The Functions of Autobiographical Memory: An Integrative Approach

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Abstract

Recent research in cognitive psychology has emphasized the uses, or functions, of autobiographical memory. Theoretical and empirical approaches have focused on a three-function model: autobiographical memory serves *self*, *directive*, and *social* functions. In the reminiscence literature, other taxonomies and additional functions have been postulated. We examined the relationships between functions proposed by these literatures, in order to broaden conceptualisations and make links between research traditions. In Study 1, we combined two measures of individual differences in the uses of autobiographical memory. Our results suggested four classes of memory functions, which we labelled Reflective, Generative, Ruminative, and Social. In Study 2, we tested relationships between our four functions and broader individual differences, and found conceptually consistent relationships. In Study 3, we found that memories cued by Generative and Social functions were more emotionally positive than were memories cued by Reflective and Ruminative functions. In Study 4, we found that reported use of Generative functions increased across the lifespan, while reported use of the other three functions decreased. Overall, our findings suggest a broader view of autobiographical memory functions that links them to ways in which people make meaning of their selves, their environment, and their social world more generally.

The Functions of Autobiographical Memory: An Integrative Approach

Theoretical perspectives across a range of traditions have suggested that we use our autobiographical memories to develop a coherent sense of our selves, our emotions, our future plans, and our relationships with other people (Bluck & Alea, 2008; Conway, 2005; Conway & Pleydell-Pearce, 2000; Habermas, 2007; Habermas & de Silveira, 2008; McLean & Pasupathi, 2006(?); Olivares, 2010; Pasupathi, 2006). Because of the rich role of autobiographical memory in daily life, the ways people use their memories is relevant across cognitive (e.g., Conway, 2005), clinical (e.g. Berntsen & Rubin, 2007), developmental (e.g. Kulkofsky, 2011), social (e.g. Beaman, Pushkar, Etezadi, Bye, & Conway, 2007; Goddard, Dritschel, & Burton, 1997), and personality psychology (e.g. Habermas, 2007; McLean, 2005). Here, we define *function* as "reasons for remembering" or "uses of autobiographical memory" or "motivations for remembering", consistent with explicit definitions in the cognitive memory functions literature (e.g. Bluck & Alea, 2011; Bluck, Alea, Habermas, & Rubin, 2005). That is, we do not necessarily equate function with "adaptiveness", nor make strong claims about the adaptive vs. maladaptive nature of the reasons that people give for thinking about or talking about the past, (although we return to this point and issues with determining "adaptiveness" in the Discussion).

The primary aim of the current paper is to broaden and enrich existing conceptualisations of autobiographical memory functions. We consider models of the functions of autobiographical memory from different literatures and how these proposed functions might relate to each other, as well as how they might relate to other individual differences and motivations. Across four studies, our data suggest that previously identified memory functions cluster together in meaningful ways, consistent with four distinct classes which we label Reflective, Generative, Ruminative, and Social functions. These four classes of functions are based on well-established concepts in social and personality psychology. Therefore this conceptualisation helps to integrate the functions of autobiographical memory with broader literatures, and suggests that the way people use their memories may reflect more general individual differences or motivations. We first describe two of the existing models of memory functions and their theoretical and empirical foundations.

The Cognitive Approach: The Three-Function Model

According to prevailing theory in the cognitive autobiographical memory literature, autobiographical memory serves three major functions (e.g., Bluck et al., 2005; Cohen, 1998;

Pillemer, 1992). The first is a *self* or identity or psychodynamic function: we remember events from the past because our memories tell us about who we are, as an individual that is consistent over time (Bluck & Alea, 2008; Conway, 2005; Wilson & Ross, 2010). The second is a *directive*, or problem-solving function: we recall events from the past in order to learn a lesson, to solve a current problem, or to guide and plan into the future (Pillemer, 2003). The third is a *social* or communicative function (Alea & Bluck, 2003; Pillemer, 1998): we remember events from the past in conversation with other people because telling about ourselves and hearing about others helps to build and maintain intimacy in relationships (Alea & Bluck, 2007; Harris, Keil, Sutton, Barnier, & McIlwain, 2011; Pasupathi, 2001; Pasupathi, Stallworth, & Murdoch, 1998; Weldon, 2000).

Operationalisation: The TALE

The three-function model is predominant in the cognitive tradition, and the three functions have most typically been operationalised using the Thinking About Life Experiences questionnaire (TALE; Bluck et al., 2005; Rasmussen & Berntsen, 2010; Rasmussen & Habermas, 2011), which has recently been substantially revised (see Bluck & Alea, 2011). We refer to this revised version as TALE-R. In order to stimulate empirical investigation of memory functions, Bluck et al. (2005) developed the Thinking About Life Experiences questionnaire (TALE), with the aims of validating the theorised three-function model of autobiographical memory and measuring the frequency with which people use their memory for these different functions. Using a "top-down" approach in which theory guided item development, Bluck et al. (2005) generated 28 items that they considered addressed self, directive, and social functions, and asked participants to make "frequency" ratings in response to each item. They then conducted factor analyses to test whether these items grouped as predicted into three factors. The results indicated that the three-function model was generally supported, with some unexpected complexities. The "self" function was narrow and included only items developed to assess self-continuity. The "directive" function was broader than expected and included items related to both identity and emotional regulation (see also Williams, Conway & Cohen, 2008). The "social" function split into two factors, which Bluck et al. related to the development of new relationships and nurturing of existing relationships (but, for a different interpretation of these two social factors, see Rasmussen & Habermas, 2011). In the subsequent revised version of the TALE (TALE-R; Bluck & Alea, 2011), the self function was named "Self-Continuity" to emphasise its more specific focus, the directive function was narrowed to only include "Directing Behaviour" items (with self-focused and emotion regulation items removed), and

the social function was named "Social-Bonding" and included building new relationships, whereas items related to empathising with or helping others were removed.

The Reminiscence Approach

While the three-function model and the TALE as a measurement tool have proven relatively robust and provided important insights into the uses of autobiographical memory (e.g., Rasmussen & Berntsen, 2010), there is good reason to think that this view may not capture the full range of ways that people use their memories in day-to-day life. The reminiscence literature, with its psychodynamic origins and lifespan perspective, offers several alternative taxonomies of individual differences in the functions of thinking and talking about the past, particularly in older adulthood (see Bluck & Alea, 2002; Watt & Wong, 1991; Webster, 1998; Webster & Cappeliez, 1993; Wong & Watt, 1991). These reminiscence functions may capture a broader and richer range of the ways in which people use their memories (see Webster, 2003), because it suggests a number of additional reasons or motivations for thinking and talking about the past. Taxonomies in this literature have generally been developed using a combination of theoretical and empirical work, with a high degree of overlap in the functions suggested by different authors (e.g., Cappeliez, O'Rourke & Chadbury, 2005; Webster, 2003; Webster & Haight, 1995; Wong & Watt, 1991).

Operationalisation: The Reminiscence Functions Scale

Particularly well validated is the Reminiscence Functions Scale (RFS; Webster, 1993), which measures the frequency with which people think and talk about the past for eight different functions: (1) Problem Solving, (2) Identity, (3) Conversation, (4) Boredom Reduction, (5) Intimacy Maintenance, (6) Death Preparation, (7) Teach/Inform, and (8) Bitterness Revival. These functions were developed based on both theorised memory functions and a more "bottom-up" approach in which participants answered open-ended questions about why they reminisce (Webster, 1994). Based on a secondary factor analysis, Webster (2003) further suggested that these eight functions could be mapped on to two dimensions: (1) social vs. self oriented; and (2) reactive/loss oriented vs. proactive/growth oriented. In the resulting 2 × 2 "circumplex" model, the functions fit within four quadrants (see Figure 1): Problem Solving and Identity functions fit within the "self-growth" quadrant, Conversation and Teach/Inform fit within the "social-growth" quadrant, Boredom Reduction and Bitterness Revival fit into the "self-loss" quadrant, and Intimacy Maintenance and Death Preparation fit into the "social-loss" quadrant (Webster, 2003). Although these functions

come from a reminiscence tradition, the items and the scale were developed using lifespan samples (see Webster, 1993).

Integrating Traditions

It is clear that research on memory functions in both the autobiographical memory and the reminiscence literatures is attempting to explain and measure at least some of the same phenomena (see also Cappeliez et al., 2005; Webster, 2003). A number of different theoretical claims have been made about how the memory functions from the two traditions might be related (Bluck & Alea, 2002; Cappeliez et al. 2005). However, it currently remains unclear how the dominant three-function model from the autobiographical memory literature fits with the additional functions suggested by the reminiscence literature. To examine this further, in the current studies we combined the TALE-R and RFS, as they are the two scales that we believe to be the best validated and most commonly used measures from the autobiographical memory and reminiscence literatures. Conceptually, the Problem Solving, Identity, and Conversation functions measured by the RFS map respectively onto the Directive, Self, and Social functions measured by the TALE-R.

Bluck et al., (2005) reported intercorrelations between the TALE subscales and the RFS subscales. While these conceptually overlapping functions did indeed intercorrelate the most strongly, the majority (24 out of 32) of the correlations were significantly positive. In regards to the five additional RFS functions, Bluck and Alea (2002) argued that Webster's (1993) Death Preparation function was subsumed by the *self* function, and that Webster's (1993) Teach/Inform and Intimacy Maintenance functions were subsumed by the *social* function, while Webster's (1993) Boredom Reduction and Bitterness Revival functions did not readily fit into the three-function model (see also Kulkofsky, Wang, & Hou, 2010; McLean & Lilgendahl, 2008). In contrast, Cappeliez et al. (2005) developed a different model of these relationships, in which Death Preparation, Boredom Reduction, and Bitterness Revival were subsumed by the *self* function; Teach/Inform was subsumed by the *directive* function; and Intimacy Maintenance was subsumed by the *social* function. But so far, no research has directly tested these relationships, and whether the three-function model does cover these additional functions.

More strongly, as introduced above, there is a conceptual tension between these two approaches to measuring the uses of autobiographical memory. In Webster's (2003) 2×2 model of the functions, Identity, Problem Solving, and Conversation functions all lay very close to each other and occupied the extreme end of the proactive/growth dimension (see Figure 1). Thus, assuming

that these are essentially the same as the *self*, *directive*, and *social* functions from the autobiographical memory literature and measured by the TALE-R, it appears that the three-function model only captures the uses of autobiographical memory that are more positively valenced, at least according to Webster's (2003) conceptualisation of this dimension. On the other hand, the remaining RFS factors spread along the range of this reactive/loss-proactive/growth dimension, and some appear more negative in valence. That is, there is reason to think that there are a broader range of positively and negatively valenced ways of using memories of the past, and that this range is not fully captured by the three-function model of autobiographical memory functions (see also Webster & McCall, 1999, Wong & Watt, 1991).

Another reason to think taxonomies from the reminiscence literature capture a broader range of memory functions comes from studies on age differences. Using the TALE, Bluck and Alea (2009) found that younger adults gave higher ratings on both Self-Continuity and Directing Behaviour functions than older adults, with no age differences for Social-Bonding functions (Bluck & Alea, 2009). One implication of these results is that, based on the three-function model, older adults generally report lower frequencies across all memory functions. Consistent with these findings, Webster and McCall (1999) found that younger adults rated the reminiscence functions Identity, Problem Solving, Boredom Reduction and Bitterness Revival higher than older adults did, whereas ratings of Conversation and Intimacy Maintenance did not differ across age groups. However, importantly, there were two reminiscence functions that were rated higher in the older age group, namely Death Preparation and Teach/Inform, suggesting that older adults may think and talk about their memories for different reasons than do younger adults (see also Rybash & Hrubi, 1997), and that those functions that become increasingly important with age are not captured by the three-function model.

Overview of the Studies

Across four studies, we examined the overlap and divergence between functions proposed in the autobiographical memory and reminiscence traditions using a number of different approaches. We aimed to understand how these functions related to each other, and how they might relate to other individual differences and motivations. In Study 1, we combined items on the TALE-R and the RFS in a factor analysis. We examined how the functions measured in these two traditions clustered together. We conceptualised the resulting four classes of memory functions as Reflective, Social, Ruminative, and Generative. We conducted the subsequent studies to build on this

conceptualisation and to explore the nature of the these four classes of memory functions. In Study 2, we tested the relationship between memory functions and other non-memory individual differences and motivations. In Study 3, we examined whether these functions produced different memory content, particularly in terms of emotional valence. Finally in Study 4, we used a large stratified sample to examine changes in how people reported using their memories across the lifespan. Specifically, we examined whether there were functions of autobiographical memory that were particularly important for older adults.

Study 1

Our first aim was to examine the relationship between memory functions measured by the TALE-R vs. the RFS, to see how functions clustered together and which might be considered related to each other. Based on previous theory (as noted above), a number of alternative hypotheses for these relationships were possible. Because of these competing hypotheses, our analysis, while driven by existing literature, remained exploratory.

Method

Participants and procedure. Two hundred and thirty-six (198 females and 38 males, mean age 24.69 years, $SD = 5.63$, range 19-63 years) undergraduate students from Aarhus University, Denmark, participated in this study. Participants were recruited in two ways. One hundred and thirty six participants participated during class as part of a psychology research methods course. The data for these participants were collected as part of a larger study (see Rasmussen & Berntsen, 2009; 2010), in which participants completed a number of "pen and paper" questionnaires, including the TALE-R and the RFS[1]. For the current study, we report previously unreported data relating to the combination of the TALE-R and the RFS. A further 100 participants, who had signed up to be contacted regarding research opportunities, were emailed and invited to complete the study online by following a link in the email. These participants completed a number of questionnaires online, including the TALE-R and the RFS, all in one session (see also Study 2). All participants were informed that their responses were anonymous and that they were free to withdraw at any point during the procedure.

Materials. For the two questionnaires described below, we developed and administered our own Danish version. Danish questionnaires were developed by a process of translation, independent

back-translation, and discussion by Danish-English bilinguals, to ensure fidelity with the English version. These Danish versions have previously been used and validated in Danish samples (Rasmussen & Berntsen, 2010; Rasmussen & Habermas, 2011).

Thinking About Life Experiences Revised Questionnaire. The TALE-R (Bluck & Alea, 2011) addresses the *self* (Self-Continuity), *directive* (Directing Behaviour), and *social* (Social-Bonding) functions of autobiographical memory as motivations for thinking and talking about the past. This 15-item scale has three subscales, each consisting of five items related to one of the three functions. The instructions are: "Sometimes people think back over their life or talk to other people about their life - it may be about things that happened quite a long time ago or more recently. We are not so interested in the times that you think back over specific events as in when and how you bring together and connect the events and periods of your life" (Bluck et al., 2005, p. 97). This instruction is followed by a stem statement for the function items: "I think back over or talk about my life or certain periods of my life…". Participants rate items on 5-point scales (1 = *almost never*, 5 = *very frequently*). The reliabilities as measured by Chronbach's alpha were acceptable (.822 for the self-function, .797 for the directive function, and .789 for the social function).

Reminiscence Functions Scale. This 43-item scale (Webster, 1993; 1997) addresses eight different reminiscence functions: Identity (6 items), Problem Solving (6 items), Conversation (5 items), Teach/Inform (5 items), Death Preparation (6 items), Boredom Reduction (6 items), Intimacy Maintenance (4 items), and Bitterness Revival (5 items). The instructions are: "At different points throughout their lives, most adults think about their past. Recalling earlier times can happen spontaneously or deliberately, privately or with other people, and may involve remembering both happy and sad episodes. The process of recalling memories from our personal past is called reminiscence, an activity engaged in by adults of all ages. This questionnaire concerns the why, or functions of reminiscence…" (Webster, 1993). This instruction is followed by the stem statement: "When I reminiscence it is to…". Participants rate items on 6-point scales (1 = *never*, 6 = *very frequently*). We also amended the wording of two RFS items to make them relevant across samples regardless of age. Specifically, we changed the Death Preparation item, "Because it gives me a sense of personal completion or wholeness as I approach the end of my life" to "Because it gives me a sense of personal completion or wholeness", and the Teach/Inform item "To teach younger family members what life was like when I was young and living in a different time" to "To teach

younger family members what life was like when I was young". The reliabilities as measured by Chronbach's alpha were acceptable (.880 for Identity, .857 for Problem Solving, .826 for Conversation, .780 for Teach/Inform, .810 for Death Preparation, .874 for Boredom Reduction, .821 for Intimacy Maintenance, and .876 for Bitterness Revival).

Results

Analysis strategy. First, we conducted factor analyses on the TALE-R items and the RFS items separately, to test whether we replicated the established factor structures for these measures. Next, we studied the relationship between the two scales and the memory functions they measure, by conducting a second-order factor analysis on the subscales of the two questionnaires.

Factor analysis of original scales. For the 15 TALE-R items, initial analyses indicated that they were not normally distributed. Hence, we conducted Principle Axis Factoring (as per the recommendations of Costello & Osborne, 2005), and we used a varimax rotation to maximize the extent to which each item loaded on a single factor. We fixed a 3-factor solution to match the three factors identified in previous research (Bluck & Alea, 2011). This 3-factor solution accounted for 48.59% of the variance. The items divided as expected into three separate factors, such that all the "Self-Continuity" items loaded on Factor 1, all the "Directing Behaviour" items loaded on Factor 2, and all the "Social-Bonding" items loaded on Factor 3. Thus we replicated the factor structure reported by Bluck and Alea (2011).

For the 43 RFS items, initial analyses indicated that they were not normally distributed. Hence, we conducted Principle Axis Factoring, and we used a varimax rotation to maximize the extent to which each item loaded on a single factor. We fixed an 8-factor solution to match the eight factors identified in previous research (Webster, 1993; 2003). This 8-factor solution accounted for 57.63% of the variance. We generally found support for the existing factors, with most items clustering as expected. All the "Identity" and "Problem Solving" items loaded on Factor 1, as well as one "Teach/Inform" item. The "Boredom Reduction" items (except for one) loaded on Factor 2. All the "Bitterness Revival" items loaded on Factor 3. The "Death Preparation" items (except one) loaded on Factor 4, as well as the additional Boredom Reduction item. The "Conversation" items loaded on Factor 5. The remaining "Teach/Inform" items all loaded on Factor 6. All the "Intimacy Maintenance" items loaded on Factor 7. Finally, only the remaining "Death Preparation" item loaded clearly on Factor 8. Thus, in this young adult population, we by-and-large replicated the

factor structure reported by Webster (1993), including the overlap in the Identity and Problem Solving factors previously reported.

Relationship between scales. To examine the relationship between the memory functions measured by the TALE-R and those measured by the RFS, we calculated scores for each participant on each of the 11 total TALE-R and RFS subscales by computing the average across the items belonging to each subscale (and keeping all items with their respective subscales regardless of the previous factor analyses), since these are both previously validated measures. Then we conducted simple correlations on the subscale scores, as done by Bluck et al. (2005) when they developed the original TALE questionnaire. As they found, scores on most of the subscales from the two questionnaires correlated significantly with each other (see Table 1), indicating that the scales at least partially overlap. Replicating Bluck et al.'s (2005) findings, the magnitude of the correlations also suggested that the strongest overlap was between subscales that were conceptually similar. The TALE-R Self-Continuity subscale was correlated strongly with the RFS Identity subscale ($r = .606$), the TALE-R Directing Behaviour subscale was correlated strongly with both the RFS Identity ($r = .583$) and RFS Problem Solving subscales ($r = .662$), and the TALE-R Social-Bonding subscale was strongly correlated with the RFS Conversation subscale ($r = .543$).

We then conducted a second-order factor analysis – using the 11 subscale scores – to determine overlap and groupings among the subscales from the two measures (see Webster, 2003, for a similar analysis strategy). We extracted factors using Principle Axis Factoring, as preliminary analyses indicated that scores on the subscales were not normally distributed (see Costello & Osborne, 2005). Directly following Webster's (2003) analyses, we used a varimax rotation to maximize the extent to which each item loaded on a single factor[2], and we set an eigen-value criterion of 1 since we did not have an a priori prediction about how many factors would emerge. As described above, a number of alternative hypotheses were possible regarding how the subscales would cluster together.

This analysis resulted in a four factor solution (see Table 2)[3], largely consistent with the four quadrants in Webster's (2003) 2 x 2 circumplex model (see Figure 1). This 4-factor solution accounted for 53.11% of the variance. The first factor included the TALE-R Self-Continuity and Directing Behaviour subscales, as well as the RFS Identity and Problem Solving subscales. The second factor included the TALE-R Social-Bonding subscale and the RFS Conversation subscale. The third factor included the RFS Boredom Reduction, Bitterness Revival, and Intimacy

Maintenance subscales. The fourth factor included the RFS Death Preparation and Teach/Inform subscales.

We speculated that these four functions could be linked to broader individual differences and motivations, both because of prior theory and research linking autobiographical memory and broader individual differences (e.g. Sutin, 2008; Teasdale & Green, 2004), and because motivations for thinking and talking about the past are likely to be linked to more general motivations for thought and behaviour. We conceptualised Factor 1 - encompassing the Self-Continuity/Identity and the Directing Behaviour/Problem Solving subscales from the TALE and the RFS - as *Reflective* functions of autobiographical memory, indicating a tendency to use memory to understand more about one's self and one's behaviour. We conceptualised Factor 2 - encompassing the Social-Bonding subscale from the TALE and the Conversation subscale from the RFS - as *Social* functions of autobiographical memory, indicating a tendency to use memory to interact with others and to build social relationships. We conceptualised Factor 3 - encompassing the Boredom Reduction, Bitterness Revival, and Intimacy Maintenance subscales from the RFS - as *Ruminative* functions of autobiographical memory, indicating a tendency to use memory to dwell on sadness or loss. We conceptualised Factor 4 - encompassing the Teach/Inform and the Death Preparation subscales from the RFS - as *Generative* functions of autobiographical memory, indicating a tendency to use memory to feel a sense of fulfilment and to leave a legacy.

Summary and Discussion

In Study 1, we examined the way that functions identified in the autobiographical memory and the reminiscence literatures clustered together. Our analysis supported four general classes of memory functions, consistent with the four quadrants proposed by Webster (2003; see Figure 1), which we labelled Reflective, Ruminative, Social, and Generative.

We adopted the concepts of "Reflection" and "Rumination" from the clinical literature on self-focused attention, of which autobiographical memory or reminiscing might be considered one possible kind. Reflection and Rumination are argued to represent dispositional differences in the motives with which people engage in self-relevant thought (Silvia, Eichstaedt & Phillips, 2005; Trapnell & Campbell, 1999). Reflection refers to "intellectual self-attentiveness", or to "epistemic curiosity" about the self; self-focused attention that is motivated by an interest in one's self and one's behaviour (Trapnell & Campbell, 1999). Rumination refers to "neurotic self-attentiveness"; self-focused attention that is motivated by perceived threats and losses (Trapnell & Campbell,

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1999). Rumination is distinguished from reflection by its passive focus on the causes and consequences of negative events, rather than active problem-solving (Nolen-Hoeksema, 1991). Thus, these traits appeared conceptually similar to two of our classes of memory functions: Factor 1 - encompassing subscales relating to Self or Identity functions and Directing Behaviour or Problem Solving functions - and Factor 3 - encompassing subscales relating to rehashing negative memories thinking of lost loved ones, and reducing boredom. The conceptual link between self-focused attention and these two factors in particular is supported by the fact that these two factors incorporated subscales that lay towards the "Self" end of Webster's (2003) "Self-Social" dimension (see Figure 1), although they represent much broader self-focused functions than simply developing a sense of identity or self-continuity.

The Social factor, encompassing both the TALE-R Social-Bonding subscale and the RFS Conversation subscale appeared the most simple to conceptualise. However, despite the predicted overlap between these two subscales, the items from the two source scales also appear to measure quite different aspects of social remembering. The TALE-R focuses on relationship building, while the RFS focuses on more pragmatic, conversational functions. For this reason, we were unsure about the broader individual differences, dispositions, or motivations that this Social factor might tap into. Previous research using the TALE-R has been inconsistent regarding whether the Social-Bonding function is related to extraversion, for instance (Rasmussen & Berntsen, 2010). For this reason, we maintained a neutral "Social" label for this factor.

We adopted the concept of Generativity from research on "generative concern" as a motivation that becomes increasingly relevant across the lifespan (McAdams & de St. Aubin, 1992; McAdams, Diamond, de St. Aubin, & Mansfield, 1997). Generativity is defined as "concern for and commitment to the well-being of the next generation, as manifested in parenting, teaching, mentoring, and other behaviours and involvements that aim to contribute a positive legacy that will outlive the self" (McAdams et al., 1997, p. 678), and is linked to the motivation to be needed, to pass something to the next generation, to defy death, and to develop a sense of immortality (McAdams & de St. Aubin, 1992). By this definition, remembering for Teach/Inform and Death Preparation functions could be thought of as reflecting generative concern.

Study 2

In Study 2, we tested our conceptualisation of the four factors as related to broader individual differences in reflection, rumination, sociability, and generativity, as well as to emotional

regulation and mood. We included emotion regulation and mood measures because of the emotionally valenced nature of our conceptualisations of the functions, particularly Reflective and Ruminative (see also Webster's 2003 conceptualisation; Figure 1). We predicted that scores on our Reflective factor would be positively correlated with measures of trait reflection and emotion regulation, that scores on our Social factor would be positively correlated with measures of social relationships, that scores on our Ruminative factor would be positively correlated with measures of trait rumination, and that scores on our Generative factor would be positively correlated with measures of generative concern.

Method

Participants and procedure. One hundred (83 females and 17 males, mean age 23.29 years, *SD* = 6.20, range 19-63 years) undergraduate students from Aarhus University, Denmark, participated in this study[4]. These participants were a subset of participants from Study 1, and were specifically the 100 participants who completed the TALE-R and RFS online in Study 1. They completed several additional questionnaires in addition to the two functions questionnaires (reported in Study 1), all in the same session. They participated voluntarily and did not receive any remuneration or inducement. All participants were informed that their responses were anonymous and that they were free to withdraw at any point during the procedure.

Materials. All participants completed Danish versions of the TALE-R and the RFS as described in Study 1, as well as Danish versions of the following additional measures. The order of the questionnaires was fixed for all participants – participants completed questionnaires in the order they are listed below. The RFS and the TALE-R ended the series of questionnaires.

Emotion Regulation Scale (ERQ). The ERQ (Gross & John, 2003) is a 10-item scale that measures individual differences in the tendency to engage in two different kinds of emotion regulation: Reappraisal (6 items), where people reduce the negative impact of an event by thinking about it differently; and Suppression (4 items), where people suppress the behavioural expression of negative emotion. Reappraisal is considered adaptive, and scores on this subscale are associated with positive mood, good interpersonal functioning, and general wellbeing (Gross & John, 2003). Suppression is considered maladaptive, and scores on this subscale are associated with negative emotion, poorer interpersonal functioning, and lower wellbeing (Gross & John, 2003). Participants

indicated on a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*) to what extent they agree with each item. Reappraisal items include "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm" and Suppression items include "I control my emotions by not expressing them". The reliabilities as measured by Chronbach's alpha were acceptable (.856 for Reappraisal subscale and .677 for Suppression), considering the low number of items in these subscales.

Loyola Generativity Scale (LGS). The LGS (McAdams & de St. Aubin, 1992) is a 20-item scale that measures individual differences in generative concern: that is, motivation for doing good in the world, for nurturing the next generation, and for pro-social behaviour. Participants indicate on a 4-point Likert scale (0 = *never applies*; 3 = *applies very often or nearly always*) to what extent each item applies to themselves. Items include "I feel as though my contributions will exist after I die" and "I have important skills that I try to teach others". The reliability as measured by Chronbach's alpha was acceptable (.738).

Social Provisions Scale (SPS). The SPS (Cutrona & Russell, 1987) is a 24-item scale that measures the quality of social relationships in terms of 6 dimensions: Attachment, Social Integration, Opportunity for Nurturance, Reassurance of Worth, Reliable Alliance, and Guidance. Participants indicate on a 4-point Likert scale (1 = *strongly disagree*; 4 = *strongly agree*) to what extent they agree with the items. Items include "I have close relationships that provide me with a sense of emotional security and well-being" (Attachment), "I feel part of a group of people who share my attitudes and beliefs" (Social Integration), "I feel personally responsible for the well-being of another person" (Opportunity for Nurturance), "I have relationships where my competence and skill are recognized" (Reassurance of Worth), "There are people I can count on in an emergency" (Reliable Alliance), and "There is someone I could talk to about important decisions in my life" (Guidance). The reliabilities of these subscales as measured by Chronbach's alphas did not reach an acceptable level for all subscales (.627 for Attachment, .720 for Social Integration, .817 for Opportunity for Nurturance, .644 for Reassurance of Worth , .487 for Reliable Alliance, and .698 for Guidance). These lower alphas are probably due to the low numbers of items in the subscales, but the results of this measure, and particularly of certain subscales, should therefore be interpreted with caution.

Rumination-Reflection Questionnaire (RRQ). The RRQ (Trapnell & Campbell, 1999) is a 24-item scale that measures the extent to which people engage in two forms of self-focused attention: rumination (first 12 items) and reflection (second 12 items). Participants indicate on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*) to what extent each item is true of themselves. Rumination items include "I always seem to be "re-hashing" in my mind recent things I've said or done", and Reflection items include "I often love to look at my life in philosophical ways". While research has supported the distinction between Rumination and Reflection, scores on each subscale are also often positively correlated (e.g. Teasdale & Green, 2004 Thomsen, Tønnesvang, Schnieber, & Olesen, 2011). The reliabilities as measured by Chronbach's alphas were acceptable (.918 for Rumination, .897 for Reflection).

Positive and Negative Affect Schedule (PANAS). The PANAS (Watson, Clark, & Tellegen, 1988) is a 20-item scale with two dimensions that measure current mood in terms of positive and negative affect. Each dimension is represented by 10 words that describe either positive or negative feelings or emotions. Participants indicate on a 5-point Likert scale (1 = very slightly or not at all; 5 = extremely) to what extent they have felt as indicated by each item "during the past week including today". The reliabilities as measured by Chronbach's alpha were acceptable (.862 for Positive Affect and .852 for Negative Affect).

Results

Analysis strategy. We calculated correlations between our four classes of memory functions (identified in Study 1; measured by the TALE-R and the RFS) and the individual differences measures (i.e., ERQ, LGS, SPS, and RRQ; see Table 3). Because of the interpretation of multiple correlations, we adopted a conservative significance criterion ($p < .01$), and we focus our discussion on the strongest relationships and those for which we had a priori predictions. For the PANAS, there were no significant relationships with a $p < .01$ criterion (see Table 3).

Relationship between memory functions and individual differences.

Reflective. Most strongly, participants' scores on Reflective functions of autobiographical memory were correlated with the Reflection and Rumination subscales of the RRQ (see Table 3). These associations with the RRQ scales were consistent with our specific hypotheses, and the conceptualisation of this class of memory functions as "Reflective", particularly given prior

research suggesting that trait reflection and rumination are positively correlated. The Reflective function was also correlated with the Reappraisal subscale of the ERQ, but not the Suppression subscale, indicating that Reflective functions of memory may be associated with emotion regulation.

Social. Participants' scores on Social functions of autobiographical memory were less strongly correlated with the individual difference measures. None of the relationships were significant with a $p < .010$ criterion. That is, contrary to our specific predictions, scores on the Social function were not strongly correlated with scores on the SPS subscales (see Table 3).

Ruminative. Participants' scores on Ruminative functions of autobiographical memory were correlated most strongly with Rumination on the RRQ – in line with our specific predictions – and not with Reflection on the RRQ (see Table 3). This supports the conceptualisation of this class of memory functions as "Ruminative".

Generative. Participants' scores on Generative functions of autobiographical memory were correlated most strongly with their scores on the LGS, in line with our specific predictions, as well as with Reflection on the RRQ (see Table 3). This supports the conceptualisation of this class of memory functions as "Generative".

Summary

The pattern of relationships in Study 2 was generally consistent with the way we conceptualised the four classes of autobiographical memory functions – as linked with more general individual differences and motivations. The strongest correlations were between the measures we predicted would be related to each other for Reflective, Ruminative and Generative functions: The Reflective function correlated positively with reflection and reappraisal; the Ruminative function correlated positively with rumination, and the Generative function correlated positively with generative concern. Scores on the Social function were not clearly related to our measure of social relationships. We return to this in the General Discussion.

Study 3

In Study 3, used an alternative method to examine the nature of the memory functions.

Rather than focus on self-rated frequencies, we examined the valence and phenomenological qualities associated with memories cued by specific items from our four classes of memory functions, in contrast to the general cues used in previous work (e.g., Rasmussen & Berntsen, 2009). Based on previous literature, and on our conceptualisation of the factors, we particularly expected differences in terms of emotional valence. Rasmussen and Berntsen (2009) found that memories elicited for social functions were more positive than memories elicited for both self and directive functions. Thus we expected memories cued by Social functions to be more positive, and memories cued by Reflective functions to be more negative. Based on our conceptualisation of the Generative and the Ruminative functions, we expected memories cued by Generative functions to be more positive, and memories cued by Ruminative functions to be more negative.

Method

  Participants. Thirty-seven (31 females and 6 males, mean age 22.03 years, *SD* = 2.49, range 19-30 years) psychology undergraduates from Aarhus University, Denmark, participated in return for cinema tickets. All participants were informed that their responses were anonymous, that they should not elicit anything that was uncomfortable for them to disclose, and that they were free to withdraw at any point during the procedure.

  Materials. We used a subset of 32 items from the Danish versions of the TALE-R and the RFS as retrieval cues. For each of the four classes of memory functions – Reflective, Social, Ruminative, and Generative – we selected 8 items as cues. We selected an even number from each of the TALE and RFS source subscales. For the Social function, we added 2 additional items from the Social - Nurturing Relationships subscale from the original TALE (Bluck et al., 2005), in an attempt to cover a broader range of social functions (see Appendix A for item details and English versions of the 32 items).

  Procedure. Participants were tested in groups of between 2 and 8. They sat at individual computers. The experimenter told participants that they would be presented with a series of situations on the computer, and, for each one, they should think of an event from their lives that they would think about or talk about in the given situation. Participants were encouraged to think of specific events, to sample widely from their life, and to try not to repeat events if possible. The experimenter told participants that they should press the space bar as soon as they had the event in

mind. They would then be prompted to type a description of the event and to answer some questions about it.

Items were presented in a random order on the computer screen, along with the stem "What is a memory that you would think about or talk about…..". This prompt allowed us to use the items as memory cues without changing their wording from the frequency rating questionnaire (see Appendix A). At the bottom of the screen, an instruction appeared reminding participants to "Press the spacebar as soon as you have a memory in mind". When participants pressed the spacebar, they were prompted to type in a detailed description for the event, to report whether it was general or specific, to report how old they were in years at the time of the event, and to rate on 7-point Likert scales the memory's clarity (1 = *not at all clear*, 4 = *somewhat clear*, 7 = *extremely clear*), personal significance (1 = *not at all significant*, 4 = *somewhat significant*, 7 = *extremely significant*), rehearsal (1 = *not rehearsed at all*, 4 = *somewhat rehearsed*, 7 = *rehearsed a great deal*), and valence (1 = *highly negative*, 4 = *neutral*, 7 = *highly positive*). If participants did not press the spacebar, the item timed out after 1 minute, and the computer automatically presented the next item. The procedure was repeated until participants had completed all 32 items. This procedure took approximately 1 hour and 20 minutes.

Results

Analysis strategy. Across each of our measures – elicitation success, elicitation latency, memory specificity, age at time of event, rated clarity, rated significance, rated rehearsal, and rated valence – we conducted a series of univariate 4-level (function: Reflective vs. Social vs. Ruminative vs. Generative) ANOVAs. We present the means and standard deviations for our 8 measures in Table 4, as well as the *F* values, significance levels, and effect sizes from our statistical tests. The *p* values reported for follow-up comparisons below were adjusted to include Bonferroni corrections for multiple comparisons.

Memory characteristics. Of most interest to our hypotheses, there were significant differences between the rated emotional valence of memories elicited for the four different functions. Memories elicited for both Reflective and Ruminative functions were rated as less positive than memories elicited for Generative functions (adjusted $p = .022$ and $p = .031$, respectively), and similarly, memories elicited for both Reflective and Ruminative functions were rated as less positive than memories elicited for Social functions (adjusted $p = .010$ and $p = .007$,

respectively). Overall, these results indicate that memories elicited for Generative and Social functions were rated as more positive than memories elicited for Reflective and Ruminative functions (see Table 4).

There were additional differences in the phenomenological characteristics of memories elicited for the different functions. Memories elicited for Generative functions were significantly older than memories elicited for Reflective (adjusted p = .002) and Social functions (adjusted p = .005, all other ps > .383). Memories elicited for Ruminative functions had higher clarity ratings than memories elicited for Generative functions (adjusted p = .020), whereas memories elicited for Reflective functions had a higher personal significance rating than memories elicited for Generative functions (adjusted p = .001). Finally, memories elicited for Generative functions had lower rehearsal ratings than memories elicited for Reflective (adjusted p = .051), Ruminative (adjusted p = .001), and Social functions (adjusted p = .002). There were no significant differences in memory specificity and elicitation latency between the four memory functions.

Summary and Discussion

In general, while there were some differences in the qualities of memories elicited for the different functions, the clearest and most consistent differences were in terms of emotional valence: Consistent with our predictions and with our conceptualisation of the classes of memory functions, Social and Generative functions elicited more positive memories than Reflective and Ruminative functions. These valence differences did not appear to be driven by differences in other characteristics. These findings also suggested an important distinction between frequency ratings and content of memories when conceptualizing the positive vs. negative nature of memory functions, an issue we return to in the General Discussion.

Study 4

In Study 4, we were interested in changes in the motivations for thinking and talking about the past across the lifespan, and whether such changes were consistent with our conceptualisation of the four classes of memory functions. There are a number of reasons to think that the functions of autobiographical memory shift with age. First, early adulthood is a time of identity development (e.g. Erikson, 1950; Fitzgerald, 1988; Habermas & Bluck, 2000). Thus we might expect that younger adults engage in more Reflective remembering than older adults, since reflection is associated with both constructive self-focused attention and with the *self* and *directive* functions of

autobiographical memory. Second, the autobiographical memories of older adults exhibit a positivity bias such that older adults remember more positive events and fewer negative events than do younger adults (Charles, Mather, & Carstensen, 2003; Kennedy, Mather, & Carstensen, 2004; Mather & Carstensen, 2005), and older adults engage in less rumination than younger adults (Sütterlin, Paap, Babic, Kübler & Vögele, 2012). Thus, we might expect that older adults engage in less Ruminative remembering, since rumination is associated with negative self-focused attention, and with revisiting past hurts and losses. On the other hand, generative concern is considered to be of increasing importance from mid-late adulthood (McAdams, de St. Aubin & Logan, 1993). Thus we might expect that older adults engage more in Generative remembering. Previous findings using both the TALE and the RFS have been generally consistent with these predictions (e.g., Bluck & Alea, 2009; Rybash & Hrubi, 1997; Webster & McCall, 1999). Thus, we expected that scores on Reflective and Ruminative functions would decrease across the lifespan, that scores on Social functions may not change, and that scores on Generative functions would increase across the lifespan, consistent with previous findings and with the way we had conceptualised the four factors.

Method

Participants and procedure. Five hundred and twenty women and 509 men completed this survey (total $n = 1029$) as part of a larger set of questionnaires. Women were aged between 20 and 70, with average age 45.76 years ($SD = 14.32$). Men were also aged between 20 and 70 years, with average age 46.15 years ($SD = 14.26$). The data were collected by TNS Gallup via an internet based questionnaire. The sample was stratified with respect to *age*, *gender*, *geography*, and *education*. Additional questionnaires (for a different study) were administered at the same time, and they are not reported here[5]. To study changes across the lifespan, we split our participant sample into age-based quartiles. Details of these quartiles and participant demographics are presented in Table 5.

Materials. We administered a questionnaire using a combination of items from the Danish TALE-R and RFS. Because of constraints on the length of the questionnaire, we could not administer both scales in their entirety. Hence, we constructed a 39 item questionnaire which included: (1) all 15 items from the TALE-R, across the Directing Behaviour (5 items), Self-Continuity (5 items) and Social Bonding (5 items) factors; and (2) selected items from the RFS, across the Identity (2 items), Problem Solving (2 items), Conversation (4 items), Teach/Inform (4 items), Death Preparation (4 items), Boredom Reduction (3 items), Intimacy Maintenance (2 items),

and Bitterness Revival (3 items) factors. This yielded: Reflective (14 items), Social (9 items), Ruminative (8 items), and Generative (8 items; see Study 1). The RFS items were the subset that were also used in Study 3 and that had the highest loadings on their respective subscales in Study 1 (see Appendix A).

The instructions were the same for all items, regardless of source questionnaire: "Sometimes people think back on or talk to other people about their memories. It can be about events or experiences that happened very long ago or more recently. In the following questions, we present some different reasons why you think about or talk about your memories. Mark on the scale for each question to indicate how often you think back on or talk about your memories with the given purpose." This was followed by a stem statement: "I think about or talk to other people about my memories ...…". All items were rated on a 5-point scale (1 = *almost never*, 5 = *very often*).

Results

Analysis strategy. First, we conducted factor analysis to evaluate the clustering of subscales (from the TALE-R and the RFS) into four broader classes of functions as identified in Study 1, in this large, demographically stratified sample. We calculated scores on the four classes of functions, and then used a mixed model ANOVA to first test for main and interaction effects of gender and age, and second, test for linear trends across age groups.

Factor Analysis. We conducted the same factor analysis as in Study 1 – using scores on the 11 subscales of the TALE-R and the RFS. We extracted factors using Principle Axis Factoring, as preliminary analyses indicated that scores on the subscales were not normally distributed (see Costello & Osborne, 2005). We used a varimax rotation to maximize the extent to which each item loaded on a single factor[6], and we fixed four factors. This four factor solution accounted for 62.08% of the variance (see Table 6 for factor loadings). The first factor replicated our Reflective class of functions, and included the TALE-R Self-Continuity and Directing Behaviour subscales, as well as the RFS Identity and Problem Solving subscales. The second factor replicated our Social class of functions, and included the TALE-R Social-Bonding subscale and the RFS Conversation subscale. The third factor was consistent with our Generative class of functions, and included the RFS Teach/Inform, Death Preparation, and Intimacy Maintenance subscales. The fourth factor was consistent with our Ruminative class of functions, and included the RFS Boredom Reduction and Bitterness Revival subscales. With the exception of the Intimacy Maintenance subscale, we

replicated our four factor solution in this large data set from a stratified sample. In the analyses below, we included the Intimacy Maintenance items with the Generative class of functions rather than the Ruminative class of functions. We return to discussing the nature of the Intimacy Maintenance memory function in the Discussion.

Age and gender differences on the four classes of functions. We conducted a 2 (Gender: female vs. male) × 4 (Age Quartile: 1 vs. 2. vs. 3 vs. 4) × (4) (Function Factor: Reflective vs. Social vs. Ruminative vs. Generative) mixed models ANOVA on participants' scores on the four functions. There was a marginally significant main effect of Gender, $F(1,1021) = 3.51$, $p = .061$, $\eta_p^2 = .003$, qualified by a small but significant interaction between Gender and Function, $F(3,1021) = 15.42$, $p < .001$, $\eta_p^2 = .015$. There were no significant interactions between Gender and Age Quartile, all Fs < 1.02, all ps > .429. Follow-up tests indicated that gender differences depended on function: women scored significantly higher than men only on Generative functions, $t(1027) = 4.427$, $p < .001$.

We also found significant main effects of Age Quartile, $F(3,1021) = 7.15$, $p < .001$, $\eta_p^2 = .021$, and Function Factor, $F(2,1021) = 666.35$, $p < .001$, $\eta_p^2 = .395$. The Age Quartile main effect indicated that, across functions, scores generally decreased with age; on follow-up comparisons Age Quartiles 1 and 2 scored higher than Age Quartiles 3 and 4 (adjusted ps < .008, with a Bonferroni correction). Follow up comparisons for the Function Factor main effect indicated that across age groups scores on the four functions were significantly different from each other (all adjusted ps < .001, with a Bonferroni correction): Social functions were reported most frequently (M = 2.80), followed by Reflective functions (M = 2.63), then Generative functions (M = 2.35), with Ruminative functions reported the least (M = 1.78; see Figure 2). However, these latter two main effects were moderated by an Age Quartile × Function Factor interaction, $F(9,3063) = 49.27$, $p < .001$, $\eta_p^2 = .126$.

We followed up on this Age Quartile × Function Factor interaction by obtaining Polynomial contrasts for Age Quartile, separately for each Function Factor. We were interested in whether there were significant linear trends across age groups. Across all four classes of functions – Reflective, Social, Ruminative, and Generative – there were significant linear trends (all Fs > 49.32, all ps <.001). The data (in Figure 2) indicated that the patterns were different for the different functions. Reported use of memory for Reflective, Ruminative, and Social functions decreased with age. This decrease appeared strongest for Reflective and Social functions, with a smaller decrease across age for Ruminative functions (see Figure 2). In clear contrast to the other three classes of functions,

reported use of memory for Generative functions increased with age (see Figure 2).

General Discussion

We studied the relationship between the three-function model of autobiographical memory, dominant in cognitive psychology, and a broader taxonomy of memory functions from the reminiscence literature, as well as the reported frequency of memory functions, the content of memories elicited for the different functions, and changes in function use across the lifespan. We aimed to identify patterns of overlap and divergence between these two different approaches, in order to develop broader conceptualisations of memory functions. Our factor analyses in Study 1 as well as our life span comparisons in Study 4 both indicated the value of incorporating additional functions from the reminiscence literature. Our analyses suggested that memory functions clustered together meaningfully into four overall classes, largely consistent with the four quadrants of Webster's (2003) circumplex model. This circumplex model covers both growth/proactive and loss/reactive ways of using autobiographical memory (see Figure 1; Webster, 2003). We interpreted these four classes of functions as (1) Reflective, (2) Social, (3) Ruminative, and (4) Generative. One advantage of our conceptualisation is that at least three of these four dimensions relate to well-established individual differences and motivations. Thus, the identified dimensions offer ways of linking different motivations for remembering the past and more general motivations. We discuss each of the four functions in turn.

Reflective Function

Our Reflective class of functions incorporated the Self/Identity and Directive/Problem Solving subscales from both the TALE-R and the RFS. We conceptualised it as "Reflective" because it resonated with other research on self-focused attention undertaken for different reasons or with different motives (Silvia, 2005). Reflection is self-focused attention motivated by curiosity or interest in one's self and one's behaviour (Silvia et al., 2005; Trapnell & Campbell, 1999). Reflection is considered a positive, adaptive form of self-focus, although it can involve thinking about negative events (Grossmann & Kross, 2010; Thomsen, Tønnesvang, Schnieber, & Olesen, 2011). Our conceptualisation of this factor was supported by our finding that higher self-reported frequency of Reflective remembering was associated with habitual reflection, as well as with the tendency to engage in adaptive reappraisal for emotion regulation (in Study 2). Interestingly, Reflective remembering was also associated with habitual rumination (in Study 2), and items on

this function also generated more negative memories (in Study 3). So while Reflective uses of memory might focus on more negative content, such a focus might have longer term benefits, at least in some circumstances or for some individuals (see also Watkins, 2008). Future research could focus on how these everyday Reflective uses of autobiographical memory fit with broader research on different motives for thinking about both positive and negative events. Nevertheless, the emergence of this Reflective class of memory functions suggests that motives for thinking about life events might be related to motives for thinking about the self more generally. Finally, the frequency of the Reflective functions decreased over the life span, consistent with previous research (Bluck & Alea, 2009; Webster & McCall, 1999), and with the notion that self-focused attention may be more relevant for younger adults particularly because of identity development.

The finding that self and directive functions clustered together in our analysis is consistent with a number of previous studies suggesting that these functions overlap (e.g. Bluck et al., 2005; Rasmussen & Habermas, 2011; Webster, 1993), or at least need to be very specifically operationalized in order to clearly differentiate (see Bluck & Alea, 2011; Rasmussen & Berntsen, 2009). In Webster's (2003) circumplex model, the Identity and Problem Solving factors of the RFS lie very close to each other, and occupy the self-growth quadrant of the 2×2 dimensional space (see Figure 1). Thus, our Reflective factor concords with this quadrant of the model. Examples used in the literature to illustrate *self* and *directive* functions are also often not clear cut. For example, Bluck et al. (2005) argued that autobiographical memory "can serve as an aid to solving problems and to the development of opinions and attitudes" (p. 93). While Bluck et al. (2005) classed this example under *directive* functions, developing opinions and attitudes is clearly also fundamental to one's sense of self-identity, and several of the *self* items in the original TALE addressed opinions and beliefs. Similarly, while emotion regulation and self-enhancement could be seen as self or identity related functions (Wilson & Ross, 2010), they could also be seen as problem-solving with regards to maintaining a particular affective status (see Bluck et al., 2005). Thus, even when inspecting the kinds of examples that are used for *self* and *directive* functions, it can be difficult to conceptually tease them apart, and our results suggest that they may be usefully considered together.

Social Function

Our Social class of memory functions incorporated the TALE-R Social-Bonding subscale and the RFS Conversation subscale. Items from this Social factor generated more positive memories (in Study 3), and this finding is consistent with other research demonstrating that positive memories

are generally enlisted to serve social and conversational functions (McLean & Lilgendahl, 2008; Rasmussen & Berntsen, 2010). Conversational goals encompassed by the RFS (e.g. "as a social lubricant to get people talking") are somewhat different in tone to the Social-Bonding functions encompassed by the TALE-R (e.g. "When I hope to also learn more about another person's life"), and thus the combination of items from both scales may cover a fuller range of social functions, including both simple conversational functions and deeper social bonding functions. Interestingly, (in Study 4), this class of functions had the highest frequency ratings across age groups, indicating that the Social functions of memory are particularly important in everyday life.

Our conceptualisation of this factor as capturing Social functions of memory was relatively straightforward – there was clear conceptual overlap between the Social-Bonding and Conversation subscales. However, frequency ratings on this function were not strongly related to our other individual difference measures, and particularly surprisingly, not strongly related to measures of quality of social relationships (in Study 2). Previous research has also found unexpectedly low relationships between the social uses of memory and personality traits like extraversion (Rasmussen & Berntsen, 2009). Future research is needed to investigate the complexities within this social factor, and what other individual differences it might be related to, in order to better understand the nature of social functions of memory.

Ruminative Function

Our Ruminative class of functions incorporated the Boredom Reduction, Bitterness Revival, and (in Study 1) Intimacy Maintenance subscales – all from the RFS. Thus this factor represents one class of memory functions that is not captured at all by the three-function model. We conceptualised this factor as "Ruminative", and it encompassed subscales higher on Webster's (2003) loss-related dimension. Rumination is self-focused attention motivated by perceived losses and threats (Silvia et al., 2005; Trapnell & Campbell, 1999), and thus conceptually related with Bitterness Revival and Intimacy Maintenance (thinking of people who have passed away), although less obviously with Boredom Reduction. Supporting our interpretation of this factor, we found that higher reported frequency of Ruminative remembering was associated with habitual rumination (but not reflection; in Study 2), and that items from this class of functions elicited more negatively valenced memories (in Study 3). Interestingly, these functions also had the lowest scores across the lifespan, and showed less change across age groups than the other functions (in Study 4).

One way of understanding why Boredom Reduction fits with this Ruminative factor comes

from recognizing that the scales that measured memory functions focus on frequency. While thinking of the past to 'fill the time' might not appear to be particularly negative behaviour, reporting that one engages in this behaviour "frequently" might be associated with lower well-being in terms of mood and with ruminative tendencies (as in Study 2). Thus, more research is needed to more clearly specify the nature of this Ruminative factor, and the commonalities between the items it includes. More generally, future research might focus on this distinction between individual differences in frequency of remembering for different functions, and other ways of conceptualizing the nature of the functions (e.g. the nature of the content generated).

In our factor analyses, Intimacy Maintenance proved the most difficult function to assign to one of our four functions. It loaded more strongly with Ruminative functions in Study 1, and with the Generative functions in Study 4. Inspecting Webster's (2003) circumplex model (Figure 1) helps to understand why this was the case. In this model, Intimacy Maintenance lies alone, virtually equidistant from the Teach/Inform-Death/Preparation cluster and the Boredom Reduction/Bitterness Revival cluster. Thus, this function may be somewhere "in between" the more positively valenced Generative function and the more negatively valenced Ruminative function. Perhaps the valenced nature of this function depends on the specific content that people think about to serve this function and the phenomenology of their remembering, as well as simply the frequency. For instance, complicated grief is characterized by persistent, intrusive memories of the deceased (Maccallum & Bryant, 2010). Further, the change in the clustering of this function from Study 1 (with young adults only) to Study 4 (with a stratified lifespan sample) suggests that the nature and meaning of this function may shift across the lifespan. Further research is required to more clearly determine the positive or negative nature of thinking about the past to maintain intimacy with people who have passed away, and the nature of this function across age groups.

Generative Function

Our Generative class of functions incorporated the Teach/Inform and Death Preparation subscales from the RFS, as well as the Intimacy Maintenance subscale (in Study 4). Thus this factor represents a second class of memory functions that is not captured by the three-function model. We conceptualised it as Generative because this cluster of items appeared related to the concept of "psychological generativity", which focuses on the motivation to create a legacy and have a positive impact on the world (McAdams et al., 1997). Generativity is argued to come from both individual and social motivations, particularly regarding the need for "symbolic immortality", "the need to be

needed", and culturally based expectations (McAdams & de St. Aubin, 1992). By this definition, thinking and talking about past experiences to teach others and to feel a sense of achievement in the face of mortality are clearly conceptually related to generativity, as is using memory to maintain a sense of contact with people who have passed away. Support for our conceptualisation comes from Study 2, in which scores on this function were associated with a measure of generative concern. Previous research has found that generative concern and action is associated with psychological well-being and with well-adjusted personality types (de St. Aubin & McAdams, 1995; Cox, Wilt, Olson, & McAdams, 2010). Consistent with this prior research and a positive interpretation of this function, we found that memories elicited to items from the Generative function were rated more emotionally positive (in Study 3). Converging evidence across studies support the conclusion that Generative functions of memory are distinct from both Reflective and Social functions, in contrast with previous speculation that these additional functions could be classified as either *self* or *social* (e.g. Bluck & Alea, 2002; Cappeliez et al., 2005).

Also consistent with our conceptualisation is the finding that scores on the Generative functions increased with age (in Study 4). Notably, the sharpest increase was between the first and second age quartiles, indicating that –like generative concern – these Generative memory functions become increasingly relevant from middle age (see McAdams et al., 1993). Including this function in our taxonomy of memory functions means that we are capturing those functions which are increasingly relevant for older adults. The positive nature of this class of functions is also consistent with other changes in autobiographical memory across the lifespan: older adults generally show a positivity bias in memory (Mather & Carstensen, 2005) and engage in less rumination (Sütterlin, Paap, Babic, Kübler & Vögele, 2012). Thus, our broader conceptualisation of autobiographical memory functions has more general applicability across the lifespan.

Our positive interpretation of the Generative factor is not entirely consistent with Webster's (2003) circumplex model, in which Teach/Inform lay towards the proactive/growth end of this dimension and Death Preparation lay towards the reactive/loss end, although both were relatively close to the mid-point (see Figure 1). Our findings suggested that these two functions were related, and were both generally positive in terms of their relationship with other measures and in the content they generated. It is possible that Webster's (2003) interpretation of this dimension as ranging from growth to loss is not the most accurate way of conceptualising it, and that a different interpretation is required. Future research could focus on how this factor is best interpreted and whether there is a role for individual differences in the positive vs. negative connotations of this

memory function for people, particularly regarding death preparation.

Additional Functions

The aim of our analysis was to study the relationship between memory functions posited in the autobiographical vs. reminiscence literatures – using the two most commonly used scales in these literatures. While our findings pointed to broader classes of memory functions, there may also be additional functions of memory that are not measured by either the TALE or the RFS. One particularly commonly theorised function that is not present in either scale is *emotion regulation -* the idea that we use our memories to help ourselves to repair negative emotions and maintain a positive mood (Joormann & Siemer, 2004; Pasupathi, 2003; Rusting & Dehart, 2000; Williams et al., 2008). A large literature supports a general "positivity bias" in autobiographical memory, presumably to assist emotion regulation (see, for instance, Walker, Skowronski, & Thompson, 2003), and this positivity bias becomes more pronounced in older age (e.g., Mather & Carstensen, 2005). A number of theorists and researchers have suggested that emotion regulation may be incorporated in the class of "Self" functions (e.g. Pasupathi, 2006; see also Williams et al., 2008). However, it is not clear that people who score highly on Identity functions would necessarily be those who score high on emotion regulation. Indeed, in the original TALE measure, Bluck et al., (2005) included some emotion regulation items, which they predicted would be part of the self function. Contrary to their expectations, these items loaded with the directive function (which also included a number of identity-relevant items; see Bluck et al., 2005), and emotion regulation could be reasonably hypothesised to be related to problem-solving. In developing and streamlining the TALE-R, emotion regulation items were excluded to try to separate the three functions more clearly (Bluck & Alea, 2011).

In the studies reported here, there was only one item that appeared to refer to emotion regulation – "to relieve depression", which comes from the Boredom Reduction factor of the RFS. In Study 1, when we analysed the RFS items to replicate the 8-factor model, this item did not load with the other Boredom Reduction items, and instead loaded with the Death Preparation items. In Study 2, people's scores on our measure of the tendency to engage in reappraisal for emotion regulation were associated with their scores on the Reflective class of functions. These results suggest that there may be a relationship between emotion regulation and a number of memory functions, but the emotion regulation function of autobiographical memory needs future research to determine whether it fits within existing conceptualisations or whether it represents a separate class

of functions. More generally, a broader conceptualisation of classes of memory functions should pave the way for identifying and exploring the nature of additional, as yet unidentified functions of autobiographical memory. Additionally, based on this conceptual work, future research may focus on further integrating these traditions and on developing new measures that index functions memory functions drawn from across literatures.

The basic conclusion to be drawn from the present series of studies is that the ways that people use their autobiographical memories may be conceptually similar to ways in which people make meaning more generally of their selves, their environment, and their social world.

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Author note

Footnotes

1. Additional measures administered at the same time included the *Autobiographical Memory Questionnaire* answered for five different memories, the *Centrality of Event Scale* answered for five different memories, the *NEO Five Factor Inventory*, the *Positive Affect and Negative Affect Scale* and the *Zimbardo Time Perspective Inventory* (see Rasmussen & Berntsen, 2009; 2010 for further information and references).

2. An alternative analysis strategy would have been to use an oblique rotation instead of an orthogonal rotation, since the factors are likely to intercorrelate. We repeated the analysis with an oblimin rotation, and the results were the same. As might be expected from an oblique rotation, some of the factor loadings were weaker, but all items clustered as into the four reported factors.

3. Inspection of the scree plot – combined with the eigen values – provided converging support for this four factor solution. It showed an initial change in the curve after Factor 1 and a second change in the curve after Factor 4.

4. We report data here only for the 100 participants who completed the full battery of questionnaires. An additional 37 participants commenced the questionnaires but did not complete them, and their data were discarded.

5. Additional measures administered at the same time included the PTSD checklist (PCL, Blanchard et al., 1996), the 7-item Centrality of Event Scale (CES; Berntsen & Rubin, 1996) answered for a highly positive and highly negative event, and the Center for Epidemiologic Studies Depression Scale (CES-D; Sawyer-Radloff, 1977)

6. As in Study 1, an alternative analysis strategy would have been to use an oblique rotation instead of an orthogonal rotation, since the factors are likely to intercorrelate. We repeated the analysis with an oblimin rotation, and the results were the same. As might be expected from an oblique rotation, some of the factor loadings were weaker, but all items clustered as into the four reported factors.

Table 1

Correlations between the three TALE-R factors and the eight RFS factors in Study 1

	TALE-Self-Continuity	TALE-Directing Behaviour	TALE-Social-Bonding
RFS – Identity	.606**	.583**	.293**
RFS - Problem Solving	.362**	.662**	.320**
RFS – Conversation	.170**	.226**	.543**
RFS - Boredom Reduction	.280**	.266**	.232**
RFS - Death Preparation	.371**	.398**	.313**
RFS - Bitterness Revival	.259**	.308**	.150*
RFS - Teach/Inform	.187**	.221**	.138*
RFS - Intimacy Maintenance	.187**	.221**	.058

Note: $n = 236$. Values are rs obtained from Pearson's correlations. **$p < .01$, *$p < .05$

Table 2

Factor Loadings for the Second-Order Factor Analysis in Study 1

		Factor			
		1	2	3	4
Reflective	TALE: Self-Continuity	.568	.027	.203	.212
	TALE: Directing Behaviour	.727	.188	.207	.061
	RFS: Identity	.783	.198	.192	.261
	RFS: Problem Solving	.690	.332	.212	.075
Social	TALE: Social-Bonding	.242	.573	.105	.025
	RFS: Conversation	.114	.864	.064	.244
Ruminative	RFS: Boredom Reduction	.212	.251	.446	.096
	RFS: Bitterness Revival	.198	.049	.744	-.004
	RFS: Intimacy Maintenance	.147	.000	.366	.259
Generative	RFS: Teach/Inform	.158	.169	.061	.753
	RFS: Death Preparation	.393	.166	.295	.421

Table 3

Correlations Between the Four Functions, Individual Differences, and Mood in Study 2

	REFLECTIVE	SOCIAL	RUMINATIVE	GENERATIVE
RRQ – Rumination	.393*	.175	.404*	.233
RRQ – Reflection	.374*	.237	.009	.298*
LGS – Generativity	.230	.246	-.001	.359*
SPS – Attachment	-.043	.103	-.154	.023
SPS – Integration	-.095	.088	-.063	.172
SPS – Nurturance	.189	.096	-.038	.148
SPS – Reassurance	.044	.200	-.237	.106
SPS – Reliability	.127	.104	-.054	.063
SPS – Guidance	.121	.096	-.043	.100
ERQ – Reappraisal	.285*	.254	.074	.220
ERQ – Suppression	.072	-.03	.149	-.009
PANAS – Positive	.204	.122	-.094	.182
PANAS – Negative	.189	.003	.226	-.042

Note: Values are *r*s obtained from Pearson's correlations. *$*p < .01$, , n = 100.*

Table 4

Characteristics of Elicited Memories in Study 3

	Reflective	Social	Ruminative	Generative	F	η_p^2
Rated Valence (1-7)	4.25 (0.76)	4.61 (0.68)	3.96 (0.68)	4.72 (0.69)	8.21**	.420
Percentage Elicited	92.91 (10.43)	92.23 (13.29)	94.26 (10463)	89.86 (15.26)	1.73	.132
Elicitation Time (seconds)	34.52 (15.84)	32.57 (12.59)	29.63 (14.51)	30.28 (13.77)	2.29	.167
Percentage Specific	50.92 (20.84)	44.59 (26.61)	47.64 (18.82)	50.00 (20.83)	0.77	.063
Age at Event (years)	17.58 (2.69)	17.68 (3.21)	16.78 (3.09)	16.04 (3.00)	6.30**	.357
Rated Clarity (1-7)	4.73 (0.73)	4.80 (0.70)	4.95 (0.80)	4.55 (0.76)	3.48*	.235
Rated Significance (1-7)	5.11 (0.74)	4.84 (0.63)	4.76 (0.82)	4.62 (0.76)	5.46**	.325
Rated Rehearsal (1-7)	4.45 (0.81)	4.63 (0.82)	4.59 (0.80)	4.06 (0.75)	7.35**	.393

Note: Values for each variable are means, with standard deviations in parentheses. For reported *F*s $n = 37$, $df = 3$. **$p < .01$, *$p < .05$

Table 5
Participant Demographics in Study 4

	N	Mean Age (SD)	Age range	Percent female
Age Quartile 1	246	27.32 (3.71)	20-33	51.60%
Age Quartile 2	254	38.69 (3.26)	34-45	51.20%
Age Quartile 3	268	51.96 (3.73)	46-58	48.90%
Age Quartile 4	261	64.42 (3.18)	59-70	50.60%

Table 6

Factor Loadings for the Factor Analysis in Study 4

|		Factor			
		1	2	3	4
Reflective	TALE: Self-Continuity	.716	.189	.265	.225
	TALE: Directing Behaviour	.782	.280	.185	.234
	RFS: Identity	.711	.229	.245	.186
	RFS: Problem Solving	.730	.241	.105	.212
Social	TALE: Social-Bonding	.452	.677	.183	.120
	RFS: Conversation	.239	.827	.177	.260
Ruminative	RFS: Boredom Reduction	.175	.347	.056	.703
	RFS: Bitterness Revival	.380	.074	.172	.517
Generative	RFS: Intimacy Maintenance	.264	.108	.485	.090
	RFS: Teach/Inform	.065	.179	.806	.043
	RFS: Death Preparation	.328	-.020	.441	.349
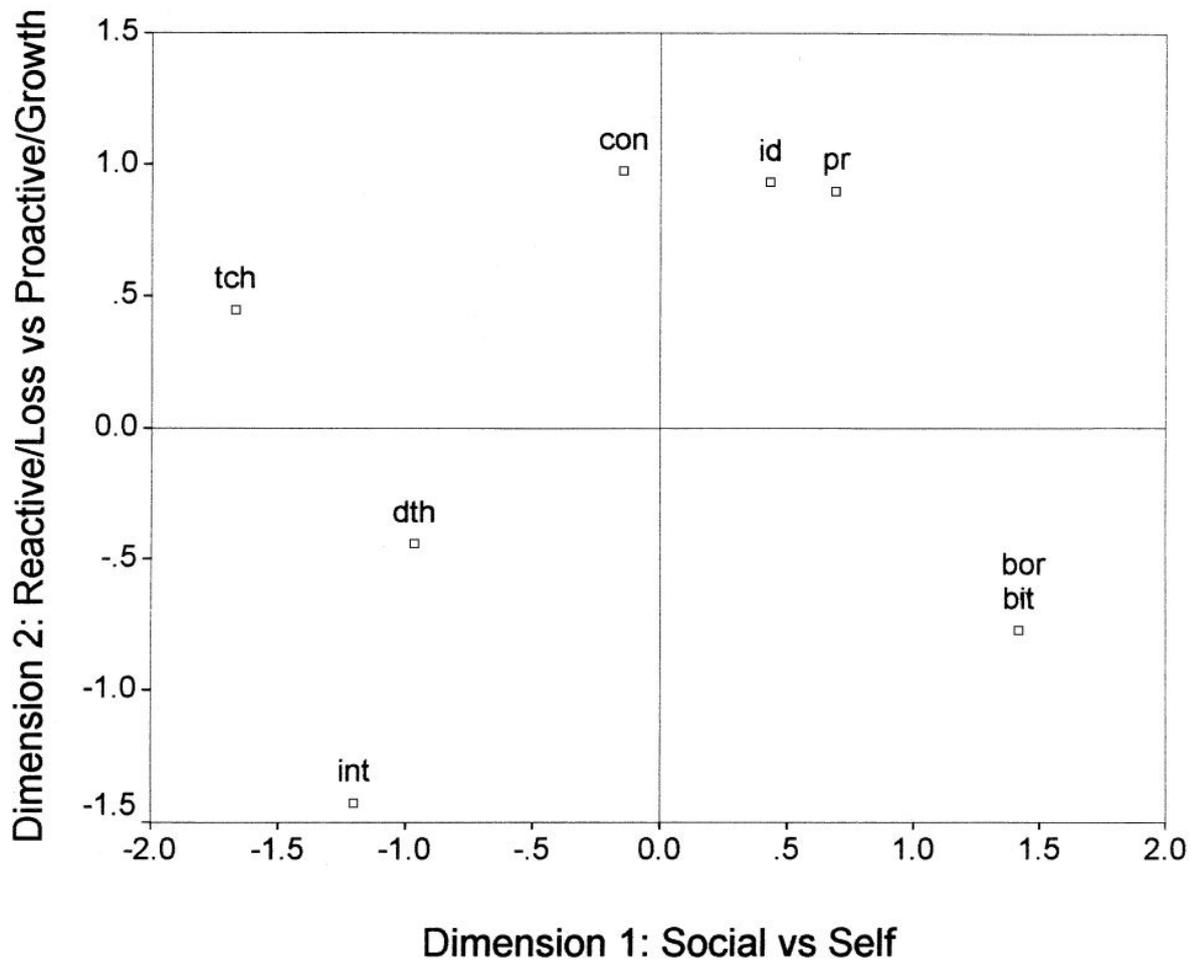
Figure 1: Webster's (2003) Circumplex Model of Reminiscence Functions. ID = identity, PR = problem solving, CON = conversation, TCH = teach/inform, DTH = death preparation, INT = intimacy maintenance, BOR = boredom reduction, BIT = bitterness revival. Reproduced with permission from the author.
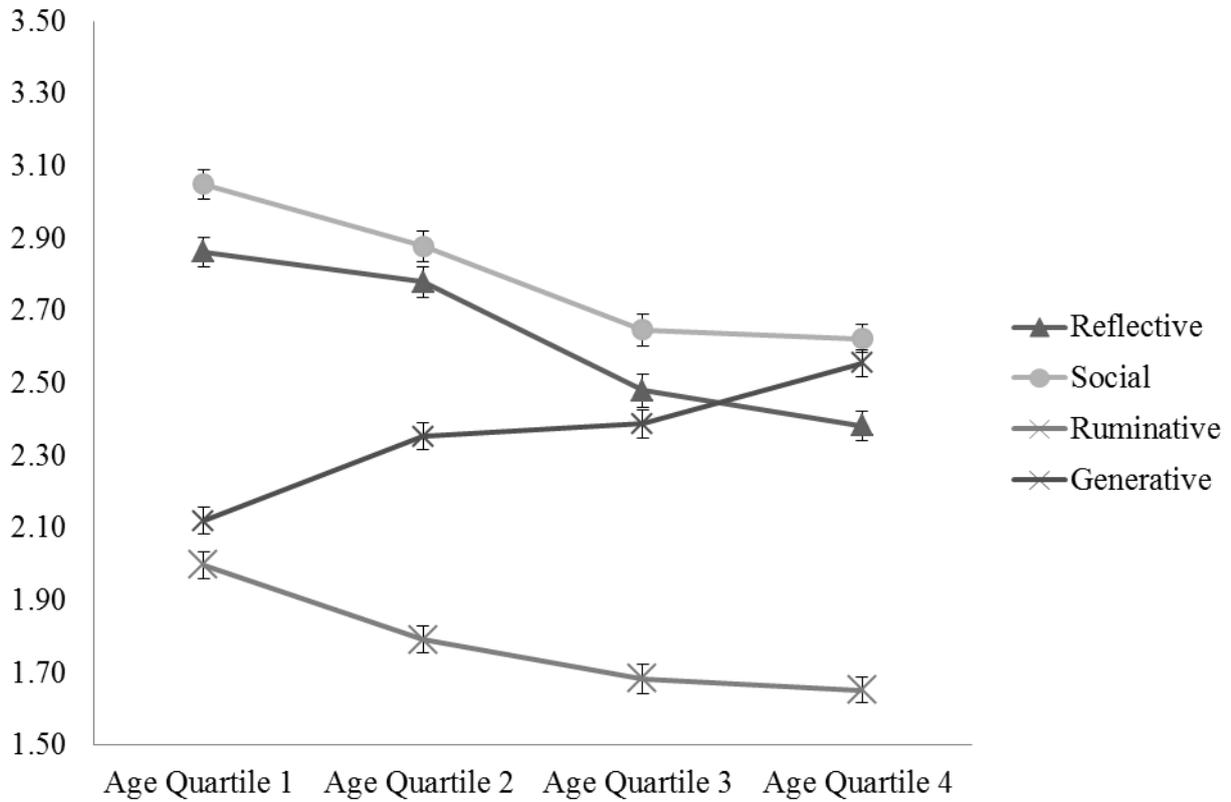
Figure 2: Scores on the Four Classes of Memory Functions, Across Age Groups, in Study 4. Values are means; upper and lower error bars represent one standard error of the mean.

Appendix A: Items Used in Study 3 (RFS items were also used in Study 4)

Stem: "What is a memory that you would think about or talk about......"

Source	Source factor	Our factor	Item (English)
TALE-R	Directive	Reflective	When I believe that thinking about the past can help guide my future
TALE-R	Directive	Reflective	When I need to make a life choice and I am uncertain which path to take
TALE-R	Self	Reflective	When I am concerned about whether my beliefs have changed over time
TALE-R	Self	Reflective	When I want to understand how I have changed from before
RFS	Problem Solving	Reflective	To see how my strengths can help me solve a current problem
RFS	Problem Solving	Reflective	To avoid repeating mistakes at some later date
RFS	Identity	Reflective	Because remembering my past helps me define who I am now
RFS	Identity	Reflective	To try to understand myself better
RFS	Boredom Reduction	Ruminative	To reduce boredom
RFS	Boredom Reduction	Ruminative	For something to do
RFS	Boredom Reduction	Ruminative	For lack of any better mental stimulation
RFS	Bitterness Revival	Ruminative	To keep painful memories alive
RFS	Bitterness Revival	Ruminative	To keep memories of old hurts fresh in my mind
RFS	Bitterness Revival	Ruminative	To rekindle bitter memories
RFS	Intimacy Maintenance	Ruminative	To keep alive the memory of a dead loved one
RFS	Intimacy Maintenance	Ruminative	To remember people I was close to but who are no longer part of my life
RFS	Death Preparation	Generative	Because it gives me a sense of personal completion or wholeness
RFS	Death Preparation	Generative	Because it helps me to prepare for my own death
RFS	Death Preparation	Generative	Because I feel less fearful of death after I finish reminiscing
RFS	Death Preparation	Generative	Because it helps me to cope with thoughts of my own mortality
RFS	Teach/Inform	Generative	As a way of bridging the generation gap
RFS	Teach/Inform	Generative	In order to leave a legacy of family history
RFS	Teach/Inform	Generative	To teach younger family members what life was like when I was young
RFS	Teach/Inform	Generative	In order to teach younger persons about cultural values

TALE-R	Social	Social	When I want to maintain a friendship by sharing memories with friends
TALE-R	Social	Social	When I hope to also learn more about another person's life
TALE	Social-Nurturing	Social	When I want to make someone else feel better by talking to them about similar past experiences
TALE	Social-Nurturing	Social	When I want to help someone by telling them about my own past experiences
RFS	Conversation	Social	Because it brings me closer to newer friends and acquaintances
RFS	Conversation	Social	To create ease of conversation
RFS	Conversation	Social	As a social lubricant to get people talking
RFS	Conversation	Social	Because it promotes fellowship and a sense of belonging