2.02$ ),  $t(18) = 0.24$ ,  $p = .82$ . Each word appeared as the target six times (twice for each trial type) in each block. Each word also appeared as the flanker four times in each block (twice in congruent trials and twice in incongruent trials). Flanker words were never more than 1 letter longer or shorter than the target word with which they were paired.

***Stimuli for the emotion condition.*** The final stimuli comprised 10 negative words (i.e., jail, burn, hate, annoy, tumor, prison, guilty, terrible, mutilate, and slaughter) and 10 positive words (i.e., cute, gift, joke, happy, lucky, friend, joyful, treasure, laughter, confident) from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999). All negative words had a valence rating below 2.75 ( $M = 2.20$ ,  $SD = .37$ , range = 1.64-2.74) All positive words had a valence rating above 7.5 ( $M = 8.05$ ,  $SD = .25$ , range = 7.62-8.45). There was no difference in arousal ratings between negative words ( $M = 6.23$ ,  $SD = .43$ ) and positive words ( $M = 6.29$ ,  $SD = .42$ ),  $t(18) = .32$ ,  $p = .756$ . There was no difference in mean length between negative words ( $M = 5.90$ ,  $SD = 1.76$ ) and positive words ( $M = 5.90$ ,  $SD = 1.76$ ),  $t(18) = 0.00$ ,  $p = 1.00$ . Each word appeared as the target six times in each block (twice for each trial type) and as the flanker four times in each block (twice in congruent trials and twice in incongruent trials). Flanker words were never more than 1 letter longer or shorter than the target word with which they were paired.

***Outcome variables.*** Response times were recorded for each trial. Response times greater than 3 standard deviations above or below that subject's mean were replaced with the value 3 standard deviations above or below the mean, respectively (Friedman & Miyake, 2004, p. 110). Interference cost was calculated as the response time on correct incongruent trials minus the

response time on correct congruent trials. Higher interference cost scores reflect poorer resistance to distracter information.

**Proactive Interference Task.** To assess proactive interference, we administered a modified version of Tolan and Tehan's (1999) proactive interference task (PIT) on a desktop computer with OpenSesame software (Mathot et al., 2012). Each trial of this PIT contained three phases: the learning phase, the distracter phase, and the recall phase. In the learning phase, subjects saw either one or two lists of four words (50% of trials, each). Words appeared sequentially in the center of the screen at a rate of one second per word. Subjects were instructed to remember words from the most recently presented set.

In the distracter phase, subjects completed a verbal distracter activity in which they were presented with eight numbers (ranging from 1 to 99) displayed sequentially in the center of the screen for one second each. Subjects were instructed to say aloud whether the number was "bigger" or "smaller" than fifty. This distracter activity was chosen based on previous research suggesting that a verbal distracter activity for eight seconds leads to greater proactive interference relative to a non-verbal distracter activity or a verbal distracter activity for a shorter duration of time (Tolan & Tehan, 1999).

In the recall phase, subjects completed a cued-recall test in which they were presented with a word fragment (e.g., t \_ \_ \_ \_ r ) and asked to recall the word from the most recently presented set that matched the word fragment within ten seconds. Subjects were instructed to begin typing their response immediately upon recalling the word that fits the recall cue. We measured the response time to report the word (i.e., the total time from when the word fragment is displayed until the subject presses enter to submit the recalled word). In two-set trials, both the target word from the second set (e.g., *teacher*) and a lure word from the first set (e.g., *traitor*)

fit the word fragment. The lure and target words appeared in the same position in the sequence of four words in their respective sets. For example, if the lure word appeared as the last word in the first set, then the target word would appear as the last word in the second set.

Subjects completed a total of forty trials, including twenty one-set trials and twenty two-set trials. In 50% of one-set trials, each of the four words displayed were negatively valenced. In the remaining 50% of one-set trials, each of the four words were neutrally valenced. For all two-set trials, the second set comprised four neutral words. For 50% of two-set trials, the first set (i.e., the set containing the distracting information) comprised negative words. For the remaining 50% of two-set trials, the first set contained neutral words.

***Stimuli for proactive interference task.*** For the PIT, we again drew stimuli from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999). The final stimuli comprised 80 negative words and 160 neutral words (see Supplementary Materials 2.1). All negative words had a valence rating below 3 ( $M = 2.14$ ,  $SD = .27$ , range = 1.25-2.82). All neutral words had a valence rating between 4 and 6, ( $M = 5.16$ ,  $SD = .52$ , range = 4.05-6.00). There was no difference in mean length between negative words ( $M = 5.60$ ,  $SD = 1.08$ ) and neutral words ( $M = 5.43$ ,  $SD = 1.02$ ),  $t(238) = 1.19$ ,  $p = .23$ . In both one-set and two-set trials, the target word appeared in the first, second, third, and final position of the to-be-remembered set in 20%, 30%, 30%, and 20% of trials, respectively.

***Outcome variables.*** We calculated three indices of performance on the PIT task. *Accuracy* was calculated as the proportion of correctly recalled words. *Accuracy interference cost* was calculated as the proportion of correctly recalled words on neutral one-set trials minus the number of correctly recalled words on two-set trials. *Accuracy interference cost* was calculated separately for negative trials (i.e., trials in which the interfering information was

negative) and neutral trials (i.e., trials in which the interfering information was neutral). Higher accuracy interference cost scores indicate poorer resistance to proactive interference. *Response time* was calculated as the duration of time to provide a correct response. If subjects failed to provide a correct response (i.e., failed to provide a response or provided an incorrect response), their response time was set to ten seconds (i.e., the maximum time subjects were given to recall the word). Response times greater than 3 standard deviations above or below that subject's mean were replaced with the value 3 standard deviations above or below the mean, respectively. Response time interference cost was calculated as the duration of time to provide a correct response in two-set trials minus the duration of time to provide a correct response in neutral one-set trials. Response time interference cost was calculated separately for negative and neutral trials. Greater proactive interference should lengthen the time taken to retrieve the target word on two-set trials. Accordingly, higher response time interference cost scores indicate poorer resistance to proactive interference. Lastly, we calculated the *number of intrusions* as the number of lure words reported during the recall phase on two-set trials. The number of intrusions was calculated separately for negative and neutral trials. More intrusions indicate poorer resistance to proactive interference.

**Self-report measures.** Subjects completed eight self-report questionnaires during Visit 1, including the Inventory of Complicated Grief (ICG; Prigerson et al., 1995), Quick Inventory of Depressive Symptomatology – Self Report (QIDS-SR; Rush et al., 2003), and the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979), to assess symptoms of complicated grief, depression, and PTSD, respectively. All items in the IES were adapted to inquire specifically about the death. We used the intrusions sub-scale of the IES to assess grief-related intrusive thoughts.



## **Procedure**

During the first study visit, we obtained informed consent and administered the Mini-Neuropsychiatric Interview. Subjects then completed a brief series of questionnaires, including assessments of depressive symptoms, PTSD, and CG. Eligible subjects then returned for a second visit in which they completed three computer tasks, including the FT to assess resistance to distracter information and the PIT to assess proactive interference. The task order was randomized. Subjects received \$50 compensation for their time and travel costs. The Committee on the Use of Human Subjects at Harvard University approved the protocol for this study.

## **Results**

### **Subjects**

Of the 80 subjects who met inclusion criteria and completed all relevant study measures, 40 met criteria for the CG group and 40 met criteria for the bereaved comparison group. The demographic characteristics of the CG and comparison groups appear in Table 2.1. There was no difference between the groups in age, gender, ethnicity, type or duration of relationship to the deceased, cause of death, or time since death. The results of the diagnostic interview and self-report assessments appear in Table 2.2. Of the 29 individuals who reported current PTSD, 28 endorsed bereavement-related PTSD and 8 individuals endorsed PTSD in response to both bereavement and another event. Two subjects from the CG group did not complete the FT. Similarly, two subjects from the CG group did not complete the PIT. Accordingly, all analyses of these tasks will include 40 subjects from the bereaved comparison group and 38 subjects from the CG group.

**Table 2.1.** Demographic characteristics of bereaved adults with and without complicated grief

		Comparison Group	CG	Test Statistic	<i>p</i>
Demographic Characteristics	Gender			$\chi^2(1)=1.29$	.182
	Female	65.0%	52.5%		
	Male	35.0%	47.5%		
	Ethnicity			$\chi^2(5)=3.76$	.297
	African American	30.0%	40.0%		
	Caucasian	62.5%	42.5%		
	Hispanic	0.0%	7.5%		
	Age	45.23 (14.65)	46.49 (11.04)	$t(77)=-0.43$	.667
Relationship Characteristics	Relationship Type			$\chi^2(3)=4.28$	.233
	Parent	72.5%	52.5%		
	Sibling	15.0%	25.0%		
	Spouse	5.0%	15.0%		
	Other	7.5%	7.5%		
	Time Known	36.73 (16.23)	33.00 (17.98)	$t(77)=0.97$	.337
Event Characteristics	Cause of Death			$\chi^2(2)=0.50$	.781
	Sudden/Violent	10.3%	15.4%		
	Long-term Illness	56.4%	51.3%		
	Short-term Illness	33.3%	33.3%		
	Time Since Death	4.65 (4.55)	4.18 (6.36)	$t(77)=0.38$	.706

*Note.* CG = Complicated grief.

### Resistance to Distracter Information

We first examined accuracy in categorizing the target stimuli. Bereaved adults with CG ( $M = .93$ ,  $SD = .11$ ) were less accurate than the bereaved comparison group ( $M = .97$ ,  $SD = .06$ ) in the emotion condition of the FT,  $t(56.35) = 2.12$ ,  $p = .039$ ,  $d = 0.56$ . The CG group ( $M = .92$ ,  $SD = .13$ ) was similarly less accurate than the bereaved comparison group ( $M = .96$ ,  $SD = .10$ ) in the non-emotion condition, however this difference did not rise to the level of statistical significance,  $t(67.65) = 1.58$ ,  $p = .116$ ,  $d = 0.42$ .

**Table 2.2.** Diagnostic interview and self-reports of psychopathology in bereaved adults with and without complicated grief

	Comparison			Test Statistic	<i>p</i>
	Group	CG			
Self-report assessments	Complicated Grief (ICG)	13.73 (8.98)	42.88 (9.68)	<i>t</i> (78)=-13.97	.000
	Depression (QIDS)	5.05 (3.45)	11.64 (4.73)	<i>t</i> (77)=-7.93	.000
	Post-traumatic Stress Disorder (IES)	14.60(15.32)	43.88 (14.81)	<i>t</i> (78)=-8.69	.000
	Grief-related Intrusions (IES-Intrusions)	6.68 (8.28)	21.18 (7.79)	<i>t</i> (78)=-8.07	.000
	Major Depressive Episode: Current	0.0%	40.0%	$\chi^2(1)=20.00$	.000
	Major Depressive Disorder: Lifetime	47.5%	70.0%	$\chi^2(1)=4.18$	.034
	Bipolar Disorder (I or II): Lifetime	2.5%	15.0%	$\chi^2(1)=3.91$	.048
	Posttraumatic Stress Disorder : Current	0.0%	72.5%	$\chi^2(1)=45.49$	.000
	Panic Disorder: Current	2.5%	20.0%	$\chi^2(1)=6.14$	.029
	Panic Disorder: Lifetime	5.4%	31.7%	$\chi^2(1)=8.66$	.003
MINI Diagnostic Information	Social Anxiety Disorder: Current	2.6%	29.3%	$\chi^2(1)=10.18$	.001
	Obsessive Compulsive Disorder: Current	5.3%	27.5%	$\chi^2(1)=6.94$	.008
	Generalized Anxiety Disorder: Current	0.0%	25.6%	$\chi^2(1)=11.20$	.001
	Alcohol Abuse/Dependence: Current	5.3%	7.7%	$\chi^2(1)=0.19$	.665
	Substance Use/Dependence: Current	2.6%	2.6%	$\chi^2(1)=0.00$	.985
	Anorexia Nervosa: Current	0.0%	0.0%		
	Bulimia Nervosa: Current	0.0%	5.3%	$\chi^2(1)=2.05$	.152

*Note.* CG = Complicated grief, ICG = Inventory of Complicated Grief, QIDS = Quick Inventory of Depression Symptoms, IES = Impact of Events Scale, MINI = Mini-International Neuropsychiatric Interview.

**Table 2.3.** Means and standard deviations for response time to correctly classify target word on the emotional and non-emotional Flanker Task.

		Comparison		<i>t</i> (76)	<i>p</i>	<i>d</i>
		Group	CG			
Emotional	Filler	709.06 (125.39)	768.58 (133.58)	-3.08	.003	-0.71
	Congruent	738.80 (147.96)	792.42 (150.81)	-2.97	.004	-0.68
	Incongruent	791.49 (836.55)	836.55 (153.05)	-2.47	.016	-0.57
	Cost	52.69 (41.45)	44.13 (39.78)	1.52	.133	0.35
Non-emotional	Filler	738.92 (142.92)	836.40 (135.85)	-2.03	.046	-0.47
	Congruent	762.86 (164.21)	874.80 (168.94)	-1.59	.117	-0.36
	Incongruent	805.37 (175.36)	899.93 (161.47)	-1.30	.198	-0.30
	Cost	42.51 (37.48)	25.13 (61.31)	0.93	.356	0.21

*Note.* CG = Complicated grief. Response times are presented in milliseconds.

The mean response time to classify the target for each trial type in both conditions of the FT appears in Table 2.3. We first performed a 2 (group) x 2 (condition) x 2 (trial type) mixed-model full-factorial analysis of variance (ANOVA) with the response time for all correct responses on the FT as the dependent variable. The ANOVA revealed a main effect of a main effect of trial,  $F(1, 75) = 82.49, p < .001, \eta_p^2 = 0.52$ , with subjects exhibiting longer response times on incongruent trials relative to congruent trials. There was also a main effect of condition  $F(1, 75) = 23.81, p < .001, \eta_p^2 = 0.24$ , with subjects exhibiting longer response times in the non-emotional condition relative to the emotion condition, and a main effect of group,  $F(1, 75) = 5.74, p = .019, \eta_p^2 = 0.07$ , with longer response times in the CG group relative to the bereaved comparison group. In addition, there was a significant interaction between condition and group,  $F(1, 75) = 7.28, p = .009, \eta_p^2 = 0.09$ , as well as a significant interaction between condition and trial,  $F(1,75) = 10.51, p = .002, \eta_p^2 = 0.12$ . However, we did not observe the hypothesized interaction between group and trial,  $F(1, 75) = 1.78, p = .187, \eta_p^2 = 0.02$  or an interaction between group, condition, and trial,  $F(1,75) = 1.29, p = .259, \eta_p^2 = 0.02$ . Planned comparisons revealed no difference in interference cost between those with and without CG in either the emotional condition,  $t(76) = 1.52, p = .13, d = 0.35$  or the non-emotional condition,  $t(76) = 0.93,$

$p = .36$ ,  $d = 0.21$ . These findings remained non-significant when we used log-transformed interference cost scores in both the emotional condition,  $t(76) = 1.63$ ,  $p = .107$ ,  $d = 0.37$ , and the non-emotional condition,  $t(76) = .91$ ,  $p = .366$ ,  $d = 0.21$ .

Due to concern about low accuracy in some subjects, we also repeated the 2x2x2 ANOVA in the subset of subjects who exhibited above chance accuracy (62.5%) for both incongruent and congruent trials in both task conditions. This subset excluded 2 subjects from the bereaved comparison group and 4 subjects from the CG group. The same pattern of results was observed in this subset. Most notably, the hypothesized interaction between group and trial-type remained non-significant,  $F(1, 70) = 2.59$ ,  $p = .112$ ,  $\eta_p^2 = 0.04$ .

FT interference scores in the emotional and non-emotional conditions were not associated with intrusive grief-related cognitions,  $r(74) \geq -.09$ ,  $p \leq .423$ . Similarly, FT scores were not associated with grief-related cognitions in the subset of those with CG,  $rs(38) \leq |-.16|$ ,  $p \geq .357$ , or the bereaved comparison group,  $r(38) \leq .14$ ,  $p \geq .393$ .

### **Resistance to Proactive Interference**

The proportion of correctly recalled words, mean response time to correctly recall words, and the proportion of intrusions in the PI task appear in Table 2.4. We first performed a 2 (group) x 2 (valence) mixed-model ANOVA on accuracy interference cost. There was a main effect of valence,  $F(1, 76) = 19.48$ ,  $p < .001$ ,  $\eta_p^2 = 0.20$ , with subjects exhibiting greater accuracy interference cost in the emotion condition. However, we did not observe the hypothesized main effect of group,  $F(1, 76) = 1.35$ ,  $p = .248$ ,  $\eta_p^2 = 0.02$ , nor was there was a significant interaction between group and valence,  $F(1, 76) < .00$ ,  $p = .998$ ,  $\eta_p^2 < 0.01$ .

We next performed the same 2 (group) x 2 (valence) mixed-model ANOVA with the response time interference cost as the dependent variable. There was again a main effect of

valence,  $F(1, 76) = 20.79, p < .001, \eta_p^2 = 0.22$ , with subjects exhibiting greater interference cost on negative trials. However, we did not observe the hypothesized main effect of group,  $F(1, 76) = 1.24, p = .269, \eta_p^2 = 0.02$ , nor was there a significant interaction between group and valence,  $F(1, 76) = .87, p = .354, \eta_p^2 = 0.01$ .

Finally, we performed the same 2 (group) x 2 (valence) mixed-model ANOVA with the number of intrusions as the dependent variable. There was a main effect of valence,  $F(1, 76) = 35.17, p < .001, \eta_p^2 = 0.32$  and a marginally significant main effect of group,  $F(1, 76) = 3.51, p = .065, \eta_p^2 = 0.04$ . There was no interaction between valence and group,  $F(1, 76) = .001, p = .973, \eta_p^2 < .01$ . As seen in Table 2.4, planned comparisons revealed that bereaved adults with CG exhibited more intrusions than did those in the bereaved comparison group in both the emotional and non-emotional conditions, but those differences failed to reach the level of statistical significance,  $ts(76) \leq |-1.71|, p \geq .091$ .

In the non-emotional condition, accuracy interference cost, response time interference cost, and intrusions were not associated with intrusive grief-related cognitions,  $rs(76) \leq |-.22|, p \geq .053$ . In the emotion condition, greater response time interference cost was associated with *fewer* grief-related intrusive cognitions as measured by the IES-intrusions sub-scale,  $r(76) = -.24, p = .033$ . However, this association was no longer statistically significant after we used the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995) to hold the false discovery rate at 5%. PIT scores were not associated with intrusive grief-related cognitions in the subset of those with CG,  $rs(36) \leq |-.31|, p \geq .058$ , or those without CG,  $rs(38) \leq |-.19|, p \geq .253$ .

**Table 2.4.** Means and standard deviations for accuracy, response time, and intrusions for emotional and non-emotional trials in the Proactive Interference Task.

Outcome Variable	Trial Type	Distracter	Target	Comparison				
				Group	CG	<i>t</i> (76)	<i>p</i>	<i>d</i>
Accuracy	1-Set	Negative	Negative	.84 (.16)	.62 (.23)	4.75	.000	1.09
		Neutral	Neutral	.76 (.18)	.61 (.23)	3.28	.002	0.75
	2-Set	Negative	Neutral	.45 (.23)	.25 (.17)	4.37	.000	1.00
		Neutral	Neutral	.56 (.19)	.35 (.20)	4.58	.000	1.05
	Cost	Negative	Neutral	.31 (.21)	.36 (.23)	-0.97	.337	-0.22
		Neutral	Neutral	.21 (.18)	.26 (.21)	-1.06	.291	-0.24
Response Time	1-Set	Negative	Negative	4126.60 (1835.83)	6346.05 (2087.73)	-4.99	.000	-1.14
		Neutral	Neutral	4448.82 (2110.90)	6489.47 (2017.81)	-4.36	.000	-1.00
	2-Set	Negative	Neutral	7026.52 (1870.90)	8569.85 (1331.57)	-4.18	.000	-0.96
		Neutral	Neutral	6225.59 (1727.41)	8041.00 (1571.32)	-4.85	.000	-1.11
	Cost	Negative	Neutral	2577.70 (1803.68)	2080.37 (1501.03)	1.32	.191	0.30
		Neutral	Neutral	1776.77 (1534.25)	1551.52 (1406.12)	0.68	.502	0.16
Intrusions	2-Set	Negative	Neutral	.31 (.19)	.36 (.19)	-1.30	.199	-0.15
		Neutral	Neutral	.17 (.13)	.22 (.16)	-1.71	.091	-0.39

Note. CG = Complicated grief. Accuracy and intrusions are reported as the proportion of trials in which the subject provided an accurate response and the proportion of trials in which the subject reported an intrusion (i.e., a lure word), respectively. Response times are reported in milliseconds.

## Discussion

Bereaved adults with CG experience intrusive thoughts related to the death and the deceased. In this study, we examined possible impairment in two types of cognitive inhibition (i.e., resistance to distracter information and resistance to proactive interference) that may contribute to these intrusive grief-related cognitions and, in turn, the broader CG syndrome. To our knowledge, this is the first study to examine inhibition in bereaved adults.

Contrary to our hypotheses, the CG group did not exhibit difficulties resisting distracter information relative to the bereaved comparison group. There was a significant main effect of trial-type in both the emotional and non-emotional condition, suggesting that both groups experienced interference from distracting information on incongruent trials. However, individuals with CG evinced the same ability to resist this distracting information as did those without CG. In addition, there was no association between resistance to distracter information and a measure of intrusive grief-related intrusive cognitions.

Our findings regarding resistance to proactive interference are somewhat less clear but broadly fail to support the hypothesis that bereaved adults with CG exhibit greater deficits in the ability to resist proactive interference. We found no evidence that groups differed in proactive interference as assessed by either accuracy or response time interference cost. The CG group exhibited a trend toward having more intrusions than the comparison group. However, this effect was small and outside the range of statistical significance.

There are several possible explanations for these null findings. First, our tasks may not have adequately assessed the cognitive control processes of interest. There are arguments against this possibility. We observed the hypothesized interference effect in both conditions (i.e., emotional and non-emotional) of both tasks (i.e., the FT and PIT), suggesting that the tasks



successfully created interference that had to be resisted in order to successfully complete the task. In addition, we drew our tasks from previous assessments of the relevant processes, including one study in which latent variable-analyses found that these tasks loaded highly on the processes of interest (i.e., the FT loaded highly on the resistance to distracter information variable and the PIT loaded highly on the resistance to proactive interference variable; Friedman & Miyake, 2004). However, by relying on a single task to assess these processes, our study is vulnerable to the problem of task impurity. That is, because inhibition necessarily acts on some other aspect of cognition or behavior (e.g., a memory, a response, etc.), performance on any given task will always be affected by idiosyncratic task demands that are independent of inhibition. For example, consistent with past studies (Friedman & Miyake, 2004; Tolan & Tehan, 1999) we used the PIT as an assessment of proactive interference. However, because the to-be-resisted irrelevant information was presented only five seconds before the to-be-remembered information and fourteen seconds before the cued recall, it is possible that subjects never successfully removed the first-set words from working memory. Consequently, the PIT indices we reported here may also reflect the success with which individuals expelled information from working memory (cf. the modified Sternberg task in Joormann & Gotlib, 2008). In addition, in our version of the PIT, subjects read the first set of words aloud and the second set silently. Although this task parameter was set with the intention of maximizing proactive interference (Tolan & Tehan, 1999), it also introduces the possibility that the observed difference between 1-set and 2-set trials is attributable, at least in part, to the difficulty of encoding words read silently relative to words read aloud. These examples illustrate how idiosyncratic task characteristics obscure the tasks' ability to assess inhibition. Accordingly, in future studies, researchers may consider administering multiple tasks designed to assess a specific type of cognitive inhibition

and using latent construct analyses to remove variance attributable to idiosyncratic characteristics of the individual tasks (Miyake et al., 2000).

Second, deficits in cognitive inhibition may exist at a higher level of abstraction than as assessed in this study. Some researchers have recently argued that the neurobiological mechanisms of cognitive control, including inhibition, may differ depending on the nature of the object under control (Nee et al., 2013). If so, the stimuli we used in this study (i.e., emotional and non-emotional words) may have failed to adequately assess the type of inhibition impaired in those with CG. One intriguing possibility is that deficits may exist only for inhibition of higher-order representations such mental sets, tasks, or operations, rather than cognitive control over a single mental object (e.g., a word), as was assessed in the current study (Badre, 2008; Badre & D'Esposito, 2009). For example, a bereaved adult may be able to inhibit a single mental representation (e.g., an image of the deceased) but may find it difficult to disengage from a more complex grief-related task (e.g., attempting to find meaning in the loss).

A related possibility is that bereaved adults with CG may exhibit deficits for types of information not assessed in this study. Perhaps most plausibly, bereaved adults with CG may exhibit impaired inhibition of grief-related or attachment-related stimuli (cf. difficulty exerting cognitive control of trauma-related stimuli in those with PTSD; Pineles, Shipherd, Mostoufi, Abramovitz, & Yovel, 2009). Consistent with this possibility, Maccallum and Bryant (2010) found that, relative to bereaved adults without CG, bereaved adults with CG were slower to name the ink color for grief-related words in a Stroop Task, suggesting that those with CG maybe have difficulty resisting distraction from grief-related information. In this study, we assessed the broad ability to inhibit emotional and non-emotional information with the aim of identifying a cognitive vulnerability that may exist outside the specific domain of grief-related

thoughts. We did so because grief-related thoughts are highly salient to the CG population and, consequently, any observed inhibition deficit for grief-related thoughts may be attributable to the high salience of these thoughts for those with CG rather than a deficit in cognitive inhibition. A possible alternative means of addressing this issue is to intervene on the ability to inhibit grief-related stimuli in those with CG. In doing so, researchers can assess the effect of improved cognitive inhibition over grief-related stimuli independent of the salience of those stimuli.

Finally, it may simply be that bereaved adults with CG do not exhibit noteworthy deficits in cognitive inhibition. Accordingly, in future studies, researchers should consider examining other factors that may increase the likelihood of experiencing intrusive grief-related thoughts. One possibility is that intrusive thoughts about the death may be driven by a persistent perception that the death remains unexplained. Memories for events that are self-relevant and poorly understood are highly accessible and evoke intrusive thoughts about the event (Wilson & Gilbert, 2008). Indeed, bereaved adults who struggle to make sense of the death also think about the death more and recover more slowly than those who report having made sense of the death (Bonanno et al., 2002). In future studies, researchers should more closely examine the association between perceived explicability of the death and its relation to preoccupation with thoughts related to the deceased. Wilson & Gilbert's (2008) model of affective adaptation provides guidance for how researchers might assess the perceived explicability of events, suggesting that an event is explained if the individual knows (a) what the event is, (b) why it occurred, (c) how it fits into their self-concept, and (d) what it means for their life more broadly. In doing so, it will be important for researchers to assess not just *if* the event has been explained but also *how* the event has been explained, as some explanations are likely to be less salubrious

than others (e.g., attributing the cause of death to one's self may be more pathogenic than attributing the death to natural causes).

### **Limitations**

Our study has limitations. First, we relied on convenience sampling to recruit participants, a method which may have led to the recruitment of a sample that does not adequately represent the populations of interest. This potential bias is perhaps most plausibly present in our bereaved comparison group. Nearly half of the bereaved comparison group had a lifetime history of depression; a rate substantially above the lifetime prevalence rate observed in the general population (Kessler et al., 2005). Second, our data are cross-sectional, preventing any determination of causality in the hypothesized association between cognitive inhibition and CG. Third, although we included an assessment of intrusive thoughts related to the death (i.e., the IES-Intrusions subscale), we did not include an assessment of intrusive thoughts related to the deceased. Accordingly, we were unable to assess the relationship between cognitive inhibition and intrusive thoughts related to the deceased in this sample.

### **Conclusion**

In this study, we examined the ability to resist distracter information and the ability to resist proactive interference in bereaved adults with and without complicated grief. We found no evidence that resistance to distracter information is impaired in those with CG relative to those without CG. Although we did find limited support for the possibility that there is a modest deficit in the ability to resist proactive interference in those with CG, the effect was small, outside the range of statistical significance, and present in only one of our three indices of proactive interference. Our results suggest that cognitive inhibition is unlikely to feature prominently in the etiology of CG for most bereaved adults. In future studies, researchers should examine other

types of cognitive control (e.g., inhibition of grief- or attachment-related information and cognitive control over mental sets) and higher-order cognitive variables (e.g., perceived explicability of the death) in an effort to better understand the cognitive vulnerabilities that contribute to the presence of intrusive grief-related thoughts and, in turn, the broader CG syndrome.

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### **Chapter 3**

#### **Paper 2: Cognitive Set Shifting in Bereaved Adults With and Without Complicated Grief**

## Abstract

**Background:** Complicated grief (CG) is a bereavement-specific syndrome characterized by prolonged and impairing grief. Preoccupying thoughts related to the death and the deceased are a hallmark clinical feature of the CG syndrome. Moreover, rumination is concurrently and prospectively associated with greater overall CG severity. Deficits in cognitive control may contribute to the preoccupying and repetitive nature of grief-related cognitions in those with CG. In this study, we examined the ability to shift between mental representations in bereaved adults with and without CG. We hypothesized that, relative to those without CG, those with CG would exhibit deficits in cognitive set shifting.

**Method:** To test this hypothesis, we recruited bereaved adults with CG ( $n = 38$ ) and a bereaved comparison group of adults who did not exhibit CG, depression, or post-traumatic stress disorder ( $n = 39$ ). Subjects completed the Internal Shift Task to assess the ability to shift between mental representations.

**Results:** Contrary to our hypotheses, bereaved adults with CG did not exhibit deficits in the ability to shift between mental representations in either the emotional,  $t(72) = -0.86, p = .395, d = -0.20$ , or non-emotional,  $t(72) = -0.25, p = .802, d = -0.06$ , conditions of the Internal Shift Task.

**Discussion:** Our results fail to support the hypothesis that bereaved adults exhibit deficits in the ability to shift between mental representations. Accordingly, in future studies it will be important for researchers to examine alternative factors that contribute to greater risk for preoccupying grief-related cognitions and the broader CG syndrome.

## **Cognitive Set Shifting in Bereaved Adults With and Without Complicated Grief**

Complicated grief is a syndrome of cognitions, emotions, and behaviors that arise together following the death of a loved. The elements of this syndrome include persistent and intense yearning for the presence of the deceased, emotional pain, preoccupation with thoughts related to the death, and preoccupation with thoughts related to the deceased (Horowitz et al., 1997; Shear et al., 2011). In the initial months following the loss, most bereaved adults will experience at least some elements of this syndrome. For the majority of bereaved adults, the frequency and severity of most or all of these elements will diminish over time (Bonanno, 2004). However, for a minority of individuals (6.7%; Kersting, Braehler, Glaesmer, & Wagner, 2011), they may persist for years after the loss, provoking substantial distress and impairment across domains of functioning (Latham & Prigerson, 2004; Mitchell, Kim, Prigerson, & Mortimer, 2005; Prigerson et al., 1999; Szanto, Prigerson, Houck, Ehrenpreis, & Reynolds, 1997). These distinct trajectories raise an important question: why does the CG syndrome persist in some individuals but not in others?

One possibility is that people differ in the threshold of activation for specific elements of the CG syndrome (Robinaugh, LeBlanc, Vuletich, & McNally, 2014). That is, some individuals may be more vulnerable to experiencing one or more of the CG symptoms. For example, greater dependence on one's spouse prior to their death may render one more vulnerable to experiencing difficulty imagining the future after the death (Maccallum & Bryant, 2013). Because of the plausible causal relations among CG symptoms, this vulnerability to experiencing a given CG symptom may, in turn, contribute to emergence of the broader CG syndrome (Robinaugh et al., 2014).

In this study, we examined a potential vulnerability factor that may increase risk for experiencing two prominent elements of the CG syndrome: preoccupation with thoughts about

the death and preoccupation with thoughts about the deceased. Bereaved adults with CG report “hard to dispel” grief-related mental images (Horowitz, Bonanno, & Holen, 1993, p. 269). In addition, rumination (i.e., a style of repetitive, negative, and preoccupying thought) is associated with greater overall CG severity following the death of a loved one (Boelen, 2012; van der Houwen, Stroebe, Schut, Stroebe, & van den Bout, 2010). Consistent with these findings, the authors of the DSM-5 have emphasized the preoccupying nature of grief-related thoughts in the diagnostic criteria for this syndrome (American Psychiatric Association, 2013).

Rumination and preoccupying grief-related cognitions may result from deficits in cognitive control (Harvey, 2004; Joormann, 2010; Koster, De Lissnyder, Derakshan, & De Raedt, 2011; Verwoerd, Wessel, & de Jong, 2009). Cognitive control (or executive function) refers to a collection of related but distinguishable processes responsible for the control and coordination of other cognitive processes (Miyake et al., 2000). These processes include *inhibition* (i.e., the ability to suppress a stimulus that pulls for a response so as to carry out an alternative response; Nigg, 2000, p. 221), *updating* (i.e., the ability to update and monitor the contents of working memory; Miyake et al., 2000) and *shifting* (i.e., the ability to flexibly shift between mental representations, Monsell, 2003)

In this study, we will focus specifically on the ability to shift between mental representations. Shifting is commonly assessed using the Wisconsin Card Sort Task (WCST). In the WCST, subjects learn to appropriately categorize cards through schedules of reinforcement. The rules dictating how to categorize each card change throughout the task. As a result, subjects must shift their mental representation of the task instructions in order to successfully perform the task. Dysphoric or depressed individuals exhibit deficits in the ability to switch task sets in both the standard WCST (Channon, 1996; Grant, Thase, & Sweeney, 2001) and a modified-WCST



that incorporates emotional stimuli (Deveney & Deldin, 2006). Moreover, set shifting deficits on the WCST predict the propensity to ruminate (Davis & Nolen-Hoeksema, 2000).

More recently, researchers have used the Internal Shift Task (IST; De Lissnyder, Koster, & De Raedt, 2012) to examine the ability to shift between internal mental representations. In the IST, subjects view a series of serially presented faces and keep mental count of the number of faces they see in two categories (e.g., male and female faces). In some trials, the face is from the same category as the face preceding it (e.g., consecutive female faces). In others, the face is from a different category than the preceding face (e.g., a male face followed by a female face). In these ‘switch’ trials, subjects must shift their mental representation in order to update their mental count of the new category. The difference in response time between switch trials and no-switch trials provides an index of the ability to shift between mental representations.

In two recent studies, researchers have found that ruminators exhibit deficits in the ability to shift between mental representations in the IST (De Lissnyder et al., 2012; Koster, De Lissnyder, & De Raedt, 2013). Interestingly, these deficits are most pronounced when ruminators are attending to the emotional features of a face and, especially, when shifting from a face displaying a negative emotion toward one displaying a neutral expression. Together, these findings suggest that deficits in the ability to shift attention away from negative internal representations may foster rumination (Ehring & Wahl, 2008; Ehring & Watkins, 2008). Accordingly, this vulnerability might similarly contribute to the preoccupying thoughts related to the death and the deceased in those with CG which, in turn, may contribute to the broader CG syndrome.

To test this possibility, we administered the IST to bereaved adults with and without CG. We hypothesized that, relative to a bereaved comparison group without CG, bereaved adults with

CG would exhibit deficits in their ability to flexibly shift attention between internal representations. We further hypothesized that this shifting ability would be associated with repetitive negative thought in those with and without CG.

## **Method**

### **Subjects**

Subjects were bereaved adults between 21 and 65 years old who had experienced the death of a loved one at least 1 year ago. Exclusion criteria included non-English speaking status, current mania, current psychosis, and any other factor that would render the individual unable to provide informed consent, understand the computer tasks or assessment questions, or adequately ensure their safety during the study visit. Subjects were assigned to the complicated grief group if they exhibit elevated CG symptom severity (i.e., a score of 30 or higher on the Inventory of Complicated Grief; ICG; Prigerson et al., 1995). Subjects were assigned to the bereaved comparison group if they did not exhibit elevated CG symptom severity (i.e., a score of 29 or lower on the ICG) and did not meet criteria for current depression or current post-traumatic stress disorder (PTSD) on a semi-structured clinical interview. We restricted the bereaved comparison group to those without depression or PTSD because individuals with both PTSD and depression experience ruminative and preoccupying negative thoughts and, thus, may exhibit the same cognitive deficits we were interested in examining in this study (Ehring, Frank, & Ehlers, 2008; Morina, 2011; Nolen-Hoeksema, McBride, & Larson, 1997; Nolen-Hoeksema, Parker, & Larson, 1994; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; van der Houwen et al., 2010). Accordingly, inclusion of bereaved adults with depression or PTSD would have reduced our ability to detect between-group differences in set-shifting.

We recruited subjects through online advertisements (e.g., Craig's List), print advertisements (e.g., Metro newspaper), flyering, referral from local treatment centers, and word of mouth. Among those who participated in our first study visit ( $n = 95$ ), 1 met criteria for current psychosis and was excluded from the study and 9 did not meet inclusion criteria for either the CG or the bereaved comparison group. An additional 5 subjects failed to return for the second study visit and were lost to follow-up. Among those who did participate in the second study visit, 3 did not complete the Internal Shift Task. The final sample included 77 subjects.

### **Measures**

**Diagnostic interview.** The Mini-International Neuropsychiatric Interview (Sheehan et al., 1998) is a structured diagnostic interview seventeen Axis I disorders, including MDD and PTSD. In this study, we administered the MINI PTSD module for both the death of a loved one and for any other Criterion A event reported by the subject.

**Internal Shift Task.** To assess set shifting, we administered the Internal Shift Task (De Lissnyder et al., 2011; Koster et al., 2013) on a desktop computer with OpenSesame software (Mathot, Schreij, & Theeuwes, 2012). In the IST, subjects viewed a series of sequentially presented faces and kept mental counts of the number of faces they had seen in two categories. Subjects completed two conditions of the task. In the first, subjects attended to the emotional expression of the faces (i.e., angry or neutral). In the second, subjects attended to the gender of the faces by gender (i.e., male or female). We will refer to these conditions as the emotional and non-emotional conditions, respectively. The order of the conditions was randomly assigned.

In both conditions, subjects completed 144 trials across 12 blocks of trials. Each block contained between 10 and 14 trials. That is, subjects were shown between 10 and 14 sequentially presented faces in each block. Subjects were instructed to keep a silent mental count of the

number of faces they had seen in that block from both categories relevant to that condition (i.e., male and female faces in the non-emotional condition; angry and neutral faces in the emotional condition). Subjects were instructed to press the space bar on the keyboard immediately upon updating their mental count to include the presented face. After pressing the space bar, subjects saw a blank screen for 200 ms and were then presented with the next trial. A trial was considered a no-switch trial if the face presented was of the same category as the face that preceded it (e.g., consecutive angry faces). A trial was considered a switch trial if the face presented was of a different category than the face that preceded it (e.g., a neutral face followed by an angry face). The faces remained on the screen until the subject pressed the space bar to indicate they had updated their mental count. At the end of each block, subjects were asked to report their mental count for the number of faces they had seen in both categories. Prior to completing each condition, subjects completed two practice trials in which they reported their mental counts out loud during each trial so that the experimenter could confirm the subject understood the task instructions.

*Stimuli.* Stimuli were 48 faces drawn from the Karolinska Directed Emotional Faces picture set (Goeleven, De Raedt, Leyman, & Verschuere, 2008; Lundqvist, Flykt, & Ohman, 1998). In the emotion condition, there were 24 neutral faces and 24 angry faces. For both categories, half of the faces were male and half were female. In the non-emotion condition, there were 24 male faces and 24 female faces. For both categories, half of the faces expressed anger and the remaining half had a neutral expression. Each of the 48 faces appeared 3 times in both conditions. For more information about the task stimuli, see De Lissnyder et al. (2012) and Koster et al., (2013).

**Outcome variables.** We calculated two indices of performance on the IST: accuracy and switch cost. A block was considered accurate if the subject correctly reported the number of both types of faces that appeared in that block (e.g., reporting the correct count of male and female faces in the non-emotion condition). Switch cost was calculated as the response time taken to press the space bar (i.e., the time taken to update the mental count) on switch trials minus the time taken to do so on no-switch trials. In keeping with previous research (De Lissnyder et al., 2012; Koster et al., 2013), we used each subject's median scores for switch trials and no-switch trials in our calculation of switch cost and all blocks of trials (correct and incorrect) were included in this calculation.

**Self-report measures.** Subjects completed 8 self-report questionnaires during the first study visit, including the Inventory of Complicated Grief (ICG; Prigerson et al., 1995), Quick Inventory of Depressive Symptomatology – Self Report (QIDS-SR; Rush et al., 2003), and the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979), to assess symptoms of complicated grief, depression, and bereavement-related PTSD, respectively. All items in the IES were adapted to inquire specifically about the death. In addition, subjects completed and the Perseverative Thinking Questionnaire (Ehring et al., 2011) to assess the general tendency to engage in transdiagnostic repetitive negative thought.

## **Procedure**

During the first study visit, we obtained informed consent and administered the MINI. Subjects then completed a brief series of questionnaires, including assessments of CG, depression, and bereavement-related PTSD. Subjects then returned for a second visit in which they completed three cognitive tasks, including the internal shift task. The order of the three cognitive tasks was randomized. Subjects received \$50 compensation for their time and travel

costs. The Committee on the Use of Human Subjects at Harvard University approved the protocol for this study.

## Results

### Subjects

The final sample included 77 subjects, 38 of whom met criteria for the CG group and 39 met criteria for the bereaved comparison group. Demographic characteristics of the sample appear in Table 3.1. There was no difference between the groups in any of the assessed demographic factors. The results of the diagnostic interview and self-report assessments appear in Table 3.2. Of the 29 individuals who reported current PTSD, 28 endorsed bereavement-related PTSD.

**Table 3.1.** Demographic characteristics of bereaved adults with and without complicated grief

		Comparison Group	CG	Test Statistic	<i>p</i>
Demographic Characteristics	Gender			$\chi^2(1)=1.56$	.253
	Female	64.1%	50.0%		
	Male	35.9%	50.0%		
	Ethnicity			$\chi^2(5)=6.46$	.264
	African American	28.2%	39.5%		
	Caucasian	64.1%	44.7%		
	Hispanic	0.0%	7.9%		
	Age	45.08 (14.81)	46.95 (10.49)	$t(68.58)=-0.64$	.526
Relationship Characteristics	Relationship Type			$\chi^2(3)=2.87$	.412
	Parent	71.8%	55.3%		
	Sibling	15.4%	23.7%		
	Spouse	5.1%	13.2%		
	Other	7.7%	7.9%		
	Time Known	36.49 (16.37)	34.32 (17.38)	$t(74)=0.56$	.578
Event Characteristics	Cause of Death			$\chi^2(2)=0.12$	.941
	Sudden/Violent	10.5%	10.8%		
	Long-term Illness	57.9%	54.1%		
	Short-term Illness	31.6%	35.1%		
		Time Since Death	4.67 (4.61)	4.32 (6.50)	$t(74)=0.27$

*Note.* CG = Complicated grief.

**Table 3.2.** Diagnostic interview and self-reports of psychopathology in bereaved adults with and without complicated grief

	Comparison			Test Statistic	p
	Group	CG			
Self-report assessments	Complicated Grief (ICG)	13.79 (9.08)	42.95 (9.73)	$t(77) = -13.60$	.000
	Depression (QIDS)	5.10 (3.48)	11.57(4.63)	$t(74) = -8.26$	.000
	Post-traumatic Stress Disorder (IES)	14.74 (15.49)	43.45 (14.99)	$t(75) = -6.90$	.000
	Repetitive Negative Thought (PTQ)	19.31 (8.62)	28.49 (12.29)	$t(74) = -3.79$	.000
MINI Diagnostic Information	Major Depressive Episode: Current	0.0%	39.5%	$\chi^2(1)=19.12$	.000
	Major Depressive Disorder: Lifetime	48.7%	68.4%	$\chi^2(1)=3.076$	.079
	Bipolar Disorder (I or II): Lifetime	2.6%	15.8%	$\chi^2(1)=4.07$	.044
	Posttraumatic Stress Disorder : Current	0.0%	76.3%	$\chi^2(1)=47.75$	.000
	Panic Disorder: Current	0.0%	18.4%	$\chi^2(1)=5.20$	.023
	Panic Disorder: Lifetime	5.1%	31.6%	$\chi^2(1)=9.05$	.003
	Social Anxiety Disorder: Current	2.6%	18.4%	$\chi^2(1)=5.20$	.023
	Obsessive Compulsive Disorder: Current	2.6%	26.3%	$\chi^2(1)=8.87$	.003
	Generalized Anxiety Disorder: Current	0.0%	21.1%	$\chi^2(1)=9.16$	.002
	Alcohol Abuse/Dependence: Current	2.6%	5.3%	$\chi^2(1)=.37$	.541
	Substance Use/Dependence: Current	0.0%	5.3%	$\chi^2(1)=2.11$	.147
	Anorexia Nervosa: Current	0.0%	0.0%		
	Bulimia Nervosa: Current	0.0%	5.3%	$\chi^2(1)=2.11$	.147

*Note.* CG = Complicated grief, ICG = Inventory of Complicated Grief, QIDS = Quick Inventory of Depression Symptoms, IES = Impact of Events Scale, PTQ = Perseverative Thinking Questionnaire, MINI = Mini-International Neuropsychiatric Interview.

## Internal Shift Task

We first examined accuracy of mental counts. Bereaved adults with CG ( $M = .55$ ,  $SD = .29$ ) were less accurate than the bereaved comparison group ( $M = .82$ ,  $SD = .18$ ) in the emotion condition,  $t(46.93) = 3.99$ ,  $p < .001$ ,  $d = 0.56$ . The CG group ( $M = .58$ ,  $SD = .28$ ) was similarly less accurate than the bereaved comparison group ( $M = .76$ ,  $SD = .18$ ) in the non-emotion condition,  $t(63.41) = 3.43$ ,  $p = .001$ ,  $d = 0.42$ . We also examined the proportion of blocks for which the subject's mental counts of each category were within 1 number of the correct count. Bereaved adults with CG ( $M = .81$ ,  $SD = .22$ ) were again less accurate than the bereaved comparison group ( $M = .96$ ,  $SD = .08$ ) in the emotion condition,  $t(60.78) = 4.84$ ,  $p < .001$ ,  $d = 0.56$ . The CG group ( $M = .82$ ,  $SD = .20$ ) was similarly less accurate than the bereaved comparison group ( $M = .97$ ,  $SD = .06$ ) in the non-emotion condition,  $t(43.49) = 4.47$ ,  $p = .001$ ,  $d = 0.42$ .

We next examined the time taken to update mental counts for switch and no-switch trials. Three subjects (2 in the bereaved comparison group and 1 in the CG group) exhibited switch costs greater than 3 standard deviations above the sample mean and were excluded from all analyses of response time and switch cost. The mean response time to update the mental count for switch and no-switch trials as well as switch cost scores appear in Table 3.3. We first performed a 2 (group) x 2 (condition) x 2 (trial type) mixed-model full-factorial analysis of variance (ANOVA) with response time to update the mental count as the dependent variable. The ANOVA revealed a main effect of trial,  $F(1, 72) = 232.92$ ,  $p < .001$ ,  $\eta_p^2 = 0.76$ , with slower response times for switch trials relative to non-switch trials. There was also a main effect of condition  $F(1, 72) = 16.58$ ,  $p < .001$ ,  $\eta_p^2 = 0.19$ , with slower response times in the emotion condition relative to the non-emotional one. There was no main effect of group,  $F(1, 72) = 2.09$ ,



**Table 3.3.** Response time indices for the internal shift task in bereaved adults with Complicated Grief and the bereaved comparison group

	Bereaved Comparison		CG		<i>t</i> (72)	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
General switch	1660.98	462.91	1840.13	652.81	-1.36	.178	-0.32
General no-switch	1242.25	337.20	1386.87	485.41	-1.49	.141	-0.35
General switch cost	418.73	218.29	453.26	270.43	-0.60	.548	-0.14
Non-emotion switch	1610.96	465.73	1734.68	684.20	-0.91	.366	-0.21
Non-emotion no-switch	1188.04	340.90	1295.82	503.27	-1.08	.284	-0.25
Non-emotion switch cost	422.92	248.93	438.85	294.39	-0.25	.802	-0.06
Emotion switch	1711.00	485.08	1945.58	702.14	-1.67	.099	-0.39
Emotion no-switch	1296.46	369.68	1477.92	535.51	-1.70	.094	-0.40
Emotion switch cost	414.54	216.41	467.66	309.55	-0.86	.395	-0.20

*Note.* CG = Complicated grief. Response times are reported in milliseconds.

$p = .153$ ,  $\eta_p^2 = 0.03$ , suggesting that bereaved adults with CG were not slower to update their mental counts relative to the bereaved comparison group when collapsing across trial and condition. The interactions between condition and group,  $F(1, 72) = 1.56$ ,  $p = .216$ ,  $\eta_p^2 = 0.02$ , and between condition and trial,  $F(1,72) = .16$ ,  $p = .695$ ,  $\eta_p^2 < 0.01$  were not statistically significant. In addition, we did not observe the hypothesized interaction between group and trial,  $F(1, 72) = .37$ ,  $p = .548$ ,  $\eta_p^2 = 0.01$  or an interaction between group, condition, and trial,  $F(1,71) = .52$ ,  $p = .475$ ,  $\eta_p^2 = 0.01$ . Planned comparisons revealed that bereaved adults with CG did not exhibit deficits in shifting ability relative to the bereaved comparison group as measured by switch cost in either the emotional condition,  $t(72) = -.86$ ,  $p = .395$ ,  $d = -0.20$ , or the non-emotional condition,  $t(72) = -.25$ ,  $p = .802$ ,  $d = 0.03$ . These findings remained non-significant when we analyzed log-transformed switch cost scores in both the emotional condition,  $t(46.76) = .78$ ,  $p = .439$ ,  $d = 0.23$ , and the non-emotional condition,  $t(72) = .25$ ,  $p = .804$ ,  $d = 0.06$ .

Due to concern about low accuracy in some subjects, we also repeated the 2x2x2 ANOVA by using data from only the blocks in which the mental count was within 1 of the

correct count for both categories. Each of main effects and interaction effects held when limiting the analysis to this subset of the dataset. Most notably, the hypothesized interaction between group and trial-type remained non-significant,  $F(1, 72) = 0.37, p = .543, \eta_p^2 = 0.01$ .

We next examined the association between IST switch cost scores and repetitive negative thought. Contrary to our hypotheses, IST switch cost scores were not associated with repetitive negative thought in the full sample,  $rs(72) \leq |.04|, p \geq .707$ . Similarly, IST switch cost scores were not associated with repetitive negative thought in the subset of those with CG,  $rs(35) \leq .02, p \geq .895$ , or in the bereaved comparison group,  $rs(35) \leq |-.08|, p \geq .642$ .

### **Exploratory Analyses**

After failing to observe the hypothesized effects among those with CG, we conducted exploratory analyses to examine whether deficits in the ability to shift mental sets would emerge in bereaved subjects with a lifetime history of depression ( $n = 50$ ) relative to those with no lifetime history of depression ( $n = 24$ ). The mean response times to update the mental count for switch and no-switch trials in those with and without a lifetime history of depression appear in Supplementary Materials 3.1. We performed a 2 (group: lifetime history of a depressive episode vs. no lifetime history of depressive episode) x 2 (condition) x 2 (trial type) mixed-model full-factorial analysis of variance (ANOVA) with response time as the dependent variable. Similar to our previous analysis, the ANOVA revealed a main effect of trial,  $F(1, 72) = 194.37, p < .001, \eta_p^2 = 0.73$ , and a main effect of condition,  $F(1, 72) = 11.24, p = .001, \eta_p^2 = 0.14$ , with slower responses observed in switch trials and in the emotion condition, respectively. Here, there was a marginally significant main effect of group,  $F(1, 72) = 3.64, p = .060, \eta_p^2 = 0.05$ , with those in the depressed group exhibiting slower responses relative to those without a lifetime history of depression. The interactions between condition and group,  $F(1, 72) = 1.75, p = .190, \eta_p^2 = 0.02$ ,

and between condition and trial,  $F(1,72) = 0.11, p = .917, \eta_p^2 < 0.00$  were non-significant, nor was there a three-way interaction between group, condition, and trial,  $F(1,72) = 1.84, p = .179, \eta_p^2 = 0.03$ . However, we did observe an interaction between group and trial,  $F(1, 72) = 4.12, p = .046, \eta_p^2 = 0.05$ . Planned comparisons revealed subjects with a lifetime history of depression exhibited greater switch cost relative to those without a lifetime history of depression in the emotional condition,  $t(72) = -2.47, p = .016, d = -0.58$  but not in the non-emotional condition,  $t(72) = -1.24, p = .218, d = -0.29$ . Among the subset of participants with a lifetime history of depression, there was no difference in switch cost between those with ( $n = 14$ ) and without ( $n = 36$ ) a current depressive episode in either the emotional condition,  $t(48) = .21, p = .834, d = 0.24$  or in the non-emotional condition,  $t(48) = .78, p = .438, d = 0.13$ .

### **Discussion**

In this study, we examined the ability to shift between mental representations in bereaved adults with and without CG. To our knowledge, this is the first study to examine shifting in bereaved adults. Contrary to our hypotheses, we did not observe a significant difference in switch costs between those with and without CG in either the emotional or non-emotional condition. Although there was an effect of group on emotional switch cost in the hypothesized direction, the effect was small ( $d = 0.20$ ) and failed to reach statistical significance.

Our findings suggest that bereaved adults with CG do not exhibit deficits in the ability to shift between mental sets for emotional or non-emotional information. Accordingly, it is unlikely that general shifting deficits play a prominent role in the development or maintenance of CG. In future studies, it will be important for researchers to examine other factors that may render bereaved adults vulnerable to experiencing preoccupying thoughts about the death and the deceased. There are at least two potential factors worth examining. First, researchers should

examine whether bereaved adults with CG exhibit shifting deficits for other types of information. Perhaps most plausibly, bereaved adults with CG may exhibit difficulty shifting away from attachment-related stimuli (e.g., a picture of an attachment figure) or grief-related information (e.g., a picture of the deceased). Consistent with this possibility, Maccallum and Bryant (2010) found that bereaved adults with CG exhibit deficits in the ability to exert cognitive control over grief-related stimuli. However, it is unclear if this deficit is best attributed to a cognitive control deficit or if it can be attributed to the high salience of grief-related information in those with CG. One way of avoiding this confound is to experimentally manipulate the ability to shift away from grief-related mental representations in a sample of bereaved adults with CG, a manipulation which should affect shifting ability but not the salience of grief-related stimuli, and, thereby, could help clarify the potential role of set shifting for grief-related information in the maintenance of CG.

In addition, it will be important for researchers to examine other factors that may lead to the preoccupying nature of grief-related cognitions beyond deficits in cognitive control. For example, preoccupation with thoughts related to the deceased may arise not because of a failure to shift away from those thoughts, but because of a desire to engage with them. Individuals with CG report frequently thinking and daydreaming about being with the deceased and mentally contrasting that desired counterfactual reality with the undesirable reality of life without their deceased loved one (Robinaugh et al., 2015). Engagement with thoughts related to the deceased in this way may be followed by confrontation with reality about their loved one's absence and, thereby, individual differences in desire to engage with stimuli related to the deceased may contribute to preoccupying thoughts related to both the deceased and the death. Relatedly, bereaved adults may perseverate on thoughts about the death and the deceased, not because they

are unable to shift away from such thoughts, but because such ruminative thinking allows them to avoid the painful emotions associated with accepting the loss (Stroebe et al., 2007). According to this rumination-as-avoidance hypothesis (cf. Nolen-Hoeksema et al., 2008), bereaved adults may become preoccupied with some thoughts related to the death or the deceased (e.g., an action that, if avoided, could have prevented the loss) in an effort to avoid the more painful thoughts about the reality of death and the finality of the deceased's absence. This potential role of rumination is supported by findings that experiential avoidance and thought suppression statistically mediate the prospective association between rumination and CG severity (Eisma et al., 2013). Together, these possibilities suggest that the function of grief-related cognitions (i.e., satiation of desired engagement with the deceased or avoidance of aversive emotions associated with the loss) is an important area for future research.

### **Exploratory Analyses**

Relative to bereaved adults with no lifetime history of a depressive episode, those with a lifetime history of depression exhibited greater switch costs in the emotion condition of the IST. Among those with a lifetime history of depression, there was no difference between those with and without a current depressive episode. Together, these findings suggest individuals with a history of depression may exhibit deficits in set-shifting when attending to emotional information and that those deficits may persist in the absence of a current depressive episode. Importantly, this finding was based on exploratory analyses, suggesting that interpretative caution is warranted. Nonetheless, this finding raises the possibility that deficits in shifting when attending to emotional information may be more relevant to our understanding of depression than it is to our understanding of CG.

## **Limitations**

Our study has limitations. First, our sample was insufficient to detect anything but moderate to large effects. Accordingly, it may be that differences in shifting between those with and without CG exist, but require larger samples to detect. Consistent with this possibility, we observed a small effect of group on switch costs for emotional information that did not rise to the level of statistical significance in the current sample.

Second, we relied on convenience sampling to recruit participants, a method which may have resulted in a sample that inadequately represents the populations of interest. Indeed, nearly 50% of our bereaved comparison group reported a lifetime history of a depressive episode, a prevalence rate well above the lifetime prevalence of depression in the general population (Kessler et al., 2005). This limitation is particularly noteworthy in the context of our finding that bereaved adults with a lifetime history of depression exhibit shifting impairments for emotional information.

Third, our task may not have adequately assessed the ability to shift between internal mental representations. The difference between switch and no-switch trials in mental counting tasks, such as the IST, may result from a variety of bottom-up (e.g., priming on no switch trials) and top-down (e.g., sub-vocal rehearsal) beyond the ability to shift mental representations. Importantly, this limitation is not unique to the IST. Because cognitive control necessarily acts on some other cognitive process, any task assessing a cognitive control process, such as shifting, will be an impure measure of the process of interest. To avoid this limitation, researchers may consider administering multiple tasks designed to assess shifting and using latent construct

analyses to remove variance attributable to idiosyncratic characteristics of the individual tasks (Miyake et al., 2000).

Fourth, although we have referred to the IST as an assessment of set shifting, there is a lack of clarity regarding the nature of the mental representation under cognitive control in the IST. Although it is clear that the IST requires subjects to switch between mental representations, the nature of those representations has not been clearly established in the IST literature. One possibility is that subjects shift their attention between their mental count for one category and their mental count for another. A second possibility is that subjects must switch between two mental sets that dictate the operations to perform on the mental counts. In other words, the mental representations that subjects shift between may be the set of rules for updating the mental counts (e.g., if a male face is shown, update the male count by 1 and repeat the female face count from the previous trial) rather than the mental counts themselves. This distinction has important implications for our understanding of the IST as some researchers have argued that the neurobiological mechanisms of cognitive control may differ depending on the characteristics of the object under control (Nee et al., 2013), including its level of complexity or abstraction (Badre, 2008; Badre & D'Esposito, 2009).

Fifth, in this study we assessed a trans-diagnostic tendency to engage in repetitive *negative* thought. However, preoccupying grief-related cognitions are not universally negative. Indeed, they may include positive memories of the deceased (Boelen & Huntjens, 2008) or thoughts about a desirable counter-factual reality that includes the deceased (Robinaugh et al., 2015). Accordingly, our assessment of preoccupying thoughts in this study may have failed to adequately assess preoccupying grief-related cognitions. In future studies, researchers should

include assessments of grief-specific rumination (e.g., the Utrecht Grief Rumination Scale; Eisma et al., 2014) in order to clarify its associations with set shifting.

## **Conclusion**

In this study, we examined the ability to shift between mental representations in bereaved adults with CG and a bereaved comparison group without CG. We found no evidence that bereaved adults with CG exhibit deficits in shifting when attending to non-emotional information. Although bereaved adults with CG did exhibit greater difficulty with shifting relative to the bereaved comparison group in the emotional condition, this difference was small and was not statistically significant. Exploratory analyses revealed a deficit in shifting among bereaved adults with a lifetime history of depression relative to those without a history of depression, suggesting that shifting may be more relevant to the etiology of depression than it is to the etiology of CG. In future studies, researchers should examine set shifting for other types of information (e.g., attachment-related stimuli) to determine if set shifting for more specific types of information may be impaired in those with CG. In addition, researchers should investigate the function of grief-related cognitions (e.g., satiation of a desire to engage with grief-related stimuli) in an effort to better understand the factors that contribute to the presence of preoccupying grief-related cognitions and, in turn, the broader CG syndrome.



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## **Chapter 4**

Paper 3: Episodic Simulation of Novel Future Events in  
Bereaved Adults With and Without Complicated Grief



## **Abstract**

Complicated grief (CG) is a bereavement-specific syndrome associated with substantial impairment in functioning and increased risk for adverse psychosocial outcomes. One prominent clinical feature of this syndrome is subjective difficulty imagining or planning for the future. To better understand this difficulty with prospection, we examined the ability to engage in episodic simulation of novel future events in bereaved adults with and without complicated grief. Relative to those without CG, bereaved adults with CG produced event simulations with fewer episodic details, less perceptual richness, less emotion/thought content, and less episodic richness. These findings identify constructive episodic simulation as a cognitive mechanism that may contribute to the development or maintenance of the broader CG syndrome.

## **Episodic Simulation of Novel Future Events in Bereaved Adults With and Without Complicated Grief**

Bereavement is a painful and highly disruptive life event. For many, the distress and disruption associated with loss subsides over the initial weeks and months following the death (Bonanno, 2004; Bonanno, Wortman, & Nesse, 2004). However, a significant subset of bereaved adults continues to experience marked distress and impairment years after the loss (Bonanno & Kaltman, 2001; Bonanno et al., 2002; Newsom, Boelen, Hek, Hofman, & Henning, 2011). This distress and impairment may include symptoms of several mental disorders, including depression (Zisook & Kendler, 2007), post-traumatic stress disorder (Breslau et al., 1998), and complicated grief (Horowitz et al., 1997; M. K. Shear et al., 2011).

CG is a syndrome of cognitions, emotions, and behaviors that arise together following the death of a loved one and persist over time at a level that produces significant distress and impairment (Robinaugh, LeBlanc, Vuletich, & McNally, 2014). This syndrome is chiefly characterized by persistent and intense yearning for the deceased, emotional pain, and preoccupation with thoughts related to the death and the deceased (American Psychiatric Association, 2013; Horowitz et al., 1997; Parkes, 1996; Prigerson et al., 2009; M. K. Shear et al., 2011). It occurs in approximately 6.7% of bereaved adults (Kersting, Braehler, Glaesmer, & Wagner, 2011) and is associated with substantial functional impairment and adverse psychosocial outcomes, including increased risk for suicidal thoughts and behaviors (Latham & Prigerson, 2004; Mitchell, Kim, Prigerson, & Mortimer, 2005; Prigerson et al., 1999; Szanto, Prigerson, Houck, Ehrenpreis, & Reynolds, 1997).

One prominent cognitive element of the CG syndrome is a subjective difficulty with future-oriented thinking. Individuals with CG report a sense of hopeless or foreshortened future

(Horowitz et al., 1997; Shuchter & Zisook, 1993) and difficulty planning for the future was recently included in the diagnostic criteria for this syndrome (American Psychiatric Association, 2013). This difficulty imagining the future is strongly associated with other elements of the CG syndrome, including feelings of emptiness and difficulty accepting the death, and may play an important role in the maintenance of the broader CG syndrome by both affecting and being affected by these neighboring elements (Robinaugh et al., 2014). Moreover, given the importance of future-oriented thinking to everyday activities (Gerlach, Spreng, Gilmore, & Schacter, 2011; Schacter, Addis, & Buckner, 2007), difficulty imagining the future may contribute to the substantial functional impairments observed in those with CG. Accordingly, there is a clear impetus for examining the cognitive vulnerabilities that may give rise to this element of the CG syndrome.

### **Imagining the Future**

Humans have evolved the ability to think about the future in several ways (for a taxonomy of prospection abilities, see Szpunar, Spreng, & Schacter, 2014). We can set goals for the future, organize the steps needed to achieve those goals, or make predictions about an upcoming event (Szpunar et al., 2014). In addition, we have the ability to mentally simulate future events. This ability to “mentally time travel” to events in our future is referred to as episodic simulation (Schacter et al., 2007; Tulving, 1993, p. 67). It is not merely possessing semantic knowledge about the future (e.g., being aware that one will be eligible for retirement next year), but rather involves constructing a detailed representation of a specific event in one’s personal future (e.g., envisioning delivering a speech during one’s retirement party). The ability to simulate future events is a critical cognitive ability that allows us to “pre-experience” events and use these simulations to guide our behavior (Gilbert & Wilson, 2007). Indeed, cognitive

scientists have argued that the ability to flexibly recombine episodic details into simulations of future events may be the principal evolutionary reason for the reconstructive nature of our episodic memory system (Schacter & Addis, 2007a, 2007b; Suddendorf & Corballis, 1997).

There are several ways we can engage in episodic simulation of future events. We can reconstruct a previously imagined future event representation (Ingvar, 1985; Szpunar, Addis, McLelland, & Schacter, 2013). For example, after simulating the delivery of a retirement party speech, we can later bring that simulation back to mind when rehearsing the speech in the days before the party. Indeed, we maintain a store of such future event representations in much the same way that we retain a store of autobiographical memories and these encoded future event representations contribute to a stable sense of identity that stretches over time (D'Argembeau, Lardi, & Van der Linden, 2012). We can also “recast” a past event into the future (Addis, Musicaro, Pan, & Schacter, 2010). Recasting entails recalling a past episode and imagining that episode occurring again in the future. For example, imagining eating dinner with one’s family tomorrow precisely as one did yesterday. Finally, we can recombine episodic details to imagine a novel future event that is distinguishable from any past event (Schacter & Addis, 2007c). That is, we can flexibly recombine elements drawn from episodic and semantic memory in order to imagine an event in our future that is distinct from any event experienced in our past.

### **Imagining the Future Following Bereavement**

The death of a loved one constrains episodic simulation. Samuel Johnson described the experience of bereavement as “a whole system of hopes, and designs, and expectations swept away at once” (Boswell, 1799, p. 274). Indeed, much of what is lost in bereavement is the collection of future events that bereaved adults imagined they would share with their loved ones. As a result, bereaved adults can no longer draw on this reserve of previously imagined events

when envisioning their future. Similarly, the cultural life scripts that frequently guide future-oriented thought (e.g., marriage, first home, birth of first child; Berntsen & Jacobsen, 2008) are often disrupted in bereaved adults and can no longer provide clear landmarks for guiding future-oriented cognition. Recasting past events into the future may also become a less viable means of envisioning the future as many of one's most accessible memories are likely to include the deceased, and thus are no longer events that could realistically occur in the future. As a result of these changes, the ability to imagine one's future becomes more reliant on the ability to simulate novel future events. Hence, difficulty simulating novel future events may render one susceptible to the subjective feeling of having an empty or absent future, thereby contributing to the broader CG syndrome.

In two previous studies, researchers have found that bereaved adults with CG exhibit deficits in the ability to imagine specific future events when completing a future-oriented version of a memory-cueing paradigm known as the Autobiographical Memory Task (AMT; Maccallum & Bryant, 2011; Robinaugh & McNally, 2013). Although these studies provide evidence that prospection is impaired in those with CG, they are limited in at least two important ways. First, by focusing on specificity as the primary outcome variable, the AMT does not clearly assess a specific mode of prospection (Szpunar et al., 2014). Although it appears to assess the ability to engage in episodic simulation of a future event, responses in the AMT may satisfy specificity criteria while lacking the detailed mental representation and auto-noetic awareness characteristic of episodic simulations. Consequently, it is difficult to place the specificity findings from the AMT in the context of the growing body of research on prospection. Second, the specificity variable also provides very little information about the phenomenology of future event representations in those with CG. In contrast, alternative assessments of prospection, such as the

Autobiographical Interview (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002), provide greater detail about the types of details contained in future event simulations and, thus, hold the promise of further informing our understanding of prospection in those with CG.

### **The Current Study**

In the current study, we aimed to build on previous studies of prospection in CG by examining the ability to engage in episodic simulation of novel future events in bereaved adults with and without CG. We hypothesized that, relative to a comparison group of bereaved adults without CG, bereaved adults with CG would produce simulations with fewer internal details and less episodic richness (i.e., events that are less detailed and less evocative of a sense that the imagined future event is being “pre-experienced”).

In addition, we examined whether this hypothesized deficit is specific to episodic simulation or if a similar deficit would be observed on tasks that require narrative description but not episodic simulation. Previous research concerning episodic simulation with older adults has demonstrated that older adults produce fewer internal details not only during episodic simulation, but also during a picture description task that requires a detailed description of a perceptually present scene, but not episodic simulation (Gaesser, Sacchetti, Addis, & Schacter, 2011; Madore, Gaesser, & Schacter, 2014). These findings have been interpreted as reflecting an age-related change in narrative style that impacts both episodic simulation and picture description tasks (Gaesser et al., 2011; Madore et al., 2014). We hypothesized that there would be no difference between those with and without CG in the amount of detail provided in a picture description task that assesses the ability to provide a detailed description of a scene but does not require episodic simulation.

In addition to these primary aims, we examined the relationship between episodic simulation and hopelessness in bereaved adults. We hypothesized that more episodic details and greater episodic richness would be associated with less hopelessness in both bereaved adults with complicated grief and bereaved adults without complicated grief. Finally, to inform future research on constructive episodic simulation and its relation to psychopathology, we performed exploratory analyses examining the between-group differences in episodic simulation in those with and without CG under different task parameters.

## **Method**

### **Subjects**

Subjects were bereaved adults between 21 and 65 years old who had experienced the death of a loved one at least 1 year ago. Exclusion criteria included non-English speaking status, current mania, current psychosis, and any other factor that would render the individual unable to provide informed consent, understand the computer tasks and assessment questions, or adequately ensure their safety during the study visit. Subjects were assigned to the complicated grief group if they exhibited elevated CG symptom severity (i.e., a score of 30 or higher on the inventory of complicated grief; Prigerson et al., 1995). Subjects were assigned to the bereaved comparison group if they did not exhibit elevated CG symptom severity (i.e., a score of 29 or lower on the ICG) and did not meet criteria for current depression or current post-traumatic stress disorder (PTSD) on a semi-structured clinical interview. We restricted the bereaved comparison group to those without depression and PTSD because individuals with these disorders report the same subjective difficult imagining the future characteristic of CG (i.e., foreshortened or hopeless future in PTSD and depression, respectively; American Psychiatric Association, 2013; Nekanda-Trepka, Bishop, & Blackburn, 1983). Given this phenomenological

overlap, we would expect to see the same deficits in episodic simulation in those with PTSD and depression that we hypothesize will be present in those with CG. Consequently, including those with depression and PTSD in our bereaved comparison group would limit our ability to determine if those with CG exhibit deficits in the ability to imagine the future relative to those not experiencing current bereavement-related psychopathology.

We recruited subjects through online advertisements (e.g., Craig's List), print advertisements (e.g., Metro newspaper), flyering, referral from local treatment centers, and word of mouth. Among the 105 individuals who participated in our first study visit, 7 met an exclusion criterion and 12 did not meet inclusion criteria for either the CG or bereaved comparison group. In addition, 7 subjects failed to return for the second study visit and were lost to follow-up. The final sample included 79 subjects.

## **Measures**

**Diagnostic interview.** The Mini-International Neuropsychiatric Interview (Sheehan et al., 1998) is a structured diagnostic interview assessing psychiatric disorders and suicidal thoughts and behaviors. We used the MINI to assess seventeen disorders, including MDD and PTSD. In this study, we administered the PTSD module of the MINI for both the moment the subject witnessed or learned of their loved one's death and for any other Criterion A event reported by the subject. If subjects endorsed current suicidal thoughts during the MINI diagnostic interview, the interviewer completed a standardized risk assessment. If subjects endorsed moderate or high risk, the interviewer then worked with the subject to develop a safety plan and provided referral resources as clinically appropriate.

**Experimental recombination task.** To assess the episodic simulation of novel future events, we administered the Experimental Recombination Task (ERT; Addis et al., 2010). This



task was completed in two parts. Subjects first generated lists of thirty places, thirty people, and thirty objects from their lives. For each, subjects were instructed to provide items for which they had direct contact in the past (e.g., a person they know personally rather than a celebrity) and a reasonable expectation of coming into contact with in the future (e.g., a person they often encounter rather than a deceased person). For places, subjects were asked to provide specific locations (e.g., “Starbucks in Central Square” rather than “Starbucks”). For objects, subjects were asked to provide items that could reasonably appear in multiple locations (e.g., a baseball rather than a couch).

In the second part of the ERT, completed during a second study visit, subjects saw a cueing slide that displayed a randomly selected person, place, and object provided by the subject during the previous visit. Subjects were instructed to generate a specific future event that included each of those details and to describe the event out loud in as much detail as possible for three minutes. Prior to completing the task, the experimenter reviewed the task instructions (see Supplementary Materials 4.1) and the computer task reiterated the core task instructions. Subjects then listened to an example of a highly detailed future event and completed two one-minute practice trials, after which the experimenter provided feedback to ensure that the subject understood the task. Subjects then completed three blocks of six trials, providing a total of eighteen imagined future events. During each trial, the experimenter provided standard prompts if the subject ceased describing the event before the trial was over, described a vague or overly general event, imagined multiple events, or recalled a past event (see Supplementary Materials 4.1). After each trial, subjects provided an anticipated date of the future event and rated the *detail* (i.e., “The event I imagined had a lot of detail”), *likelihood of occurrence* (i.e., “This event is likely to occur in the future”), *familiarity* of the future event representation (i.e., “I have

previously imagined this event or events like this”), and *similarity* of the event to past experiences (i.e., “This future event is similar to things I’ve experienced in the past.”) of the event on a 5-point scale ranging from ‘Strongly Disagree’ to ‘Strongly Agree’. Finally, subjects also rated the *emotional valence* experienced when imagining the event (“How positive or negative are your emotions when imagining this event?”) on a 5-point scale ranging from ‘Very Negative’ to ‘Very Positive’.

The audio for each trial was transcribed and scored according to a modified version of the autobiographical interview scoring procedure (Addis, Wong, & Schacter, 2008; Levine et al., 2002; see Supplementary Materials 4.2). Using this procedure, trained raters first identified the central event described in each trial (i.e., the single contiguous event lasting less than 24 hours for which the subject provided the most detail). Raters then divided the transcription into individual details (i.e., text segments that convey a unique piece of information) and categorized them as either *internal* or *external* details. Internal details provide episodic information about the imagined future event. External details provide either semantic information or episodic information about events other than the central event (i.e., a past event or a different future event). In addition, raters further categorized all internal details into one of five secondary categorizations. *Place* and *time* details provide information about the location of the central event in space and time, respectively. *Perceptual* details provide information about the subject’s sensory experience in the central event (e.g., sights, sounds, tastes, and smell). *Emotion/thought* details provide information the subject’s mental state in the central event. Internal details that were not captured by one of these four categories were identified as *event* details. Most often, event details provided information about what happened during the event.

Finally, the raters scored each event on 14 characteristics. Person, place, and object *integration* ratings reflect the extent to which the given episodic detail (i.e., person, place, or object) was present in the event. Scores were made on a 5-point scale with higher scores reflecting the presence of that detail for a higher proportion of the event. Person, place, and object *centrality* ratings measure the extent to which the given episodic detail was a central part of the narrative of the event. Scores were made on a 5-point scale with higher scores reflecting greater centrality to the narrative. *Spatiotemporal coincidence* ratings assess the extent to which the person, place, and object details overlap in space and time. Scores were made on a 5-point scale with higher scores indicating greater spatiotemporal coincidence. *Place localization* and *time localization* ratings measure the extent to which the subject localized the event in space and time, respectively. Scores were made on a 4-point scale with higher scores reflecting greater localization. *Perceptual richness* ratings measure the number of perceptual details, number of perceptual modalities provided, and vividness of the perceptual detail. Scores were made on a 4-point scale, with higher scores reflecting more perceptual details, more perceptual modalities, greater vividness, and a greater sense of experiencing the percept. *Emotion/Thought* ratings reflect the extent to which subject was able to simulate their thoughts or feelings in the future event. Scores were made on a 4-point scale, with higher scores indicating greater clarity about the subject's specific cognitive and emotional state of mind in the future event. *Autobiographical Memory Interview (AMI) ratings* reflect the extent to which the subject was able to provide a specific detailed future event simulation. *Episodic richness* is a global measure of the extent to which a subject evokes an impression of experiencing the future event by providing a detailed event high in perceptual richness and emotion/thought content. Finally, the raters indexed the

amount of *grief-related content* in each future event on a 5 point scale with higher scores indicating more grief-related content.

**Picture Description Task.** In the Picture Description Task, subjects saw a cueing slide that displayed an image of a scene (e.g., a group of construction workers building a house). Their task was to describe the scene with as much detail as possible for three minutes. To ensure subjects understood the task, they first read task instructions presented on the screen, listened to an example of a highly detailed scene description, and completed a one-minute practice trial for which the experimenter provided feedback. Subjects then completed 3 trials of the task presented in sequential order.

In keeping with past research (Gaesser et al., 2011), the audio for each trial was transcribed and scored with a modified version of the AI scoring procedure comparable to that in the Experimental Recombination Task (see Supplementary Materials 4.3). Using this procedure, trained raters broke down the transcription into internal and external details. Here, internal details provided information about the scene depicted in the image. External details provided either semantic information nonspecific to the depicted scene (e.g., “it takes a lot of time to build a house”) or inferences about what occurred before, after, or during the event that goes beyond what is depicted in the scene (e.g., “he’ll probably go home and take a nap after this”).

**Self-report measures.** Subjects completed eleven self-report questionnaires over the course of the study, four of which will be reported here. Subjects completed the Inventory of Complicated Grief (ICG; Prigerson et al., 1995), Quick Inventory of Depressive Symptomatology – Self Report (QIDS-SR; Rush et al., 2003), and the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979), to assess symptoms of complicated grief, PTSD, and

depression. Subjects completed the Beck Hopelessness Scale (Beck, Weissman, Lester, & Trexler, 1974) to assess a subjective sense of pessimism about the future.

## **Procedure**

Subjects completed two study visits. In Visit 1, after providing written informed consent, subjects generated a list of people, places, and objects to be used in the Experimental Recombination Task. Subjects then completed the MINI diagnostic interview, followed by a brief demographics questionnaire and eight self-report questionnaires, including the ICG, IES, QIDS, and BHS. In Visit 2, subjects completed the ERT and PDT tasks. The order of the tasks was randomly assigned. There was no effect of task order on any of the ERT,  $ts(77) \leq 1.82$ ,  $ps \geq .072$  or PDT  $ts(71) \leq -1.15$ ,  $ps \geq .256$ , outcome measures derived from the AI scoring procedure. After finishing the computer tasks, subjects completed three self-report questionnaires assessing emotion regulation, attention control, and repetitive negative thought. The IRB at Harvard University approved the protocol and consent form for this study.

## **Results**

### **Subjects**

Of the 79 subjects who met inclusion criteria and completed all relevant study measures, 41 met criteria for the complicated grief group and 38 met criteria for the bereaved comparison group. The demographic characteristics of the CG and control groups appear in Table 4.1. There was no difference between the groups in age, gender, ethnicity, type or duration of relationship to the deceased, cause of death, or time since death. The results of the diagnostic interview and self-report assessments appear in Table 4.2. Of the 22 individuals who reported current PTSD, 21 endorsed bereavement-related PTSD and 7 individuals endorsed PTSD in response to both bereavement and another event.

**Table 4.1.** Demographic characteristics of bereaved adults with and without complicated grief

		Comparison Group		CG	Test Statistic	<i>p</i>
Demographic Characteristics	Gender				$\chi^2(1)=2.66$	.103
	Female	73.7%		56.1%		
	Male	26.3%		43.9%		
	Ethnicity				$\chi^2(4) 3.76$	.439
	African American	34.2%		46.3%		
	Caucasian	57.9%		39.0%		
	Hispanic	2.6%		9.8%		
	Age	45.45 (14.38)		44.70 (11.02)	$t(69.31)=0.26$	.798
Relationship Characteristics	Relationship Type				$\chi^2(4)=2.09$	.720
	Parent	60.5%		46.3%		
	Sibling	15.8%		24.4%		
	Spouse	10.5%		17.1%		
	Other	7.9%		7.3%		
	Time Known	34.34 (16.80)		30.37 (15.62)	$t(77)=1.09$	.279
Event Characteristics	Cause of Death				$\chi^2(2)= 3.55$	.170
	Sudden/Violent	16.7%		20.0%		
	Long-term Illness	58.3%		37.5%		
	Short-term Illness	25.0%		42.5%		
	Time Since Death	4.89 (4.97)		5.00 (6.26)	$t(77)=-0.08$	.935

Note. CG = Complicated grief.

### Experimental Recombination Task

**Between group comparison.** There were no differences between the CG and comparison groups in perceived amount of detail in the future event (CG:  $M=3.69$ ,  $SD = 0.64$ ; Control:  $M = 3.73$ ,  $SD = 0.69$ ),  $t(76)=.24$ ,  $p = .809$ ,  $d = 0.06$ , likelihood of the event occurring (CG:  $M = 3.54$ ,  $SD = 0.60$ ; Control:  $M =3.36$ ,  $SD = 0.63$ ),  $t(76)=-1.34$ ,  $p = .185$ ,  $d = -0.31$ , similarity of the future event to past events, (CG:  $M =3.48$ ,  $SD = 0.61$ ; Control:  $M = 3.50$ ,  $SD = 0.65$ ),  $t(76)=.16$ ,  $p = .875$ ,  $d = 0.04$ , familiarity of the future event representation, (CG:  $M = 3.27$ ,  $SD = 0.62$ ; Control:  $M=3.10$ ,  $SD = 0.77$ ),  $t(76)=-1.07$ ,  $p = .290$ ,  $d = -0.25$ , or valence of the emotions involved in the event (CG:  $M = 3.85$ ,  $SD = 0.57$ ; Control:  $M = 4.00$ ,  $SD = 0.59$ ),  $t(76)= 1.17$ ,  $p = .245$ ,  $d = 0.27$ .

**Table 4.2.** Diagnostic interview and self-reports of psychopathology in bereaved adults with and without complicated grief

	Comparison			Test Statistic	<i>p</i>
	Group	CG			
Self-report assessments	Complicated Grief (ICG)	11.79 (6.99)	42.71 (9.02)	$\chi^2(77) = -16.93$	.000
	Post-traumatic Stress Disorder (IES)	10.89 (11.61)	41.22 (15.72)	$\chi^2(77) = -9.69$	.000
	Depression (QIDS)	3.95 (2.63)	11.05 (4.78)	$\chi^2(76) = -8.07$	.000
	Hopelessness (BHS)	3.29 (4.19)	6.31 (5.02)	$\chi^2(74) = -2.85$	.006
MINI Diagnostic Information	Major Depressive Episode: Current	0.0%	56.1%	$\chi^2(1)=30.07$	.000
	Major Depressive Disorder: Lifetime	32.6%	75.6%	$\chi^2(1)=10.59$	.001
	Bipolar Disorder (I or II): Lifetime	0.0%	9.8%	$\chi^2(1)=3.91$	.048
	Posttraumatic Stress Disorder: Current	0.0%	61.0%	$\chi^2(1)=33.90$	.000
	Panic Disorder: Current	0.0%	14.6%	$\chi^2(1)=5.87$	.015
	Panic Disorder: Lifetime	5.4%	31.7%	$\chi^2(1)=8.66$	.003
	Social Anxiety Disorder: Current	2.6%	29.3%	$\chi^2(1)=10.18$	.001
	Obsessive Compulsive Disorder: Current	5.3%	27.5%	$\chi^2(1)=6.94$	.008
	Generalized Anxiety Disorder: Current	0.0%	25.6%	$\chi^2(1)=11.20$	.001
	Alcohol Abuse/Dependence: Current	5.3%	7.7%	$\chi^2(1)=0.19$	.665
	Substance Use/Dependence: Current	2.6%	2.6%	$\chi^2(1)=0.00$	.985
	Anorexia Nervosa: Current	0.0%	0.0%		
	Bulimia Nervosa: Current	0.0%	5.3%	$\chi^2(1)=2.05$	.152

*Note.* CG = Complicated grief, ICG = Inventory of Complicated Grief, QIDS = Quick Inventory of Depression Symptoms, BHS = Beck Hopelessness Scale, MINI = Mini-International Neuropsychiatric Interview

The group means for scores derived from the autobiographical interview scoring procedure appear in Table 4.3. There were no differences between the groups in the extent to which the person, place, and object details were integrated into the event or made central parts of the event narrative. There was also no difference between groups in the spatiotemporal coincidence of the person, place, and object details.

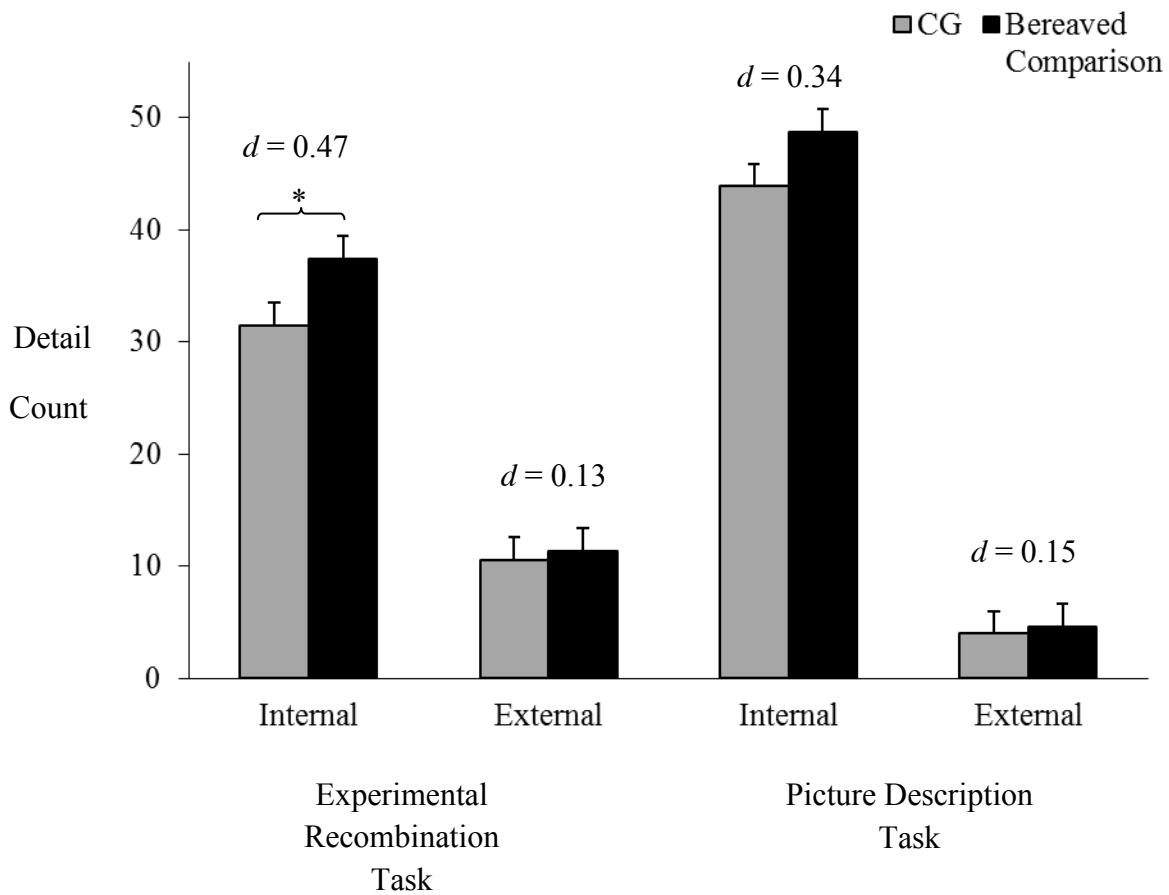
**Table 4.3.** Experimental Recombination Task results in bereaved adults with and without complicated grief

		Bereaved comparison	CG	<i>t</i> (77)	<i>p</i>	<i>d</i>
Detail Counts	External	11.35 (6.54)	10.57 (5.42)	0.58	.561	0.13
	<b>Internal</b>	<b>37.43 (12.59)</b>	<b>31.52 (12.82)</b>	<b>2.07</b>	<b>.042</b>	<b>0.47</b>
	Event	22.39 (9.98)	19.33 (8.76)	1.45	.150	0.33
	<b>Perceptual</b>	<b>6.56 (4.58)</b>	<b>4.53 (3.79)</b>	<b>2.16</b>	<b>.034</b>	<b>0.49</b>
	<b>Emotion/Thought</b>	<b>3.96 (2.41)</b>	<b>2.76 (1.99)</b>	<b>2.43</b>	<b>.018</b>	<b>0.55</b>
	Place	3.17 (1.12)	3.44 (1.77)	-0.81	.422	-0.18
	Time	1.40 (0.76)	1.26 (0.89)	0.77	.445	0.18
Rater Assessment	Localization Person	4.18 (0.71)	4.24 (0.79)	-0.33	.893	-0.08
	Place	3.58 (0.76)	3.79 (0.74)	-1.20	.506	-0.27
	Object	3.51 (0.67)	3.62 (0.66)	-0.70	.533	-0.16
	Centrality Person	4.11 (0.64)	4.12 (0.76)	-0.56	.368	-0.13
	Place	4.08 (0.61)	4.22 (0.57)	-1.06	.867	-0.24
	Object	2.97 (0.60)	2.93 (0.61)	0.27	.784	0.06
	Coincidence	3.91 (0.74)	4.05 (0.71)	-0.88	.862	-0.20
	Place Localization	1.96 (0.38)	2.03 (0.42)	-0.77	.442	-0.18
	Time Localization	0.88 (0.49)	0.70 (0.51)	1.54	.128	0.35
	<b>Perceptual Richness</b>	<b>1.70 (0.60)</b>	<b>1.40 (0.62)</b>	<b>2.18</b>	<b>.033</b>	<b>0.50</b>
	<b>Emotion/Thought</b>	<b>1.65 (0.65)</b>	<b>1.29 (0.60)</b>	<b>2.54</b>	<b>.013</b>	<b>0.58</b>
	<b>AMI</b>	<b>2.62 (0.47)</b>	<b>2.36 (0.52)</b>	<b>2.36</b>	<b>.021</b>	<b>0.54</b>
	<b>Episodic Richness</b>	<b>4.12 (0.79)</b>	<b>3.49 (1.00)</b>	<b>3.04</b>	<b>.003</b>	<b>0.69</b>
Grief content	1.08 (0.21)	1.18 (0.32)	-1.67	.099	-0.38	

*Note.* CG = Complicated grief. Emboldening signifies statistical significance.

Relative to those in the bereaved comparison group, those in the CG group provided fewer internal details (see Figure 4.1). There was no difference between groups in the number of external details. Notably, the between-group difference in internal details was not uniform across all internal detail types. The CG group provided more perceptual and emotion/thought internal





**Figure 4.1.** Mean internal and external details in the Experimental Recombination and Picture Description tasks. \*  $p < .05$

details, but did not differ from the bereaved comparison group on event, place, or time details. Individuals in the CG group were also rated as having generated events that were lower in emotion/thought content, perceptual richness, and episodic richness.

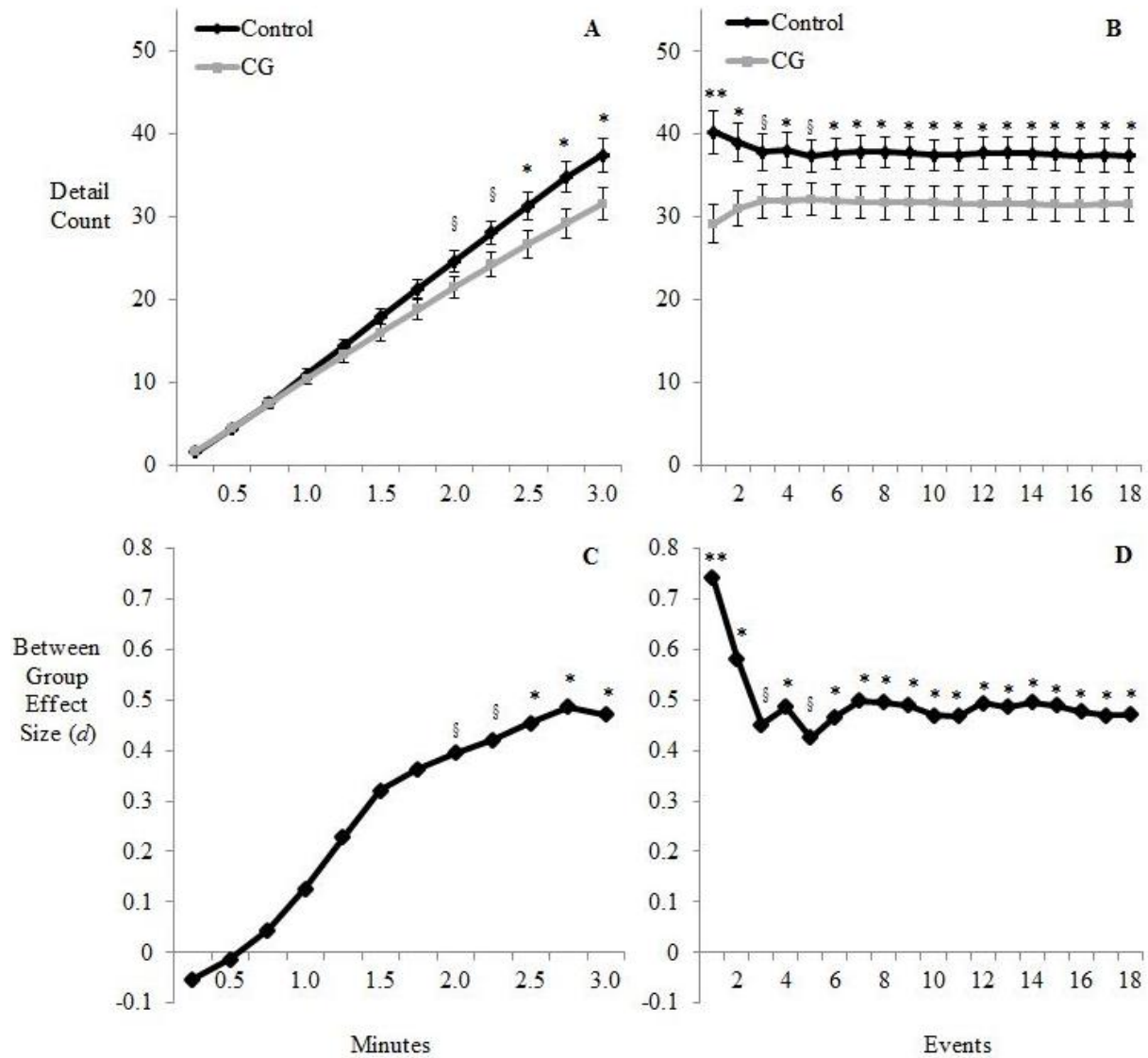
**Association with hopelessness.** Contrary to our hypothesis, hopelessness was not associated with either the number of internal details,  $r(74) < |-.01|$ ,  $p = .971$ , or episodic richness,  $r(74) = .05$ ,  $p = .691$ , in the full sample. Similarly, hopelessness was not associated with the number of internal details or episodic richness in the subset of subjects with CG  $rs(36) \leq .17$ ,  $p \geq .303$  or without CG,  $rs(36) \leq .07$ ,  $p \geq .685$ .

### **Picture Description Task**

The results for the picture description task appear in Figure 4.1. Although participants in the CG group provided somewhat fewer internal details than did participants in the bereaved control group, there was not a significant difference between groups for internal details (CG:  $M = 43.89$ ,  $SD = 15.17$ ; Control:  $M = 48.77$ ,  $SD = 13.94$ ),  $t(71) = 1.43$ ,  $p = .14$ ,  $d = 0.34$ , or external details (CG:  $M = 4.00$ ,  $SD = 3.86$ ; Control:  $M = 4.62$ ,  $SD = 4.34$ ),  $t(71) = .646$ ,  $p = .52$ ,  $d = 0.15$ .

### **Exploratory Analyses of Experimental Recombination Task**

We examined the effect of modifying two task parameters on the observed between-group difference in the number of internal details. We first examined the duration of time in which subject's imagined the future event. As seen in Figure 4.2, panels A and C, the between-group effect for internal details grew throughout the course of the trial before tapering in the final fifteen seconds of the three-minute trial. These results suggest that, in future studies, researchers should allow for a minimum of three minutes per trial as shorter durations may limit the ability to detect between-group differences. In addition, we examined the number of events used to calculate mean ERT details. The results of these analyses appear in panels B and D of Figure 4.2. Interestingly, the largest difference between groups difference emerged on the first trial. The between-groups effect was relatively stable after three trials (i.e., the effect size did not meaningfully change when incorporating subsequent trials into the mean score; range = .43-.50) and especially stable after six trials (range = .47-.50). These findings suggest that a stable estimate of the between-groups effect size can be obtained with as few as 3 trials.



**Figure 4.2.** Between-group difference in episodic simulation internal details as a function of Experimental Recombination Task parameters. Panels A and C depict the between-group effect for internal details as a function of trial time, with panel A depicting the cumulative number of details provided at fifteen second intervals and panel B depicting the between-group effect size (Cohen's  $d$ ) over this same time course. Panels B and D depict the between-group effect for internal details as a function of the number of imagined future events. Panel B depicts the mean ERT internal details. Panel D depicts the between-group effect size (Cohen's  $d$ ).  $^{\S}p < .10$ ,  $*p < .05$ .

## **Discussion**

Our results suggest that bereaved adults with CG exhibit impairments in episodic simulation of novel future events. Relative to those without CG, bereaved adults with CG produced event simulations with fewer internal (i.e., episodic) details, less perceptual richness, less emotion/thought content, and less episodic richness. The groups did not differ in the number of external details provided when imagining the future.

### **Episodic Simulation in Complicated Grief**

Our findings are consistent with and build upon two previous studies in which bereaved adults with CG exhibited deficits in the ability to imagine specific future events when completing a future-oriented version of a memory-cueing paradigm known as the Autobiographical Memory Task (AMT; Maccallum & Bryant, 2011; Robinaugh & McNally, 2013). Our results extend these previous findings in at least two important ways.

First, the ERT task used in this study targets a more specific mode of future thinking (i.e., episodic simulation) than does the AMT used in previous studies of prospection in CG. In the AMT, the primary outcome variable of interest is the specificity of the future events provided in response to the cue. Specificity is rated with either a dichotomous specificity variable signifying whether the response is a single event lasting less than 24 hours (Robinaugh & McNally, 2013) or a 4-point scale reflecting the extent to which the subject identified the location of the event, the people involved, and a specific time in which the event would take place (Maccallum & Bryant, 2011; cf. Williams et al., 1996). Although the AMT appears to assess the ability to engage in episodic simulation, this is not necessarily the case. In the AMT, subjects may provide responses that satisfy the specificity criteria but lack the detailed mental representation or auto-noetic awareness characteristic of episodic simulations. This is especially true of the dichotomous specificity variable used in our previous study of prospection and CG (Robinaugh

& McNally, 2013). For example, a subject may respond to a cue-word with the event, “my birthday party next Friday”; a response that meets the specificity criterion of a single event lasting less than 24 hours, but may not involve the construction of a detailed representation of that event. In contrast, the ERT more precisely assesses the extent to which subjects can construct detailed mental representations of future autobiographical events.

In addition, the ERT targets a more specific means of engaging in episodic simulation than does the AMT. In the AMT, subjects can generate specific future events in several ways, including recasting a past event into the future, recalling a previously imagined future event, or imagining a novel future event. In contrast, in the ERT subjects are restricted to flexibly recombining episodic details into novel future events. By assessing a specific means of engaging in a specific mode of prospection, the results from the ERT task identify a more specific deficit than has been reported in previous studies of prospection and CG.

Second, the AI scoring procedure utilized in this study provides information about the phenomenology of imagined future events in those with CG. In contrast to the limited information provided by the AMT specificity variables used in previous studies, the modified AI scoring procedure provides information about the volume and variety of details included in the event simulations as well as global information about their perceptual, emotional, and episodic richness. Notably, we found that the between-group difference in internal details was not uniform across all types of internal details. There was no difference between the groups in place, time, or event details. However, there was a significant difference between groups for perceptual and emotion/thought details. Similarly, bereaved adults with CG were no different from those without CG in their localization of the event in time and space, but were rated as having less clarity of emotion/thought content, less perceptual richness, and less episodic richness.

This phenomenological information is important for at least two reasons. First, the omission of perceptual and emotion/thought details from future event simulations may have substantial impact on one's current mood and the extent to which individuals look forward to future events with hopeful anticipation. The vividness of prospective mental imagery is closely associated with the intensity of emotions during future event simulations (Holmes & Mathews, 2010) and dysphoric and depressed individuals produce prospective mental images that are less vivid than those without emotional disorders (Holmes & Mathews, 2010; Morina, Deepro, Pusowski, Schmid, & Holmes, 2011). Similarly, the anticipated emotion of a future event strongly predicts the emotion experienced during the future event simulation (Van Boven & Ashworth, 2007). Accordingly, the failure to incorporate perceptual and emotional information in future event simulations may be closely related to the emotional numbness and failure to envision a desirable future in those with CG. To clarify the potential role of mental imagery in the development or maintenance of CG, it will be important for researchers to examine mental imagery in future event simulations for both positive and negative events in those with and without CG.

The omission of perceptual details also provides information about the components of episodic simulation that may be most difficult for those with CG. Episodic simulation requires individuals to construct the scene in which the event takes place, fill that scene with perceptual information (e.g., visual imagery), place one's self in the scene, and construct a narrative of the actions that take place in the event (Hassabis & Maguire, 2009). In this study, there was a small to moderate between-group difference in event details that was not statistically significant, suggesting that bereaved adults with CG may have less difficulty with the narrative component of episodic simulation. In contrast, the lack of perceptual details suggests difficulty with either

scene construction or the inclusion of mental imagery. Notably, in this study, subjects were provided with familiar places in which to set the scene of the future event, a task parameter that should facilitate detailed scene construction (Robin & Moscovitch, 2014). In future studies, researchers should evaluate the ability to engage in episodic simulation of unfamiliar locations and more directly assess scene construction and mental imagery in order to further clarify the components of episodic simulation most impaired in those with CG.

**Episodic simulation and hopelessness in bereaved adults.** Contrary to our hypotheses, there was no association between episodic simulation and a subjective sense of hopelessness as measured by the BHS. The BHS assesses pessimism about the future rather than a broader deficit in the ability to imagine the future. Accordingly, these null findings suggest the possibility that the BHS is not assessing the difficulty with future-oriented thinking most closely associated with episodic simulation. This possibility illustrates a noteworthy limitation in the literature on prospection and CG: the subjective difficulty with future-oriented thinking in this population is poorly characterized. Members of the DSM-5 committee identified difficulty planning for the future as a symptom of the disorder. However, to our knowledge, there is no empirical basis for identifying this mode of prospection as being especially indicative of CG. In future studies, it will be critical for researchers to clarify the subjective difficulty with future-oriented thinking in those with CG in order to clarify how deficits in episodic simulation and future event specificity may relate to this subjective difficulty and, in turn, the broader CG syndrome.

### **Picture Description In Complicated Grief**

We found that bereaved adults with CG did not significantly differ from those without CG in the number of internal or external details provided during the PDT; a task which required the detailed description of a scene but did not require episodic simulation. However, we would

note that there was a small to moderate between-group difference for internal details in the PDT that paralleled our findings in the ERT. Although this effect was non-significant, it leaves open the possibility that some of the difference between those with and without CG in the ERT may be attributable to a broader ability assessed by both the ERT and PDT. Perhaps most plausibly, individual differences in verbal fluency, narrative style, or ability to inhibit task-irrelevant information may contribute to performance on both tasks (for further discussion, see Gaesser et al., 2011; Madore et al., 2014). One additional possibility is that bereaved adults with CG may have difficulty not only with scene construction, but also with scene perception. There is substantial overlap in the neurobiological network underlying scene construction and scene perception (Zeidman, Mullally, & Maguire, 2014). Accordingly, if scene construction is impaired in those with CG, we may expect to see a related deficit in the ability to create a spatially coherent mental representation of a scene during scene perception. In future studies, researchers may consider a more thorough evaluation of performance on the PDT in those with CG by examining the types of internal details provided (e.g., distinguishing between information about specific elements of the scene and information about the relations among elements in the scene) and global ratings of the scene description (e.g., its overall spatial-coherence).

### **Limitations**

Our study has limitations. First, our data were cross-sectional, precluding any determination of causality. Difficulty engaging in episodic simulation may be a cause, consequence, or mere correlate of CG. In future studies, researchers should use longitudinal designs and manipulation of the ability to engage in episodic simulation to clarify the relationship between CG and episodic simulation. Second, although we assessed pessimism about the future, we did not include an assessment of the subjective difficulty envisioning or planning for the future. Consequently, we were unable to assess the relationship between



episodic simulation and the element of the complicated grief syndrome of most interest. This limitation is especially noteworthy given that there was no assessment of this element in our broader measure of the complicated grief syndrome (i.e., the ICG). In order to clarify the etiological path by which episodic simulation deficits may affect the broader CG syndrome, it will be necessary to better assess the subjective experience of having difficulty imagining the future both in relation to episodic simulation impairment and to the remainder of the CG syndrome. Third, when analyzing the ERT and PDT, we coded repetitions (i.e., text segments that provide information redundant with information provided earlier in the narrative) as being neither internal nor external. In previous studies, researchers have coded repetitions as external details. Our omission of repetitions from the external detail count may have contributed to our finding that there was no difference between those with and without CG in external details, whereas previous studies with clinical (Brown et al., 2014) and non-clinical (Gaesser et al., 2011) samples have found that groups exhibiting fewer internal details often exhibit a corresponding increase in external details.

### **Implications and Future Directions**

The findings and limitations of this study point to several avenues for future research. First, researchers should identify the boundaries of the prospection impairments in those with CG. We assessed only one means of engaging in one mode of prospection. In future studies, researchers should build on these findings by examining the broader profile of prospection in this population (Szpunar et al., 2014). Most notably, given the emphasis given to difficulty planning for future events in CG diagnostic criteria (American Psychiatric Association, 2013), it will be especially important to examine planning and its relation to CG. In doing so, researchers may consider assessing both the *ability* to engage in specific prospection abilities as well as the

*tendency* to do so. It may be that some bereaved adults possess the cognitive ability to engage in episodic simulation but refrain from doing so because of a preoccupation with thoughts about the past (e.g., about the death), belief that imagining a future without the deceased would be a betrayal of their loved one, or fear of the emotional pain that may accompany doing so.

Second, future research should use longitudinal designs and manipulation of the ability to engage in episodic simulation in order to clarify the nature of the relationship between CG and episodic simulation. Notably, there may be a reciprocal relationship between these variables. For example, it may be that pre-loss impairment in episodic simulation renders one vulnerable to CG after loss and that CG, in turn, exacerbates this difficulty engaging in episodic simulation. Accordingly, it will be important for researchers to administer multiple assessments of episodic simulation and CG over time including, where possible, pre-loss assessments of episodic simulation.

Third, if future studies find support for a causal role of episodic simulation deficits in the development or maintenance of CG, it will be important to clarify the etiological path by which this cognitive impairment gives rise to CG. Recently, we proposed that risk factors have their effect on the CG network either by directly influencing a given symptom or by modifying the relationship between two symptoms (Robinaugh et al., 2014; cf. Fried, Nesse, Zivin, Guille, & Sen, 2014). Most plausibly, episodic simulation impairments may contribute to the broader syndrome by engendering greater subjective difficulty imagining one's personal future. This subjective prospection difficulty may, in turn, lead to the activation of neighboring symptoms, such as a diminished sense of identity (D'Argembeau et al., 2012; Maccallum & Bryant, 2013) or anhedonia (Dunn, 2012; Sherdell, Waugh, & Gotlib, 2012). Interestingly, in our analysis of the CG network (Robinaugh et al., 2014), we found that difficulty planning for future events was

most strongly associated with difficulty accepting the death. Although the concept of ‘acceptance’ remains poorly defined, one possibility is that acceptance entails a decrease in counter-factual thinking about the past (e.g., thinking about how the death could have been avoided), present (e.g., thinking about how one’s current situation would be better if the deceased were alive) and future (e.g., thinking about the future one anticipated having with the deceased). Given the substantial overlap in episodic future thought and episodic counter-factual thought (Schacter, Benoit, De Brigard, & Szpunar, 2015), researchers may consider examining both the ability and tendency to engage in these modes of thinking in bereaved adults with and without CG.

Fourth, our exploratory analyses provide guidance for how researchers should administer the ERT in clinical populations. We found clear support for using a minimum of three minutes per event when subjects describe the future events. The between-group effect size grew throughout the three-minute trial before plateauing during the final fifteen seconds of the three-minute trial. We suspect that the plateau may be the result of individuals in the bereaved control group bringing their event description to a close in anticipation of the end of the three minute-trial. Accordingly, it may be that longer durations would produce greater differences between groups. Our findings regarding the number of events to include in the ERT were somewhat less clear. The largest between-group effect size emerged when we calculated scores by using only the first trial. The effect size was lower but relatively stable after 3 trials. These findings suggest researchers can obtain a good estimate of the between-groups effect using as few as 3 trials.

Finally, our findings have implications for the treatment of CG. Several clinical interventions for CG include an emphasis on generating personal goals for the future (e.g., Boelen, de Keijser, van den Hout, & van den Bout, 2007; Bryant et al., 2014; Melges & Demaso,

1980; K. Shear, Frank, Houck, & Reynolds, 2005). Our results support the importance of these efforts to assist patients with future-oriented thinking. However, they also suggest the possibility that these individuals may require more fundamental training in how to better simulate specific autobiographical events to support the process of imagining and working towards future goals. There are several recently-developed brief interventions that could be used prior to or in conjunction with existing CG treatments in order to facilitate more effective prospection. In one recent study, Madore, Gaesser, and Schacter (2014) found that a brief induction (i.e., guiding subjects to generate a mental picture of recently viewed scenes) was sufficient to encourage the production of more internal details when imagining future events. Blackwell, Holmes, and colleagues (e.g., Blackwell & Holmes, 2010) have developed a more sustained intervention that uses a cognitive bias modification task to foster greater use of positive prospective mental imagery. Early findings suggest that this task reduces symptoms of depression (Lang, Blackwell, Harmer, Davison, & Holmes, 2012; Torkan et al., 2014), especially anhedonia (Blackwell, Browning, Mathews, Geddes, & Holmes, 2015). Researchers have also found that a 5-week specificity training increases specificity of memory recall, suggesting that similar efforts may promote more specific future event simulations (Neshat-Doost et al., 2012; Raes, Williams, & Hermans, 2009). Finally, Favrod and colleagues (Favrod, Giuliani, Ernst, & Bonsack, 2010) have reported initial success in reducing anhedonia in adults with schizophrenia using an “anticipatory pleasure skills training” intervention that relies heavily on working with patients to construct perceptually rich simulations of positive future events. Together, these interventions suggest the possibility that relatively brief interventions directly targeting the ability to imagine future events could augment existing therapies by facilitating more effective use of episodic simulation following loss, thereby reducing the subjective difficulty imagining the future

experienced by those with CG and, potentially, promoting the ability to imagine and work towards goals for the future.

## **Conclusions**

Our findings provide further evidence that bereaved adults with CG exhibit deficits in prospection, identify impairment in a more specific mode and means of engaging in prospection than has been identified in previous studies (i.e., episodic simulation of novel future events), and provide greater phenomenological information about imagined future events in this population. Bereaved adults with CG produced events with fewer episodic details, less perceptual richness, less clarity of emotion/thought content, and less episodic richness than bereaved adults without CG. In future studies, researchers should use longitudinal designs, experimental manipulation of episodic simulation ability, and better assessment of the subjective difficulty imagining the future in order to clarify the potential etiological role of episodic simulation impairments in bereaved adults with CG.

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## **Chapter 5: General Discussion**

CG is a bereavement-specific syndrome best conceptualized as a network of mutually reinforcing cognitions, emotions, and behaviors that arise together following loss and reach a self-sustaining state of equilibrium. In this dissertation, I examined three cognitive factors that may render bereaved adults vulnerable to experiencing prominent cognitive elements of the CG syndrome and, thereby, the broader CG syndrome itself.

### **Cognitive Control and Grief-related Cognitions**

In Paper 1, I examined two types of cognitive inhibition in bereaved adults with and without CG: the ability to resist distracter information and the ability to resist proactive interference. I found no evidence that resistance to distracter information is impaired in those with CG relative to the bereaved comparison group without CG. During the completion of a Flanker Task, in which subjects categorized a target stimulus while resisting distraction from simultaneously presented task-irrelevant stimuli, bereaved adults with CG were just as able to resist distraction as those without CG. Moreover, the ability to resist distraction was unrelated to self-reported intrusive grief-related thoughts in both the full sample and in those with CG.

I found limited support for the possibility that bereaved adults with CG may have greater difficulty resisting proactive interference than do bereaved adults without CG. During a proactive interference task in which subjects had to resist interference from previously relevant but currently irrelevant stimuli, subjects with CG exhibited more frequent intrusions from the irrelevant stimuli than did those without CG. However, this effect was small and short of statistical significance. Moreover, I found no evidence of impairment in those with CG on two other indices of proactive interference (i.e., accuracy and response time interference cost). There



was no association between resistance to proactive interference and intrusive grief-related cognitions in either the full sample or in the subset of those with CG.

In Paper 2, I examined the ability to shift between mental representations in bereaved adults with and without CG. I found no evidence that bereaved adults with CG exhibit deficits in the ability to shift between mental representations in the non-emotional condition of this task. Although bereaved adults with CG did exhibit greater difficulty with shifting relative to the bereaved comparison group in the emotional condition, this difference was small and was statistically non-significant. Moreover, shifting ability was uncorrelated with a measure of repetitive negative thought.

Together, Papers 1 and 2 suggest that bereaved adults with CG do not exhibit deficits in cognitive control over emotional or non-emotional information. Accordingly, it is unlikely that general cognitive control deficits play a significant role in the etiology of CG. These null findings point to at least two possible avenues for future research. First, it may be that bereaved adults with CG do exhibit deficits in cognitive control, but for different types of information than were assessed in these studies. Most plausibly, bereaved adults with CG may exhibit deficits only in the ability to exert cognitive control over attachment- or grief-related information.

Notably, in the current studies, we found very modest evidence of possible impairments in our assessments of set shifting and proactive interference, but not resistance to distracter information. These findings were non-significant in the current studies, but they suggest that, if deficits in cognitive control do exist, they may be more likely to emerge when people with CG endeavor to exert cognitive control over *internal* information (e.g., memories or mental representations being retained in working memory) rather than when they exert control over *external* information (e.g., distraction from information in one's external environment). In

addition, researchers should consider examining cognitive control over more conceptually complex mental representations in order to more closely approximate the types of cognitive control likely to be most relevant to the maintenance of CG.

Although additional studies of cognitive control in bereaved adults are warranted, the findings from these studies also suggest the possibility that bereaved adults with CG may not be impaired in their ability to exert cognitive control over emotional or non-emotional information. Accordingly, it will be critical for researchers to examine alternative factors that may contribute to the intrusive and preoccupying grief-related cognitions characteristic of the CG syndrome. One plausible possibility is that these cognitions are present because of the functions they serve for bereaved adults struggling to adjust to the death of a loved one. For example, daydreaming and reminiscing about the deceased may ease the persistent and intense yearning for reunion with the deceased characteristic of CG. That is, preoccupying thoughts related to the deceased may be present, not because of an inability to exert cognitive control over those thoughts, but because of a desire to engage with them. This possibility illustrates the fundamental importance of better understanding the relationships among elements of the CG syndrome; a research aim prohibited by latent construct approaches to mental disorders but at the heart of the network approach (Borsboom, 2013; Robinaugh, LeBlanc, Vuletich, & McNally, 2014).

### **Constructive Episodic Simulation of Future Events**

In my third study, I examined the ability to engage in episodic simulation of novel future events. Relative to bereaved adults without CG, those with CG generated impoverished future event simulations with fewer episodic details, less perceptual richness, less emotion/thought content, and less episodic richness. Our findings are consistent with past findings on prospection in CG (Maccallum & Bryant, 2011; Robinaugh & McNally, 2013) and extend those findings by

identifying impairments in a specific means of engaging in a specific mode of prospection and by providing greater phenomenological information about imagined future events in this population. Of particular interest, we found evidence that bereaved adults produced future event simulations with less perceptual information and emotion/thought content. These findings suggest that mental imagery and scene construction may be important areas to examine in future studies of cognitive impairment in CG.

These findings have implications for the treatment of CG. In an early precursor to modern complicated grief therapy, Melges and Demaso (1980, p. 55) emphasized the importance of future-oriented identity reconstruction in which patients build “new hopes and plans of actions” concurrent to engaging in loss-oriented therapy components. Consistent with this approach, several recently tested clinical interventions for CG include an emphasis on generating personal goals for the future (e.g., Boelen, de Keijser, van den Hout, & van den Bout, 2007; Bryant et al., 2014; Litz et al., 2014; Shear, Frank, Houck, & Reynolds, 2005). Our results support the inclusion of these future-oriented components of therapy and suggest the possibility that some bereaved adults with CG may require more fundamental training in episodic simulation to support the process of generating goals and reconstructing the patient’s sense of their personal future. In future studies, it will be valuable to administer brief interventions directly targeting episodic simulation, both as stand-alone interventions and as augmentations of broader clinical interventions, in order to determine the effects of improved episodic simulation on the ability to imagine one’s future and, in turn, the broader CG syndrome.

### **Limitations and Future Directions**

There are at least three noteworthy limitations shared by each of these three studies. First, each study focused on the broader CG syndrome rather than the specific element of the CG

syndrome of most interest (i.e., intrusive and preoccupying grief-related cognitions in Papers 1 and 2; subjective difficulty imagining one's future in Paper 3). Although we did include measures related to the CG elements of interest in each study, those measures were included as secondary aims and did not precisely assess the CG elements of interest. For example, in Paper 2, we administered a measure of repetitive negative thought to assess preoccupying cognitions. However, this measure is a broad assessment of the tendency to engage in repetitive negative thought and not an assessment of the preoccupying grief-related cognitions of most interest to this study. Similarly, in Paper 3, the hopelessness construct is a measure of pessimism about the future, not of the subjective difficulty imagining or planning for the future that has been identified as an element of the CG syndrome.

This limitation does not preclude the probative merit of these studies. If cognitive impairment or bias figures prominently in the etiology of CG, we would expect to see differences at the level of the broader syndrome (i.e., between those with and without CG). Even so, by focusing our study on a comparison between those with and without CG, we may have failed to detect effects that exist when examining the more direct relationship between the cognitive vulnerability and specific elements of the CG network.

This limitation illustrates a broader problem facing the field of CG research. Because the majority of CG research has operated from a latent construct perspective in which the elements of the CG syndrome are important only insofar as they reflect the presence of the underlying disorder, research on the individual elements of the CG syndrome has been neglected. The individual elements of the syndrome are poorly defined in the CG literature and many lack adequate assessments. In order to advance our understanding of the CG syndrome, it will be critical to more precisely define the individual elements of this syndrome and generate brief,

valid, and reliable assessments of each. These assessments can then be used to more directly assess the relationship between the elements of the syndrome and cognitive biases or impairments, such as those examined in this dissertation.

Second, our findings relied on inter-individual analyses (e.g., comparing episodic simulation in those with CG relative to those without CG). However, as clinicians and researchers working with bereaved adults, we are often most interested in drawing *intra*-individual conclusions (e.g., if a given individual improves her ability to engage in episodic simulation, she will experience a reduction in CG severity). This conflict between our level of analysis and the desired level of interpretation is problematic because findings based on inter-individual variation only correspond to findings based on intra-individual variation under very specific conditions that are rarely met in psychological research (i.e., the assumption of ergodicity rarely holds; Molenaar & Campbell, 2009). Consequently, findings observed at the inter-individual level provide information about the population of interest but cannot be assumed to provide information about the processes operant within individual members of that population.

This limitation, again, does not preclude the probative merit of these studies. Although ergodicity cannot be assumed, findings at the level of the population remain informative. Indeed, despite our clinical interest in intra-individual processes, we rely on an inter-individual system of diagnosis and treatment. For example, if a patient reports thoughts, feelings, and behaviors consistent with the CG syndrome, we deem her to be in the CG population and recommend a treatment efficacious for that population. Nonetheless, in future studies, it will be important for researchers to manipulate potential cognitive risk factors and examine the effects of those manipulations on the CG syndrome at the level of the individual. This approach is likely to be most fruitful for interventions that improve the ability to imagine the future, both because of our

finding that episodic simulation is impaired in those with CG and because there already exist brief interventions that improve the ability to generate detailed future event simulations (e.g., Madore, Gaesser, & Schacter, 2014). However, this intervention approach would also provide a stronger test of our hypothesis that deficits in cognitive control render individuals susceptible to intrusive grief-related cognitions and the inverse of that hypothesis; that improvements in cognitive control will reduce the frequency of such thoughts.

Third, these studies were each limited by my reliance on convenience sampling to recruit subjects, a method which may have resulted in a sample that inadequately represents the populations of interest. For example, nearly 50% of our bereaved comparison group in Papers 1 and 2 reported a lifetime history of a depressive episode, a prevalence rate well above the lifetime prevalence of depression in the general population (Kessler et al., 2005) and the prevalence of depression in bereaved adults (Clayton, 1990). This finding is particularly noteworthy given the possibility that bereaved adults with a lifetime history of depression may exhibit impairments in the cognitive factors assessed in this study. Indeed, relative to individuals with no lifetime history of depression, those with a history of depression exhibited impairments in shifting when attending to emotional information in Paper 2. Similarly, individuals with a lifetime history of depression generated future event simulations with fewer internal details,  $t(77) = 2.70, p = .008$  and less episodic richness  $t(77) = 1.96, p = .053$  in the study reported in Paper 3.

A related issue is our choice of a bereaved comparison group. By failing to include a non-bereaved matched comparison group, I am unable to draw conclusions about the broad effect of bereavement on the cognitive processes examined in this study. Although the addition of non-bereaved comparison group would provide additional information, I have no a priori reason to believe that bereaved adults would differ from non-bereaved adults in any of the cognitive

processes of interest. Moreover, the bereaved comparison group recruited for this study was the most appropriate comparison group for exploring the fundamental question that motivated each of the studies reported in this dissertation: why does grief persist after the death of a loved one for some individuals, but not others?

In addition to these limitations, it should also be noted that each of the three studies in this dissertation were limited in scope. Across each of these studies, we examined only a small portion a much broader profile of cognitive abilities. In Papers 1 and 2, we examined administered three tasks, examining three types of cognitive control. In future studies it will be critical to (a) use multiple tasks to assess the construct of interest in order to avoid the problem of task impurity and (b) administer tasks assessing a range of cognitive processes across multiple levels of complexity in order to clarify the boundaries of potential cognitive impairments in this population. Similarly, in Paper 3, we examined one means of engaging in one mode of prospection. In future studies, researchers should examine the full profile of prospection abilities (Szpunar, Spreng, & Schacter, 2014) in order to clarify the abilities most relevant to our understanding of CG.

### **Summary and Conclusion**

Bereavement is among the most painful and disruptive life events individuals will face during their lives (Bowlby, 1980). Although the majority of individuals who experience the death of a loved one exhibit only transiently elevated distress and impairment, a significant minority develop chronic post-loss psychopathology that may last for years. A principal aim of bereavement research is to identify the factors that contribute to this trajectory of chronic distress in order to improve prevention and treatment. In these studies, we examined three cognitive factors that we hypothesized may contribute to the development or maintenance of CG. We

found negligible evidence that bereaved adults with CG exhibit deficits in the ability to exert cognitive control over emotional or non-emotional information. However, we did find that bereaved adults with CG exhibit difficulty simulating novel future events. In future studies, researchers should build upon these findings by (a) examining the association between cognitive vulnerabilities and the elements of CG they are thought to directly affect, (b) examining the full profile of cognitive vulnerabilities to determine the cognitive abilities most relevant to the etiology of CG, and (c) utilizing longitudinal designs and experimental manipulation to clarify the direction of the relationship between cognitive vulnerabilities and the broader CG syndrome. In doing so, these studies will build on the findings reported in this dissertation, contribute to our understanding of the etiology of CG, and improve our ability to support those who suffer most following the death of a loved one.



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## **Supplementary Materials**

## Supplementary Materials 2.1

### Proactive Interference Task Stimuli

#### Negative Words

abuse	burial	devil	hostage	lost	rabies	slime	trauma
ache	crash	divorce	hurt	maggot	rage	slum	ugly
addict	crucify	drown	illness	malaria	rape	stench	ulcer
afraid	cruel	enraged	injury	misery	roach	stress	unhappy
agony	crushed	failure	insult	morgue	robber	stupid	upset
alone	dead	fearful	killer	pain	rotten	thief	useless
anger	debt	filth	leprosy	poison	scum	torture	victim
assault	demon	gloom	lice	pollute	selfish	toxic	violent
betray	despise	hate	lonely	poverty	sick	tragedy	vomit
bomb	detest	hell	loser	putrid	slave	traitor	whore

#### Neutral Words

absurd	cannon	errand	history	machine	paper	runner	teacher
alien	cellar	excuse	horse	manner	part	salute	tease
alley	chair	fabric	hotel	mantel	passage	serious	theory
aloof	chaos	farm	humble	market	patent	shadow	tool
ankle	chin	finger	hydrant	method	patient	shotgun	tower
army	circle	foot	invest	milk	phase	slush	truck
avenue	cliff	fork	iron	modest	plain	solemn	trumpet
bandage	coarse	frog	item	moment	plant	sphere	trunk
banner	coast	gender	jelly	month	poetry	spray	unit
basket	column	glacier	ketchup	muddy	poster	statue	utensil
beast	context	glass	kick	museum	prairie	stiff	vanity
black	cord	golfer	knot	mystic	privacy	stomach	vest
bland	cork	habit	lamb	name	quart	stool	village
board	corner	hairpin	lamp	news	quiet	storm	violin
body	custom	hammer	lantern	noisy	rain	stove	volcano
book	dark	hand	lazy	nursery	rattle	street	wagon
bowl	detail	hard	lesbian	obey	reptile	table	watch
boxer	dirt	heroin	limber	obscene	revolt	tamper	window
butter	doctor	hide	locker	office	rock	tank	wine
cabinet	elbow	highway	lump	paint	rough	taxi	yellow

### Supplementary Materials 3.1

**Supplementary Table.** Response time indices for the internal shift task in bereaved adults with and without a lifetime history of depression

	No Lifetime History of Depression		Lifetime History of Depression		<i>t</i> (72)	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
General switch	1556.96	552.50	1843.48	558.75	-2.07	.042	-0.49
General no-switch	1202.60	443.84	1368.30	403.72	-1.60	.114	-0.38
General switch cost	354.35	208.78	478.18	252.78	-2.03	.046	-0.48
Emotional switch	1586.92	561.72	1944.15	604.57	-2.43	.017	-0.57
Emotional no-switch	1252.63	496.81	1451.78	441.08	-1.75	.085	-0.41
Emotional switch cost	334.29	238.98	492.37	266.07	-2.47	.016	-0.58
Non-emotional switch	1527.00	555.17	1742.81	590.75	-1.50	.138	-0.35
Non-emotional no-switch	1152.58	411.23	1284.82	436.68	-1.24	.218	-0.29
Non-emotional switch cost	274.42	231.57	457.99	286.03	-1.25	.216	-0.29

*Note.* CG = Complicated grief. Response times are reported in milliseconds.

## Supplementary Materials 4.1

### Adapted Autobiographical Interview Administration Manual

Adapted from:

Addis, D.R., Wong, A.T., & Schachter, D.L. (2008). Age-related changes in the episodic simulation of future events. *Psychological Science*, 19, 33-41.

Levine, B., Svoboda, E., Hay, J., Winocur, G., & Moscovitch, M. (2002). Aging and Autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging*, 17, 677-689.

This adapted version of the Autobiographical Interview involves showing subjects cue words (i.e., an object, place, and person) in order to elicit the generation of imagined events which may occur in the subject's future. Subjects are given 3 minutes (from when the cue is first shown) to generate and describe the event in as much detail as possible. The events are required to have episodic specificity. In other words, the event should be one that is a few hours in duration, specific in time and place.

#### General Administration Instructions

**The following instructions are read to subjects prior to commencing practice events:**

In this task, we are looking at how people imagine events which might happen in the future. To help with scoring we will be audiotaping your responses using the microphone so please try and speak into the microphone to every extent possible.

In this task, you will be shown a set of cue words. Each set will contain 1 person, 1 place, and 1 object that you told us about during your last visit. Your job in this task is to **imagine** an event which may occur **in your future** that is based on the person, place, and object that appears on the screen. In other words, you should imagine a possible future event that includes the person, place, and object. The event may include other people or objects, but should be built around the person, place and object that you see on the screen.

In response to each cue, we want you to tell us about **a novel event** that might happen on a particular day in the future. In other words, we want you to create or imagine a scenario that hasn't happened to you before but that might happen to you in the future. When imagining these future scenarios, you can be creative, but you cannot be totally unrealistic. So you want to think about scenarios which are plausible given your plans and thoughts about the future. You should try and imagine an event that may occur in the next few years.

Each event should be something that will occur at a **specific time and place**. In other words, the event should be **something that will last only a few minutes or hours**. For example, rather than imagining a 3 week vacation you hope to take next summer, I would want you to focus in on one particular thing that you will do on that trip such as the couple hours you spent at the beach in the afternoon of your first day of your vacation.

For each event you will be given **three minutes** to tell us **as much detail** as you can about the event. **You can tell us anything you can imagine about the event, including what you were doing, seeing, hearing, thinking, or feeling.** As you are describing the event, it is ok to pause or go back and elaborate on the details of the event itself in order to provide as detailed a description of the event as possible.

So, to summarize, you will be seeing a set of cue words on the screen: 1 person, 1 place, and 1 object. You will be asked to imagine an event occurring in the future that includes those 3 things. You will have 3 minutes to tell us **as much detail** about the event as possible.

***Do you have any questions?***

Ok. Let's begin the computer task. The computer task will first briefly reiterate the instructions including an example of an imagined future event. You'll then have a chance to complete two practice trials before getting started with the rest of the task.

**The following instructions are read to subjects after he or she imagines the first practice event.**

[Provide Feedback on 1<sup>st</sup> Imagined Event]

The computer task will now ask you some questions about the event that you described. I'm going to tell you a little bit about each of the questions.

- 1) In this question, you will be asked **when** you think it might happen. Just provide your best estimate for the date this event would occur.
- 2) Here, you will rate how **detailed** the event you imagined was on a scale of 1 – 5. If it was vague, give it a 1. If it was very vivid and detailed, rate it a 5. If it was somewhere in between, rate it a 2 through 4.
- 3) The next question will ask you about the how **likely** you think this event is to happen in the future. Rate it a 1 if it is not at all likely to occur and up to a 5 if it is very likely to occur.
- 4) Next, you will be asked about whether you've imagined an event like this before. If you've previously imagined an event just like this occurring in the future, you would rate it a 5. If you've never imagined something like this occurring, you should rate it a 1.
- 5) Next, you'll be asked if you've experienced something like this in the past. If this is exactly like something you've experienced in the past, rate it a 5. If you've never experienced something like this before, rate it a 1.
- 6) Finally, you'll be asked about the **emotions** involved in this event. If very positive, rate it a 5. If very negative, rate it a 1.

## Free Recall & General Probing

Once a cue is shown, subjects are encouraged to freely recall or imagine as much as they can about an event this cue makes them think of. Throughout, general probes are used. The purpose of general probes is to help the subject focus in on a single event if they have given non-specific information, or if they have misunderstood some other aspect of the instructions. Thus, the interviewer can use any of the probes, listed overleaf, to guide the subject and keep them on track. If the subject describes a specific event (i.e., a few hours in duration, specific in time and place, and not an event that was repeated several times) that is rich in detail, general probing is not necessary. If in doubt, though, it is better to probe. The overall goal of General Probe is to remind the subject that we are looking for an event that is specific time and place and to encourage generation of as much detail as possible. Do not provide any other guidance such as telling the subject which event to focus on, or suggesting ideas for events they could describe. You can, however, reiterate the instructions.

### General Probing Scenarios

#### 1. The subject finishes before 3 minutes are up.

- Is there anything else you can tell me?
- Are there any other details that come to mind?

#### 2. The subject provides a vague description of a specific event

- Is there anything else you can tell me?
- Tell me more about it.
- Is that everything you can say about it? We want to know all the details that come to mind.

#### 3. The subject does not imagine a specific event

- That's not quite what I was looking for. I need a single event or instance that will happen.
- Can you tell me about an incident that will happen at a particular place and time?

#### 4. The subject imagines more than one event or a series of related events

- You mentioned a number of events. I'd like you to pick just one of them to focus on and tell me as much as you can about that event.

#### 5. The subject imagines multiple places or periods of time

- For this task, we'd like you to focus on just one particular place / period of time

#### 6. The subject generates a future event but it is not clear if this is an event they have already experienced.

- Has this even happened to you before? *[If Yes]* I'd like you to focus on new events that could happen in the future.



## Supplementary Materials 4.2

### Experimental Recombination Task Scoring Manual

Adapted from:

Addis, D.R., Wong, A.T., & Schachter, D.L. (2008). Age-related changes in the episodic simulation of future events. *Psychological Science*, 19, 33-41.

Levine, B., Svoboda, E., Hay, J., Winocur, G., & Moscovitch, M. (2002). Aging and Autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging*, 17, 677-689.

#### Overview

The Experimental Recombination Task Scoring Manual quantifies elements of future event simulations. The coding for each event will proceed in four steps.

**Step 1:** Isolate and define the imagined future event.

**Step 2:** Separate text segments for each imagined event into *internal* and *external* details.

**Step 3:** Assign a *detail category* to each of the internal details.

**Step 4:** Rate the content of each event with particular focus on the internal details.

#### **Step 1: Identify the imagined event**

##### **Isolating and defining the event**

To begin, read through the full event description, identify the central event the subject is imagining in their future and briefly describe the event on the top line of the scoring sheet. Although the task instructions request specific events, many subjects give more than one event or events that are difficult to define (i.e., non-specific events). It is therefore necessary to be clear what the event is before any scoring takes place. This is particularly important when categorizing segments, as segments that are not part of the central event (external details) are tallied separately from those that are part of the event (internal details).

An event is singular (i.e., not repeated) and specific to a particular time. The event should be restricted in time (i.e., less than 1 day and typically only a few hours or minutes). If an event extends over days or weeks (e.g., a vacation), the scorer must restrict scoring to the best time-restricted event available. The event must be something in which the subject themselves is present.

An event may have other small events contained within (e.g., time spent at two different stores on an afternoon of shopping) but should be a cohesive whole. That is, the smaller contained events should be connected. For example, the subject may have lunch with Susan, get on a train with Susan once they leave the restaurant, and spend the rest of the afternoon shopping with Susan all as part of the event "Spending the afternoon with Susan."

Events should be considered distinct if there is a gap in which it is unclear how one event would lead to another (e.g., if the subject first described being at lunch with Susan but later described being at the club with Susan), if there are sufficient differences between the two events that they can no longer be considered part of a broader whole (e.g., if the subject had lunch with Susan but then went hiking with Michael), or if the events take place on different days (e.g., lunch with Susan on Saturday and then seeing a movie with Susan on Sunday).

If there are multiple events, the central event is the one for which the subject provides the most detail.

## Step 2: Text Segmentation and Primary Categorization

### Text segmentation

A segment, or detail, is an information bit; it is a unique occurrence, observation, fact, statement, or thought. This will usually be a grammatical clause -- a sentence or part of a sentence that independently conveys information (i.e., a subject and a predicate.)

A single clause may contain more than one detail. For each clause, consider whether its constituent parts convey additional information. That is, if the segments are divided, does each segment stand on its own as providing an information bit. If so, the parts can be separated and scored as separate segments.

Anytime the subject provides information beyond the basic “singular subject + predicate” unit, each additional piece of information should be considered a text segment. For example, specifying multiple subjects (e.g., My brother and I sat down), multiple verbs (e.g., We swam and ran in the race) or multiple objects (e.g., I ate a hamburger and fries) would each warrant distinct text segments (i.e., for “my brother”, “[we] ran]”, and “fries”).

### Examples:

1. “I get a banana and chips”  
→ Two text segments: “I get a banana | and chips.”
2. “I sit down with my mom and my sister.”  
→ Two text segments: “I sit down with my mom | and my sister”
3. “He had an old, brown fedora”  
→ Three text segments: “He had [a fedora] | an old, | brown”

### Primary Text Categorization

The main categorical distinction for details is whether the detail is **internal** or **external** to the event.

**Internal Details:** Internal details are text segments that provide information about the central event, (as identified above in Step 1). These details will typically include information about what happens in the event (e.g., “Don is cooking dinner”), when the event takes place (e.g., “at 6:00 PM”), where the event takes place (e.g., “on his porch), or about what the subject is thinking (e.g., “I am thinking about how good the food will be), feeling (e.g., “I am really excited), or perceiving in the event (e.g., “the food smells really good”). Internal details should be highlighted in green.

**External Details:** External details are segments that are not part of the central event. They may either refer to non-central events or to general semantic information that is not specific to the main event (e.g., “Don is a great cook”; “Sometimes Don cooks out on his porch”, “I’ve always really liked hamburgers off the grill”). External details should be highlighted in red.

**Repetition:** A detail is a repetition if it repeats a prior information-containing detail. It does not have to be a verbatim repetition nor does it need to refer only to what was said immediately prior. What characterizes a repetition is the lack of any new information beyond what was said in a prior detail for that event description. Do not count repetitions in detail counts. Repetitions should be highlighted in grey.

**Examples:**

- a. “I’m really excited to see the movie” ... [later in event description]... “So yeah, I’m just really excited to see it”  
→ “So yeah, I’m just really excited to see it” is a repetition even though it comes later in the event description because it adds no new information.
- b. “I hoped for the best. I kept my fingers crossed.”  
→ “I kept my fingers crossed” is a repetition despite not being a verbatim reiteration of the previous statement because it adds no new information.

**Corrective information:** If the subject corrects themselves the correct version should be coded as internal or external as appropriate. The incorrect version should not be counted in the detail counts and should be highlighted in grey.

**Example:**

- a. “I added a little black and sugar to the coffee. I mean cream and sugar”  
→ “I added a little cream and sugar to the coffee” should be coded in green and counted as 3 internal details (i.e., I added [cream] [to the coffee] | [and sugar] | a little). “Black and sugar” should be highlighted in grey and excluded from the internal and external detail counts.

**Nonsense words or phrases:** If the subject makes an utterance (e.g. “umms” or “uhhs”) or uses a phrase that contains no information (e.g., “we’ll do something” or “so yeah, that is that”), it should be considered a nonsense word or phrase, highlighted in grey, and excluded from the internal/external detail counts.

**Example:**

- a. “We go behind my house | which is where it is”  
→ The phrase “which is where it is” in this context does not convey information.

**Speaking to the experimenter:** If the subject (a) reads the instructions or episodic details aloud, (b) comments on the task, or (c) speaks to the experimenter, those segments should not be included in the detail counts and should be highlighted in grey.

## Distinguishing Between Internal and External Details

In some cases it can be difficult to distinguish internal from external details. Below, there are several common situations that arise in which it is unclear whether the detail is internal or external.

**Describing other people's thoughts, feelings and comments:** When subjects imagine a future event, they describe other people's thoughts and feelings along with their own. These should be coded as internal if they reflect what the individual is thinking or feeling during the central event. They should be coded as external if they reflect thoughts the individual has in general.

### **Examples:**

- a. "We're at the store and my mom is hungry so she picks up a bag of chips."  
→ **Internal Detail.** Here, the subject is providing us with information about what her mother is thinking/feeling during the central event.
- b. "So I go to meet my mom. My mom never liked Jim and sometimes we argue about how I'm still struggling with the loss so I'm feeling a little tense."  
→ **External Detail.** In this case, the subject is giving information about what her mother feels in general (i.e., not about what her mother will be thinking or feeling in the imagined future event).

**Information about time:** Subjects often give information about the length of time they would spend doing something (e.g., how long it will take to get somewhere). Time information should be coded as internal if it provides information about the central event. Time information should be coded as external if it provides general or semantic information that (although potentially related to the event) does not provide direct information about the event itself.

### **Examples:**

- a. "I love going to see movies. My house is only about an 8 minute walk from my house so I get to see movies a lot"  
→ **External Detail.** Here, the subject is providing us with general semantic information about herself and the location of her house, not about the particular event that she is describing.
- b. "We are going to walk to the movie theatre. It's only about an 8 minute walk from my house so we get there pretty quickly."  
→ **Internal Detail.** In this case, the subject is giving information that directly related to the central event, providing information about how long they will be walking to the movie theatre.

**List of possible scenarios (may/maybe/might statements):** When subjects are asked imagine a future event, they may enumerate possible scenarios with or without specifying which of these events they are anticipating would actually occur. If these different possibilities are about the central event, then each should be counted as an internal detail. Similarly some subjects will use the words "maybe" or "might" to describe what they are imagining (e.g., "and maybe I'll get heartburn so I'll take out my antacids"). These should be counted as internal details.

## Additional Notes and Conventions

**Identifying unique segments.** If you remain unsure whether a given clause or phrase contains more than one detail, it may help to consider whether you could accurately complete the secondary text categorization for each of the potentially distinct details. If so, it is likely that these do indeed convey distinct information and should be considered distinct details. In general, it is better to split the text segments into separate details if you think they could reasonably be considered to provide distinct information.

**Distinguishing Between Internal and External Details.** If you remain unsure whether the event is internal or external, the rule of thumb in these cases is to give the subject the benefit of the doubt. If a detail could reasonably be internal, it is scored as such. Importantly, this rule should not be applied to all details that could possibly be internal; only those that could reasonably be internal and for which you are unsure about how to categorize.

**Information conveyed in dialogue:** Subjects frequently imagine dialogues between themselves and the other character(s) in their imagined future event. Coding dialogue can be difficult because subjects may use the dialogue to convey both information external to the event (e.g., “and I said, ‘You know red is my favorite color’”) and information internal to the event (e.g., “and I said, ‘Isn’t this the most beautiful building you’ve ever seen. It’s so tall and white and the sun is shining off of it’”). The convention we will use is the following:

- IF the quotation contains EXTERNAL information: The entire statement made by the individual should be coded as a *single internal detail*. It is internal, because it is about what was said during the event itself. For example, “and I said, ‘You know red and green are my favorite colors’” would all be coded as a single internal detail.

- IF the quotation contains INTERNAL information: Code the dialogue as you would any other piece of the event, breaking down the dialogue into its individual text segments. For example, “and I said, ‘Isn’t this the most beautiful building you’ve ever seen. | It’s so tall | and white | and the sun is shining off of it |’” would be coded as 4 internal details.

### Step 3: Secondary Text Categorization

The third step is to place each of the internal details into one of 5 specific categories: 1) Event Details, 2) Place Details, 3) Time Details, 4) Perceptual Details, 5) Emotion/Thought Details. If the detail does not fall into one of these five categories, it should not be considered an internal detail.

**Event Details:** Overall, event details describe the unfolding of the story. They are usually happenings (e.g., "I fell down"), but also include who was there (1 point per name/person up to a maximum of 5), reactions/emotions in others, the weather, one's clothing, physical occurrences and actions of others.

#### Notes:

- a. If an item qualifies to be in another category (e.g., perceptual richness), then **priority is given to that more specific category**. An item cannot be scored as an event detail if it is in another category.
- b. Anything that the subject says should be coded as an event detail, regardless of the content of what they said. For example, "I will tell my friend that I love her beautiful blue dress" should be coded as a single event detail.
- c. Adjectives and adverbs that cannot be assigned another category (e.g., perceptual or emotion/thought detail) should be considered event details.

#### Examples:

- a. "We'll be going to Harvard Street and it will be raining"  
→ **1 Event and 1 Place Detail**. "We'll be going to Harvard Street | it will be raining" (see Place Details below).
- b. "I will go to dinner with Susan"  
→ **2 Event Details**. "I went to dinner | with Susan"
- c. "Elly, Rich, Heidi, Phil, Dianne, Shirley, and I will discuss the plan."  
→ **6 Event Details**. "Elly | Rich | Heidi | Phil | Shirley | -Dianne- | and I will discuss the plan for the day." Although 7 details are given, you should only give up to 5 points for naming distinct people who are present).

**Place Details:** Any information that involves localization in space, including countries, bodies of water, provinces, cities, streets, buildings, rooms, and locations within a room.

#### Notes:

- a. One's own orientation in space ("I was to the right of Edgar") is considered a perceptual detail and not a place detail
- b. Each piece of information provided about the place should be coded as a separate place detail should be coded as two place details (Harvard square | in Cambridge) even if the additional information could be assumed (e.g., H square in Cambridge).

#### Examples:

- a. "We'll be going to the Duck Pond in the Boston Gardens"  
→ **2 Place Details**. "We'll be going to the Duck Pond | in the Boston Gardens".

**Time Details:** Life epoch ("My twenties"), year, season, month, date, day of week, time of day, or clock time.

**Notes:**

- a. *Duration information* ("We will be there for 20 minutes") is scored a *perceptual detail*.
- b. Details that provides information about when in time a particular event occurred (e.g., "When we get there") are scored as time details.

**Examples:**

- a. "When we arrive at Shake Shack, we will be in line for about 20 minutes"  
→ **1 Time Detail** ("When we arrive"). In addition, there is 1 place detail ("at Shake Shack"), 1 event detail ("we will wait in line"), and 1 perceptual detail ("for about 20 minutes")

**Perceptual Details:** Perceptual details include auditory, olfactory, tactile/pain, taste, visual (object details, colors), spatial-temporal (allocentric-egocentric space, body position and duration).

**Notes:**

- a. In the case of objects, it can be difficult to distinguish between a perceptual and an event detail. **Objects that are directly involved in the unfolding of an event are considered event details** ("We lit the candles") whereas **objects that are part of the perceptual landscape are considered perceptual details** ("There were lit candles everywhere"). Broadly, if the subject is interacting with or possessing the object (e.g., "I will have my phone in my pocket"), it should be considered an event detail.

**Examples:**

- a. "The wind is cold but I'm not worried because I have my purple chapstick."  
→ **2 Perceptual Details** ("The wind is cold" and "purple [chapstick]"). In addition, there is 1 emotion/thought detail ("I'm not worried") and 1 event detail ("I have my [purple] chapstick").

**Emotion/Thought Details:** Any detail that pertains to the mental state of the subject at the time of the event. These include feeling states, thoughts, opinions, expectations, or beliefs.

**Notes:**

- a. **Thoughts expressed in retrospect** (at the time of the interview- "I find out later I am wrong") are tallied as external.
- b. **Beliefs or opinions that are long-standing and not specific to the event** - "I never believe in ghosts") are also external and are scored as semantic details.
- c. **Inferences about other people's mental state** ("She is sad") are considered event details, unless these inferences reflect the subjects' own mental state at the time ("I think he is angry with me"), in which case they are internal thought details.

- d. If the subject reports that “we” are thinking/feeling something, the details should be coded as emotion/thought details

#### **Step 4: Subjective Ratings**

After segmentation and categorization, ratings are assigned as an alternative means of characterizing subjects' responses. These ratings are subjective, but are influenced by the objective detail information. For most categories, a rating between 0-3 is assigned, **\*based on the internal details only\***, according to the following general criteria (described in more detail below)

#### **Detail-based Ratings**

**Place localization:** This category assesses localization of a specific location. Full credit is awarded when the exact location can be specified within a few meters but there must be some link to global information, even at a very general level. If the response is lacking specific information about localization, credit is reduced as the location becomes more global and covers a larger area (e.g., indoor/outdoor location, address, street, city, country). In addition, novel places are scored more leniently than places frequented often, such as one's bedroom.

**3 points:** There are enough specific details to re-create a setting within a few meters and the response is tied to some global/contextual information.

*e.g., breakfast table in hotel's restaurant in Mexico; sandbox in my backyard.*

**2 points:** Some specific detail but lacking global information, OR some larger scale information but lacking precise localization.

*e.g., playground at daycare; restaurant in Mexico; my house; my backyard.*

**1 point:** A general location without specific detail, OR a specific location without any context.

*e.g., in Mexico; at daycare; a sandbox; a house.*

**0 points:** No space detail

**Time localization:** This category refers to the localization of the future event within a specific time frame. Full credit is awarded when the event is both specified within a larger context (year/season/stage in life), as well as within a more precise context (time of day).

**3 points:** Year, month/season and hour/time of day specified.

*e.g., February morning in 12th grade; a fall evening when I was sixteen.*

**2 points:** At least 2 pieces of information about the time, but lacking specific or global context.

*e.g., winter of grade 12; Christmas morning at 6 am.*

**1 point:** Minimal/vague temporal detail specified.

*e.g., winter during high school; in grade 12; at dinnertime.*

**0 points:** No time detail



**Perceptual richness:** This category assesses perceptual details in any of the following 6 modalities: auditory, olfactory, tactile/pain, taste, visual (object detail, colours), spatial-temporal (allocentric-egocentric space, body position and duration). Vividness or intensity of the percept is assessed in relation to the episode. For full marks there should be mention of more than one modality, however, in cases where exceptional detail is provided but only one modality is mentioned, full points may be awarded.

**3 points:** At least 2 different modalities mentioned and response reflects the ability to experience some aspect of at least one percept. OR only 1 modality but exceptional detail provided.

*e.g., the pain feels like a knife cutting into me (pain intensity); gown with lace around the collar (visual vividness), the music is soft and sweet.*

**2 points:** 3 or more perceptual details described but lacking in richness or a feeling of experiencing.

*e.g., the sunset will be a beautiful red color, the music was really loud*

**1 point:** 1 or more perceptual details but lacks richness, OR some perceptual detail but not directly related to event.

*e.g., a red dress; it hurt to swallow; the tea will be hot, the food will be really delicious*

**0 points:** No perceptual detail.

**Emotion/thought:** This category assesses the extent to which a person is able to simulate what he/she will be thinking and/or feeling at the time the event will occur. This category is not necessarily scored in terms of its significance or intensity, as even a very trivial event can receive full points. Emotions expressed in others are scored under event details (e.g., He was angry), however, if an emotion was not expressed in another person but the subject believed or suspected it to be present (e.g., I thought that he was angry with me), then it is considered to be a thought and it is scored in this category.

**3 points:** Response must reflect the specific cognitive and/or emotional state of the subject at the time of the event.

*e.g., I will be very excited at the idea of gaining independence living away from home; I am upset because I had missed my last opportunity to see her; I will feel like I am in a dream because nothing will seem real and it will be happening in slow-motion.*

**2 points:** 1 or more thoughts/feelings related to the event are expressed/ considered but the response only partially captures the specific cognitive and/or emotional state at that time.

*e.g., I will be very eager to start my work; I will be very nervous as the ceremony starts.*

**1 point:** 1 or more thoughts/feelings expressed or considered that does not capture the key emotional/cognitive state of the subject at the time of the event.

*e.g., I can see myself wanting to go; I figure I should make an attempt at it.*

**0 points:** No emotion/thought detail.

## Global Internal Event Ratings

**AMI rating.** The Autobiographical Memory Interview (AMI; Kopelman et al., 1990) is the currently accepted measure of autobiographical memory. For the sake of comparison, we have included the episodic rating criteria from the AMI manual below. This score does not get included with other ratings when ratings are summed.

**3 points:** a detailed future event that is specific in time and place.

*e.g., They will give us a day out in London in one of the hotels- we will have a reception. They take us in cars from Peckham about 6pm to a big hotel in central London. A lovely car. There will be a dinner and a big speech. I think it will be to celebrate their centenary. Mr. Heinz will come over from Pittsburgh to make a speech. They will have a celebration there at the same time as we do. I will sit next to friend called Nellie. There will be dancing after the dinner and I will dance with Nellie. We will come home in the hired car at 3am in the morning.*

**2 points:** a specific future event with few or no details

*e.g., I will be riding in a boat along the river in Wales when I start work next summer. I will live with my cousin and my auntie, his mother, in West Wales. I don't know the name of the town which the newspaper I will work for is in. But I will go fishing in the river. I mean, just quite a simple thing, getting in rather a large boat with about 5 –6 people in it to go fishing. I won't actually go fishing. I will just watch others do it because I am not sure how to fish or whether I could.*

**1 point:** a vague future event; OR an incident that would occur on multiple occasions but no single instance is made.

*e.g., I can imagine liking a game of chess. It's hard to imagine a particular game. I play so often that one particular time in the future doesn't really stand out.*

**0 points:** a response based on general knowledge; OR no response.

*e.g., I will just go to school. That is all.*

**Episodic Richness.** This category assesses the overall richness with which an episode is described and is scored on a scale of 0-6. It is a measure of the extent to which a subject evokes an impression of true experiencing by taking a listener to a specific moment in time and place in which they are able to create the perceptual, emotional and cognitive contextual detail of an imagined future event. Text segments are not assigned to this category and only information that is internal to the isolated event is assessed.

The episodic richness rating is essentially an extension of the 3-point AMI rating, although the episodic richness criteria are more stringent than the AMI. It should not be influenced by semantic or other external details. In other words, if someone gives a highly rich event with lots of internal details, their rating should not be reduced if they should also give many external details nor should it be increased if they provide many external details.

This rating should be assigned after all other categories have been scored. In assigning the rating, consider the number of details and scores for all categories. Give particular weight to the episodic details, as this is the only category that does not receive a qualitative score. In general, the highest score will be assigned to events that in which the “story” is described in rich detail. Specificity in time, place, perception, and cognition/emotion should be taken into consideration. However, some highly-rated events may be lacking in some of these categories. For example, a subject may not volunteer time and place because it may not be necessary from their perspective (e.g., in describing a high school graduation, it is not necessary to give the date and place since this is implicit as far as the subject is concerned). This will be reflected in the ratings of those categories. In assigning the rating, you should be answering the question, “How well does this future event convey a feeling of experiencing the episode?” If you feel that the subject is verbally creating the episode, you should assign it a high rating.

### Episodic Richness Ratings

**5-6 points:** Response is rich in detail, containing at least 2 elaborations, and evokes an impression of true experiencing.

***e.g., (6 points)** Part of our 33 day trip when I will turn 30 years old. We will go to the Maritimes, me and my brother and my father. We will be in P.E.I. in a tiny little town called Rustico, beautiful beautiful little town, exactly out of the type of maritime calendar you will come get for 99 cents two months after January. We are just wandering around and we see this guy, we are down near the docks, we see a bunch of people who would take you out on deep sea fishing excursions. My dad says, “What do you guys think? Do you want to try it?” And we’re like, “Sure”. So we get on this boat called the ..., I forget what the boat is called, but the guy who, the captain’s name is Norm Peters. This guy is right out of a Hemingway novel. It is bizarre. He is dressed in overalls covered in seagull shit. He has this honking huge beard, his eyes are like sunken right into his head, you can barely see them. He has this little captain highliner cap on also covered in goose shit. It is just bizarre. He is a funny funny guy. So we go on this boat. By the time we go there, there are like about 12 other people also signed up for the fishing thing. So we go out, and it isn’t, we will be kinda disappointed because he uses a radar to find the fish. But I guess people expect to catch fish when they go on a deep sea fishing dive, er..uh trip. I seem to have the best spot on the boat. Every time I throw out the line something bit it practically before it even hit the water. So, I will be really really excited, everyone’s looking at me going what the heck is that kid using over there, man? But because I basically get enough to feed everyone, we go back with quite a big bag of six I think, or eight fillets in this bag that by the time we get back to shore it is just soaked in blood cause he fillets it right there on the ship. It will be one of the best meals we have the whole trip. Fresh out of the sea Mackerel.*

***e.g., (5 points)** We are on holiday and we live in the North of England, in Yorkshire, and we going to go to the East Coast, Bridlington, and we stay there during the week. And on the weekends, my father comes and stays with us too...he’d been born in Bridlington so it is one of his favorite spots. And in this particular morning, when we get up, it is in September, we have about a week more holiday to go, and this particular morning, we see soldiers running down towards the harbor in uniforms and helmets and putting out barbed wire. And then a man arrives along the beach where we are sitting on a seat. I*

am with my mother and two sisters, and he says, "War has been declared!", and my mother says, "Oh, my G-d!". They rush her over to the little store to buy a newspaper. They haven't got one at the time, but the man says, yes it is true. When we come back somebody has taken our seat...when she comes back, somebody has taken her seat and I realize they'd left a box of "Black Magic" chocolates. And I say, "Goodie, goodie, we'll eat them!" and she say, "No you won't, they might be poisoned, they might be poisoned!". So there is a great deal of commotion and a lot of excitement, hustle and bustle, the area where we are, we will go back to the house where we are staying and my mother will call my father and later that day he comes and picks us up and our holiday is cut short. To me, it is quite an exciting experience. When we get on the road going back home, there are hundreds of cars...there are hundreds of cars going back home, because of the outbreak of war.

**3-4 points:** Response has moderate detail and contains at least 2 elaborations.

**e.g., (4 points)** Injury, not to me necessarily. Oh yea, a friend, well...I am going to be playing badminton with this gorgeous friend of mine. She is beautiful and I am, of course, very envious of her looks, but we still have lots of laughs and lots of fun. However, on this day, we go from one building to another to get to the badminton court. And there is quite an expanse and it has been raining. And she suddenly slips and falls down; it is all kinds of contortions and peculiar movements. And I am unable to hold back my laughter and I laugh and laugh and laugh and I hurt her feelings so badly that she won't speak to me again. I don't mean to do that, but that's how it happens...perhaps I'm too immature to apologize.

**e.g., (3 points)** Taking a test. Well I can imagine the professor is teaching us. I am not sure how old I am, but I certainly am not more than 30 and the teacher tells us a story before break. As I am always interested in clinical psychology rather than social psychology, I just pretend I guess to be listening to what the professor is telling us. We go to break. When we come back, he says, "ok Vera, you tell us...you summarize this story" and I proceed to make up something that is totally irrelevant because I have to say something and I am very much embarrassed when I am told that I obviously I don't listen.

**1-2 points:** Limited detail and/or limited elaboration of events.

**e.g., (2 points) (\*note: despite providing a lot of detail, there are very few internal details provided. Ratings should only be made in regards to internal details. Accordingly, this response warrants a 2 point rating).** Oh no, I just, hmm...you said pick a couple of things, and it is, like, being pregnant, you know, it is just like, just a really fun time. Although, I will have morning sickness from the day I get pregnant, I think, for about 3 and a half or 4 months. I will be sick almost every day, and I am also young. I am younger than a lot of people who get pregnant. I am, I think I will be 20 at the time I get married, and then I will turn 21 shortly after that. So, I am 21 when I get pregnant, and turn 22 just before I have my first baby. That is a fairly young age. I guess it is just....he will be absolutely adorable. Having him is just absolutely great and I like my doctor, and I feel like I will have a good pregnancy, other than I the morning sickness. When I finally have him, I am actually 5 pounds lighter than when I got pregnant. So,

*even though I gain 24 pounds, I will lose 29. I am really thinking that they must have brought me the wrong baby. He is just ...he has the reddest face. This is some little Indian kid, I have no idea what a newborn looked like, and he has jet-black hair, and a lot of it. When he is a newborn, it is all little black curls, and he is just absolutely adorable.*

**e.g., (1 point)** *Well, I will be disciplined once at work and I think it is really unfair and um, so I don't really want to keep working at that job anymore. And that's about it.*

**0 points:** No episodic information.

### **Integration of Episodic Detail Ratings**

**Place integration:** How integrated was the place in the event described?

- 5: All of the event occurred at this location
- 4: Nearly all of the event occurred at this location
- 3: More than half of the event occurred at this location
- 2: Less than half of the event occurred at this location
- 1: The location was not mentioned or was not part of the event.

**Person integration:** How integrated was the person in the event described?

- 5: The person was present for all of the event
- 4: The person was present for nearly all
- 3: The person was present for more than half of the event
- 2: The person was present for less than half of the event
- 1: The person was not mentioned or was not part of the event.

**Object integration:** How integrated was the object in the event described?

- 5: The object was present for all of the event
- 4: The object was present for nearly all of the event
- 3: The object was present for more than half of the event
- 2: The object was present for less than half of the event
- 1: The object was not mentioned or was not part of the event.

**Rate of Coincidence:** To what extent did the person, place, and object for this event coincide (i.e., occur together) in the event?

- 5: All 3 details coincide at the same time
- 4: All 3 details coincide with at least one other detail but they do not all coincide at the same time.
- 3: Two details coincide. The third detail is in the event but does not coincide with the other details.
- 2: Two details coincide. The third detail is not in the event.
- 1: No details coincide.

### Centrality of Episodic Detail Ratings

**Place centrality:** How central was this place to the narrative of the event?

- 5: This location was part of the event and was integral to the event
- 4: This location was part of the event and played a noteworthy role in the event
- 3: The location was part of the event and played a small role in the event
- 2: The location was part of the event but did not play any role in the event
- 1: The location was not mentioned or was not part of the event.

**Person centrality:** How central was the person in the event described?

- 5: This person was part of the event and was integral to the event
- 4: This person was part of the event and played a noteworthy role in the event
- 3: The person was part of the event and played a small role in the event
- 2: The person was part of the event but did not play any role in the event
- 1: The person was not mentioned or was not part of the event.

**Object centrality:** How central was the object in the event described?

- 5: This object was part of the event and was integral to the event
- 4: This object was part of the event and played a noteworthy role in the event
- 3: The object was part of the event and played a small role in the event
- 2: The object was part of the event but did not play any role in the event
- 1: The object was not mentioned or was not part of the event.

### Grief-Related Ratings

**Grief-relatedness:** To what extent did the subject refer to grief-related information during the event. Grief-related information includes anything related to a deceased attachment figure (i.e., close friend or family member). Importantly, grief related ratings should be made for both internal and external events.

- 5: Grief-related information played a central role in the event narrative (e.g., visiting cemetery)
- 4: Grief-related information is present throughout much of the description but is not central
- 3: Grief-related info is mentioned more than once or is mentioned once and elaborated upon.
- 2: Grief-related info is briefly mentioned one time.
- 1: No grief or grief-related content

## Supplementary Materials 4.3

### Picture Description Task Scoring Manual

Adapted From:

Gaesser, B., Sacchetti, D.C., Addis, D.R., & Schacter, D. L. (2011). Characterizing age-related changes in remembering the past and imagining the future. *Psychology and Aging, 26*, 80-84.

Levine, B., Svoboda, E., Hay, J., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: dissociating episodic from semantic retrieval. *Psychology and Aging, 17*, 677-689.

#### Overview

The Picture Description Task Scoring Manual quantifies elements of picture descriptions. The coding for each event will proceed in two steps.

**Step 1:** Divide description into text segments

**Step 2:** Separate text segments for each imagined event into *internal* and *external* details.

#### **Step 1: Text Segmentation**

##### **Text segmentation**

A segment, or detail, is an information bit; it is a unique occurrence, observation, fact, statement, or thought. This will usually be a grammatical clause -- a sentence or part of a sentence that independently conveys information (i.e., a subject and a predicate.)

A single clause may contain more than one detail. For each clause, consider whether its constituent parts convey additional information. That is, if the segments are divided, does each segment stand on its own as providing an information bit? If so, the parts can be separated and scored as separate segments.

Anytime the subject provides information beyond the basic "singular subject + predicate" unit, each additional piece of information should be considered a text segment. For example, specifying multiple subjects (e.g., My brother and I sat down), multiple verbs (e.g., We swam and ran in the race), multiple objects (e.g., I ate a hamburger and fries), or modifiers (e.g., I kicked the *red* ball) would each warrant distinct text segments (i.e., for "my brother", "[we] ran]", "fries", and "red"). If the modifier+element combination is sufficiently common that it has become an accepted noun (e.g., baseball cap) or a common phrase (e.g., partly cloudy), then the modifier should *not* be counted as a separate detail. In addition, intensifiers (e.g., very, really) and numerical information (e.g., 4 [chairs]) should *not* be counted as a separate details.

##### **Examples:**

1. "He has a banana and chips"  
→ Two text segments: "He has a banana | and chips."
2. "She is sitting down with her mom and her sister."  
→ Two text segments: " She is sitting down with her mom | and her sister"
3. "He has on an old, brown fedora"  
→ Three text segments: "He has on [a fedora] | an old, | brown"

4. "The sky is partly cloudy"
  - One text segment. *Partly cloudy* is a common phrase, so *partly* should not be counted as a separate segment.
5. "He is very tall"
  - One text segment. *Very* is an intensifier and does not warrant its own detail.
6. "There are four chairs"
  - One text segment. The numerical information (i.e., 4) does not warrant its own detail distinct from the broader information about their being multiple chairs.

## Step 2: Primary Categorization

### Primary Text Categorization

The main categorical distinction for details is whether the detail is **internal** or **external** to the event.

**Internal Details:** Internal details are text segments that provide information about the event depicted in the image. These details will typically include information about what happens in the event (e.g., "That guy is sitting down and eating dinner") and information about the scene (e.g., "The sky is blue"). Internal details may include some inference as long as it is an attempt to provide information about the event/scene itself (e.g., "it appears to be a cafeteria). Internal details should be highlighted in green.

**External Details:** External details are segments that are not part of the central event. They may be general semantic information that is not specific to the main event (e.g., "It is really hard to build a house") or inferences about what is going on in the event that goes beyond what is depicted in the scene. For example, inferring the temperature of the environment (e.g., "It is a warm day"), the location of the scene (e.g., "This is probably in Florida), the condition or status of an object (e.g., "That volcano might erupt soon."), or the intentions of a person ("That guy wanted to sit alone") are not about describing the depicted scene but rather about information that is either unknowable based on the image (e.g., the intentions of the person) or are external to the scene itself (e.g., the future status of the volcano). External details should be highlighted in red.

### Other types of details

**Repetition:** A detail is a repetition if it repeats a prior information-containing detail. It does not have to be a verbatim repetition nor does it need to refer only to what was said immediately prior. What characterizes a repetition is the lack of any new information beyond what was said in a prior detail for that event description. **After you finish coding a full event, go back and read it one more time to look for repetitions. They often occur far apart in the event description.** Do not count repetitions in detail counts. Repetitions should be highlighted in grey.

### Examples:



- a. "He has on a yellow hat" ... [later in event description]... "Yeah... he is wearing a yellow hat"
  - ➔ Although it is not a verbatim repetition, it does not provide any new information and, thus, should be considered a repetition.

**Corrective information:** If the subject corrects themselves, the correct version should be coded as internal or external as appropriate. The incorrect version should not be counted in the detail counts and should be highlighted in grey.

**Example:**

- b. "He is wearing black pants. No, actually, blue pants"
  - ➔ "He is wearing blue pants" is 2 details (He is wearing pants | blue).  
"black pants. no, actually" should be highlighted in grey and excluded from the internal and external detail counts.

**Nonsense words or phrases:** If the subject makes an utterance (e.g. "umms" or "uhhs") or uses a phrase that contains no information (e.g., "we'll do something" or "so yeah, that is that"), it should be considered a nonsense word or phrase, highlighted in grey, and excluded from the internal/external detail counts.

**Example:**

- b. "There is a hammer behind the house | which is where it is"
  - ➔ The phrase "which is where it is" in this context does not convey information.

**Speaking to the experimenter:** If the subject (a) comments on the task, or (b) speaks to the experimenter, those segments should not be included in the detail counts and should be highlighted in grey.

## Rules for Text Segmentation & Categorization for Location and Position

Subjects will commonly provide information about the location or position of an object or multiple objects in the scene. These should fall into 1 of 3 categories:

- (1) **An indicator of position/location in the *image*** (e.g., at the bottom, on the left). These segments should *not* be considered internal or external. They should be highlighted in grey.

### Example:

1. "Down on the left, there is a guy wearing a baseball cap"  
→ One text segment. *Down on the left* is about the position in the image rather than the scene and does not warrant its own text segment.

- (2) **A single indicator of position/location in the depicted scene** (e.g., in, on, around, under, between, at, behind, against, to the right, near). These instances warrant **1 internal text segment**.

### Example:

1. "The jar is *on* the table."
2. "The man is sitting *on* the couch."
3. "There is a dog *under* the desk"

- (3) **Multiple indicators of position/location in the depicted scene**. These instances warrant **2 internal text segments**.

### Example:

1. "The jar is *on* the table *next to* the salt"  
a. 2 text segments. "The jar is on the table | next to the salt"
2. "The man is sitting *on* the couch *in front of* the TV."  
a. 2 text segments. "The man is sitting on the couch | in front of the TV"
3. "There is a rope *around* the pole *in* the courtyard"  
a. 2 text segments: "There is a rope *around* the pole | *in* the courtyard"

## Formatting Example

Appears to be nine men. | Seven of them with their backs turned to me [0m15s]. | Framing what I think is a house. | There's one gentleman with a saw | he seems to be cutting | and three of the gentleman framing a roof |[0m30s]. Five of them seem to put siding on the house. | The house seems to have one window, | one door |. There is a house in the background | with a fence | in between the two homes [0m45s]. | One gentleman is walking on scaffold. | One gentleman is on a ladder [1m00s]. Only one guy has a safety helmet on |. Three of them have baseball caps [1m15s] and two guys have the same hat. | Two of the guys don't have any hat. | There's trees in the background. | Again it looks like a warm day, nobody has a jacket on | [1m30s]. The sky is partly cloudy |. "Barricade" is written on the material they are building on |. There's also a sign | that says [1m45s] ideal | and there is a number on it | "8654912" [2m00s]. Seems to be sand or dirt on the foundation. | I see a green | rope. | I see [2m15s] beige | siding | that is going to be going on the house, | already started. | To the right [2m30s] it looks like the front door | where the front door will be. | Looks like there might be a slight | breeze | the trees seem to be [2m45s] going back and forth. | Two of the gentleman have suspenders on | holding up their pants.