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Autobiographical periods: A review and central components of a theory

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Abstract

Autobiographical periods refer to subjectively defined life periods with perceived beginnings and endings, including information about the people, places, activities, and objects associated with the period. Autobiographical periods are serial, parallel, and hierarchical and are associated with specific and categoric memories. Individuals construct autobiographical periods for the future and have knowledge of periods in other people's lives. The review shows that 1) autobiographical periods may facilitate the recall of specific memories; 2) specific memories from the beginning and end of autobiographical periods are more often recalled compared to specific memories from other time points; 3) autobiographical periods are used to place specific memories in time; 4) autobiographical periods play an important role in the construction of life stories; 5) autobiographical periods are related to personality traits and well-being. The central components of a theory of autobiographical periods are outlined. Thinking of life as extended time periods is suggested to be the central process through which autobiographical periods are constructed. Socio-cultural processes, experience, and goals are assumed to inform life period thinking, and thus the construction of autobiographical periods.

Autobiographical periods: A review and central components of a theory

Thinking back upon a life, it does not appear as a mass of unconnected moments. Rather we remember life as consisting of periods: My high school years, my spring semester, my marriage to Madeleine. Such periods may be both short and long, and have been identified by many researchers as an important part of autobiographical memory, labeled extended-event timelines (Barsalou, 1988), lifetime periods (Conway & Pleydell-Pearce, 2000), extendures (Linton, 1986), mini-narratives (Robinson, 1992), autobiographical periods (Brown, Hansen, Lee, Vanderveen, & Conrad, 2012), and life story chapters (McAdams, 2001). But autobiographical periods have not been theoretically elaborated or researched extensively. This stands in contrast to specific memories, i.e. memory for “a circumscribed, one-moment-in-time event...including what was seen, heard, thought, and felt” (Pillemer, 1998, p. 3), which are the target of much research and theorizing.

One reason why autobiographical periods have not received much attention may be that they do not fit into typical memory “categories” of episodic and semantic memory (Tulving, 1985; 2002), but may be considered a type of personal semantic memory, that is, semantic autobiographical memory (Thomsen, Olesen, Schnieber, & Tønnesvang, 2014). The lack of attention to autobiographical periods is apparent in an often cited theory of autobiographical memory, where autobiographical periods are described only briefly (e.g. Conway, 2005; Conway & Pleydell-Pearce, 2000). Although autobiographical periods have generally been neglected, two recent reviews promise to change this picture. Renoult, Davidson, Palombo, Moscovitch, & Levine (2012) reviewed studies on neural correlates, concluding that personal semantic memory was associated with neural correlates that were distinct from the episodic form of autobiographical memory. Prebble, Addis, and Tippett (2013) suggested that both episodic and semantic autobiographical memory contribute to the sense of self, and emphasized the importance of autobiographical periods in the temporally extended self. Both of these reviews underscore that semantic and episodic autobiographical memory are distinct types of memory and that semantic autobiographical memory has generally

been neglected. But the two papers do not include a review of studies on autobiographical periods or delineate a theoretical account of such periods. In the present paper, I attempt to close this gap in the literature and supplement the two reviews by providing a more detailed understanding of autobiographical periods as a specific type of personal semantic memory.

Although generally neglected in research, autobiographical periods are mentioned frequently when participants are not restricted to recall specific memories, i.e. when students recall their summer vacation, their first year in college, or their life story (Barsalou, 1988; Habermas & Diel, 2013; Mackavey, Malley & Stewart, 1991; Pillemer, Krensky, Kleinman, Goldsmith, & White, 1991; Robinson & Taylor, 1998; Steiner, Pillemer, Thomsen & Minigan, 2014; Thomsen, 2009) or when individuals recall their past in response to music cues or sentences (Anderson & Dewhurst, 2009; Ford, Addis & Giovanello, 2011). In addition, future autobiographical periods are a frequent part of future thoughts (Anderson & Dewhurst, 2009; D'Argembeau, Renaud & van den Linden, 2011; Demblon & D'Argembeau, 2014). In fact autobiographical periods even occur at non-trivial rates when participants are asked to retrieve specific memories (e.g. Rekart, Mineka, & Zinbarg, 2006; J.M.G. Williams & Dritschel, 1992). Thus, autobiographical periods are a distinct and important part of mental life.

Autobiographical periods are used in both private thought and public discourse and their prominence suggests that they have a major influence on individuals. Autobiographical periods structure remembering and imagination of specific episodes, thus framing how the individual conceives of her/himself and what is believed possible to achieve in the future (D'Argembeau & Mathy, 2011; Linton, 1986). They function as temporal categories that delimit the psychological present from the psychological past and future and can be used to induce mental contrasts between present and future self images, increasing motivation for behavior change (Fuhrman & Wyer, 1988; Peetz & Wilson, 2013). Autobiographical periods allow the creation of a coherent life story, which supports thinking in terms of personal development and makes a sense of self-continuity possible (Prebble et al., 2013; Thomsen, 2009). Recognizing how other individuals think of their life as periods underlies a detailed understanding of other individuals that promotes smooth interactions and serves as models for the individual's personal future (Thomsen & Pillemer, under review). Using a series of autobiographical

periods to conceive self and others as interrelated entities that extend from the past into the future emphasizes both stability and change in life, potentially providing a basis for predictability, hope, or despair. Thus, depending on the emotional quality of such periods, they may either hinder or facilitate psychological well-being (Dalglish, Hill, Golden, Morant, & Dunn, 2011).

The aim of the present article is to describe autobiographical periods, review studies in the area, and integrate the fragmented literature to develop a theory of autobiographical periods. First, autobiographical periods are defined and distinguished from related memory phenomena and methods used to study autobiographical periods are described. Second, the content and structure of autobiographical periods are described. Third, a review of studies on autobiographical periods in relation to specific memories is presented. Fourth, studies relating autobiographical periods to life stories, personality, and well-being are reviewed. Based on the review, I summarize eight central findings in the area that will be addressed by the proposed theory. The central components of the theory are then described, focusing on life period thinking, the thought process that is critical for constructing autobiographical periods. Finally, I spell out how the theory explains each of the findings derived from the review and suggest directions for future research.

Definitions and methods

One of the first researchers to identify autobiographical periods, Linton (1986) defined extendures as “sets of memories loosely bound by the coexistence of some significant persistent orientation” (p. 57). In later work, Brown and colleagues (Brown et al., 2012) defined personal periods as “blocks of time dominated by a particular set of event features, with landmark events signaling the transition from one period to the next” (p. 161). They identified people, places, objects, and activities as event features. Conway (2005) described lifetime periods as “a representation that contains knowledge about goals, others, locations, activities, evaluations, that were common to that period” (p. 608). Finally, in work on autobiographical periods as chapters in life stories, Thomsen, Pillemer, and Ivcevic (2011) defined autobiographical periods as “abstract memory representations of extended time periods encompassing different activities and episodes that all relate to the same higher-order activity, such as relationships or

education-work” (p. 268). Based on an integration of these ideas, I define autobiographical periods as subjectively delimited life periods with perceived beginnings and endings, including information about the people, places, activities, and objects associated with the period. Such periods may be brief (e.g. “my vacation”) or prolonged (e.g. “my marriage”) and they may be mundane (e.g. “my spring semester”) or highly significant (e.g. “my job as professor”). Note that individuals may remember past as well as anticipate future periods and that they may think of both their own and other peoples’ lives in terms of periods (Barsalou, 1988; Dalgleish et al., 2011; Thomsen & Pillemer, under review).

One crucial point to address is whether and how autobiographical periods are distinct from other forms of autobiographical memory. Conceptually, autobiographical periods are distinct from specific memories by representing knowledge of periods rather than knowledge of circumscribed events, which can last from minutes to hours (e.g. Pillemer, 1998). Autobiographical periods reflect more abstract knowledge, suggesting that the phenomenological experience of thinking about autobiographical periods will probably be associated with less reliving, which has been confirmed in one study (Ford et al., 2011). One way to conceptualize the distinction between autobiographical periods and specific memories is to use Tulving’s episodic-semantic memory system approach. The episodic memory system is involved when individuals remember self-experienced event localized to a specific time and place, whereas the semantic memory system is involved when individuals remember abstract facts (Tulving 1985; 2002). Based on this approach, autobiographical periods may primarily involve the semantic memory system, whereas specific memories involve the episodic memory system. However, although autobiographical periods are abstract, they are neither timeless nor non-personal as typical semantic memory (e.g., facts about chairs). Because the theory of episodic and semantic memory does not seem to account well for the distinction between autobiographical periods and specific memories, I will view the distinction between autobiographical periods and specific memories, not as the result of two different memory systems, but rather as the results of differential involvement of processing components (Cabeza & Moscovitch, 2013). Although the processing components have yet to be specified, I suggest that personal autobiographical periods and specific memories would both involve self-reference processing, but specific memories may

involve a higher degree of visual processing and autobiographical periods may involve a higher degree of verbal processing.

Empirically, autobiographical periods have been found to be distinct from specific memories in a number of ways. First, autobiographical periods are rated as more important to identity or more life changing than specific memories (Schooler & Herman, 1992; Thomsen & Pillemer, under review, studies 1 and 2; but see Waters, Bauer, & Fivush, 2014 for a study showing no differences). Second, autobiographical periods have been found to be more positive than specific memories (Habermas & Diel, 2013; Schooler & Herman, 1992; Thomsen & Pillemer, under review, studies 1 and 2; although one study reported the opposite effect (Ford et al., 2011)). Third, amnesic patients often have impaired recall of specific memories while relatively more preserved autobiographical periods (see Conway & Fthenaki, 2000, for a review). Fourth, recalling autobiographical periods versus specific memories is associated with differences in neural activity (Ford et al., 2011). Fifth, autobiographical periods seem less affected by aging than specific memories (Piolino et al., 2010). Finally, people can identify autobiographical periods when thinking about their very early childhood, indicating that autobiographical periods are less affected by childhood amnesia than specific memories (Steiner et al., 2014; Thomsen & Berntsen, 2008; Thomsen et al., 2011; 2013). These differences suggest that autobiographical periods and specific memories represent different memory types.

Autobiographical periods can also be distinguished from categoric memories. Categoric memories refer to memories which are a summary of categories of events, e.g. "bicycling to work" (Barsalou, 1988; Brewer, 1986; Neisser, 1981; J.M.G. Williams et al., 2007). Although categoric memories clearly refer to abstracted knowledge, just like autobiographical periods, the abstraction is narrower since categoric memories refer to one specific type of situation (categoric memories may be viewed as a type of situation-specific script; Schank, 1999). Autobiographical periods have a broader scope and may refer to a number of different situations that are all perceived to be a part of the same subjectively defined period. Another important difference between autobiographical periods and categoric, more script-like, memories is that autobiographical periods are associated with beginnings and endings, whereas categoric memories are "timeless", due to the processes that merge episodes based on

similarity (Schank, 1999). Confirming the distinction between autobiographical periods and categoric memories, studies have shown that categoric memories, and not autobiographical periods, are related to clinical disorders (J.M.G. Williams et al., 2007), suggesting that the two types of autobiographical memory are functionally distinct. One study found that categoric memories and autobiographical periods were not generated in response to the same cue words or by the same participants and were differentially related to semantic fluency (J.M.G. Williams & Dritschel, 1992). Note also that two studies examining different types of autobiographical memory by coding orally transmitted descriptions of a summer vacation (Barsalou, 1988) or life stories (Thomsen, 2009) have shown reliable coding of material as either categoric memory or autobiographical periods, suggesting that the two types of autobiographical memory are associated with differences in verbal expression. Thus, while the distinction between categoric memory and autobiographical periods is somewhat fuzzy and few empirical studies have compared the two types, there seems to be basis for distinguishing them.

Autobiographical periods have been examined in a variety of ways. In some studies participants are assumed to possess knowledge of an experimenter defined period, like the war in Yugoslavia, and the studies examine whether this period is used as a temporal frame to date specific memories (e.g. Brown et al., 2009). The limitation of this method is that it has only been used to address pre-defined autobiographical periods, and has mostly been used with reference to publicly shared periods, which may differ in meaningful ways from more individualized periods, e.g. with respect to social sharing and media coverage. Studies have also coded the use of autobiographical periods based on participants' verbal descriptions of their recall process (e.g. Hague & Conway, 2001), summer vacation (Barsalou, 1988), life story chapters (Chen et al., 2013) or life story (Steiner et al., 2014; Thomsen, 2009). For example, Barsalou (1988) coded all statements referring to "single events lasting longer than a day" as autobiographical periods (e.g. "I took a trip to Italy"; pp. 200-201). The strength of coding autobiographical periods based on verbal descriptions is that it samples a wide variety of autobiographical periods, but a limitation is that it is uncertain whether verbal descriptions are reliable indicators of memory processes. However, studies of over-general memory have shown that coding of memory type based on verbal descriptions is reliably related to depressive disorder and trauma history (J.M.G. Williams et al., 2007).

This supports the general notion that type of autobiographical memory may be inferred based on verbal descriptions. In other studies, participants have been asked to directly identify chapters in their life stories (e.g. Dalgleish et al., 2011; Thomsen & Berntsen, 2008). This approach also allows for the identification of subjectively defined autobiographical periods. However, the limitation is that only autobiographical periods important to the life story are identified and that not all chapters may correspond to subjectively defined periods in life. Rather they may reflect demands of a task relying on a book metaphor of memory. Finally, some studies have suggested that cue words referring to periods (e.g. adolescence, romance) are likely to elicit autobiographical periods (Dalgliesh et al., 2007, studies 3 & 6). While this method is promising with respect to identifying autobiographical periods that are not limited to the life story, the results of studies using this method may depend heavily on the specific cue words used in the study. One way to circumvent this may be to use free recall of autobiographical periods (e.g. Piolino et al., 2010; Schooler & Hermann, 1992).

In summary: Autobiographical periods are distinct from specific and categoric memories. They can be examined using a variety of methods, with coding based on verbal description and direct identification of chapters in life stories being the most frequently used methods. At present there is almost no knowledge on whether the different methods yield similar results and/or systematic differences, and examining this is of major importance.

Characteristics of autobiographical periods

In this section, I describe the most commonly identified characteristics of autobiographical periods, including content, temporal scope, life span distribution, hierarchical, serial, and parallel relationships between autobiographical periods as well as narrative knowledge associated with autobiographical periods.

Autobiographical periods have been described as containing information about the typical people, places, and activities associated with the period, as well as a general emotional tone or evaluation of the period (Conway, 2005; Conway & Pleydell-Pearce, 2000). For example, individuals can generate names of school mates from the autobiographical periods of primary school or high school (e.g. Dritschel et al., 1992; M.D. Williams & Hollan, 1981).

Autobiographical periods may vary in their temporal scope, from several days (e.g. “our vacation at Mallorca”) to decades (e.g. “my marriage”). Empirically, durations have varied considerably, with mean lengths of 4-15 years (Coste et al., 2011; Piolino et al., 2010; Schooler & Herman, 1992; Steiner et al., 2014; Thomsen & Berntsen, 2008; Thomsen et al., 2011, 2013). The broad range of durations reflects that autobiographical periods are constructed at several levels of abstraction and different methods capture autobiographical periods at varying levels of abstraction.

Some autobiographical periods have sudden beginnings (and endings), e.g. an autobiographical period of “widowhood” may begin by the sudden death of one's spouse, while others have more gradual beginnings (and endings), e.g. a romantic relationship may start gradually. The frequency of beginnings and endings of autobiographical periods have been shown to vary systematically across the life span. When autobiographical periods are examined in a life story context, studies have shown a fairly consistent picture of the life span distribution. First, individuals reported chapters from early childhood, that is, there was no childhood amnesia as is observed for specific memories (e.g. Nelson & Fivush, 2004). Second, individuals reported more autobiographical periods around adolescence and young adulthood (Mackavey et al., 1991; Robinson & Taylor, 1998; Steiner et al., 2014; Thomsen & Berntsen, 2008; Thomsen et al., 2011; 2013).

Autobiographical periods, like other categories, have been described as being hierarchical or nested (Barsalou, 1988; Conway, 2005; Neisser, 1986; Rosch, 1978). That is, more abstract and longer lasting autobiographical periods nest less abstract and shorter autobiographical periods as well as other types of autobiographical memory. For example, an autobiographical period of “marriage” may nest “living in Ribe” and “living in Aarhus”, each of which may also nest a number of briefer autobiographical periods and specific and categoric memories.

Some autobiographical periods may be serial and causally related to each other (Barsalou, 1988; Linton, 1986). For example, individuals could have a series of autobiographical periods relating to their work life, e.g. “doing my Ph.D.” and “working at Aarhus University”. Some of these may also be causally related, that is “doing my Ph.D.” may give the individual the necessary qualification to apply for and gain a position at Aarhus University. Note that such hierarchical, serial, and causal

relationships between these different types of memory may change as the individual experiences new events and reflects on the relationship between autobiographical periods and memories. Relationships between autobiographical periods, categoric, and specific memories are probably also characterized by a multitude of connections rather than single connections. That is, a given categoric or specific memory can be a part of several autobiographical periods and shorter autobiographical periods can be a part of several longer autobiographical periods (Burt, Kemp, & Conway, 2003).

Autobiographical periods may also be parallel (Barsalou, 1988; Burt et al., 2003). Thus, the autobiographical period of “marriage” may refer to the same period in life as other autobiographical periods, like “working at Aarhus University”. Re-analyses of data from previous studies on life story chapters (Thomsen & Berntsen, 2008; Thomsen et al., 2014), calculating number of autobiographical periods per year, show that parallel chapters begin to emerge between age 5-15 and that the number of parallel chapters continues to increase into adulthood, where it seems to become more stable (see Figure 1). The fact that different autobiographical periods can refer to the same span of time illustrates an important feature of autobiographical periods: Events that become a part of one autobiographical period are interspersed with events that become a part of another autobiographical period (Burt et al., 2003). Thus, on any given day the individual may experience events that are a part of “marriage”, and events that are a part of “working at Aarhus University”. This implies that autobiographical periods are not just formed by reference to continuous chunks of time.

Some researchers have emphasized the narrative structure of autobiographical periods. Thus, Robinson (1992) suggested that individuals construct mini-narratives of events extended in time, like romantic relationships. Such mini-narratives are characterized by temporal ordering and causal links between events. Relatedly, Brown and colleagues have suggested that individuals organize specific memories in thematically and causally related clusters, partly as a natural byproduct of the planning and causal reasoning that accompanies goal-pursuit (Brown, 2005; Brown & Schopflocher, 1998a and b). In a series of studies, they found that specific memories are organized in narrative-like clusters, where memories are causally related and part of the same overall event or story (Brown, 2005; Brown & Schopflocher, 1998a and b, see also D'Argembeau & Demblon, 2012; Fitzgerald, 1980; Wright & Nunn, 2000). Such

narrative clusters are also elicited when individuals are cued with autobiographical periods (Sato, 2000). Three studies have shown that specific future events are also highly likely to be embedded in narrative-like event clusters (D'Argembeau & Demblon, 2012, study 1 and 2; Demblon & D'Argembeau, 2014). Several studies, however, indicate that the event cuing method may overestimate the frequency of event clusters, since involuntary specific memories were much less likely to be recalled in such clusters (Mace, 2006; Mace, Clevinger, & Bernas, 2013; Mace, Clevinger, & Martin, 2010). There is also some discussion as to whether clusters reflect organization or retrieval strategy (D'Argembeau & Demblon, 2012; Brown, 2005; Brown & Schopflocher, 1998a). Although the frequency of event clusters is debatable, it seems plausible that autobiographical periods are associated with narrative knowledge in the form of temporal ordering and causal links, given that autobiographical periods represent activities over time and that such activities are accompanied by causal reasoning that may create temporal and causal associations between memories (Barsalou, 1988; Brown & Schopflocher, 1998a). Still it is important to emphasize that autobiographical periods at the same time contain abstractions that are not narrative, that is abstracted knowledge of the typical people and places (e.g. images and names of people associated with my high school years). Such abstract knowledge may also become associated with autobiographical periods as schemata about people and places (e.g. Brewer & Treyns, 1981; Power & Dalgleish, 2008).

In summary, autobiographical periods may be viewed as temporal categories that contain a variety of information associated with a given period of time. Thus, autobiographical periods contain information about emotional evaluations, the typical people, places, objects, and activities associated with the period as well as temporal and causal relations between associated memories. Autobiographical periods may exist at different levels of abstraction, lasting from days to years, and they are dynamically related in hierarchical, serial, and parallel ways.

Autobiographical periods and specific memories

Each autobiographical period has been suggested to be associated with a number of specific memories (Barsalou, 1988; Conway & Pleydell-Pearce, 2000; Robinson, 1992). Thus, an autobiographical period may be viewed as a category and specific

memories as instances of the category (e.g. Fuhrman & Wyer, 1988). Supporting the notion that each autobiographical period is associated with sets of specific memories, studies show that individuals often perceive memories as parts of autobiographical periods (Burt et al., 2003; Thomsen et al., 2014).

While conducting a prolonged diary study of her own memory, Linton noted that “events locked into larger units (extendures) are retained. “Isolated” events have a higher probability of being lost [...]” (Linton, 1986, p. 64-65). This concurs with another small scale study (Burt, Mitchell, Raggatt, Jones, & Cowan, 1995). Linton (1986) also noted that she often used extendures as cues for recalling specific memories.

The above suggests that many specific memories and imagined future events are associated with autobiographical periods and such associations may play a role in how the individual retrieves specific memories and identifies future events. Several studies have examined whether autobiographical periods are involved in the retrieval and dating of specific memories. Below, I review these studies in three subsections: Retrieval of specific memories/future events (cuing studies, protocol studies, and event history calendar studies), the start and end point effect, and dating of specific memories.

Retrieval of specific memories: cuing studies.

Several studies have examined the role of autobiographical periods in the retrieval of specific memories. In one of the most cited papers on autobiographical periods, Conway & Bekerian (1987; studies 2 and 3) first asked participants to generate autobiographical periods and general events (which encompass both categoric memories and briefer autobiographical periods) associated with each period. Several months later, they presented participants with general event cues preceded by either no prime or a life time period prime (e.g., “primary school”). Participants retrieved specific memories significantly faster in response to general events when these were preceded by autobiographical period primes. A later study yielded similar findings, although the effect was not present for word-cued memories (Dijkstra & Kaup, 2005). Several other studies have also shown results consistent with the idea that cuing individuals with autobiographical periods facilitate the retrieval of specific memories (Mace, 2005; Mace & Clevinger, 2013).

Some studies yield results suggesting that autobiographical periods do not always facilitate retrieval of specific memories. Schulkind, Rahhal, Klein, and Lacher (2012) found that when participants were cued with narratives consisting of an autobiographical period, a theme, and an emotion, they often recalled memories that were not from the autobiographical period specified in the cue. Rather, they recalled memories that matched the theme in the cue (see also Ball & Hennessey, 2009; Beike, Adams, & Wirth-Beaumont, 2007 for results showing no facilitation of autobiographical periods on retrieval of specific memories).

Retrieval of specific memories: protocol studies.

Reiser, Black, & Kalamarides (1986) used a think-aloud procedure to examine retrieval strategies and reported that autobiographical periods were sometimes used to retrieve specific memories. In three later think-aloud studies, Haque & Conway (2001) found that participants often thought of autobiographical periods early in the recall process before identifying a specific memory. According to the authors, this suggests that autobiographical periods are used to elaborate the word cue and provide access to groups of specific memories. Extending this study to address the construction of specific future events, D'Argembeau & Mathy (2011) reported similar results, although including goals, people, and places as cues reduced the use of autobiographical periods in cue elaboration. However, other studies have shown that word-cues were often associated with direct retrieval of specific memories, that is, participants did not need to think about autobiographical periods to recall a specific memory (Uzer, Lee & Brown, 2012).

Retrieval of specific memories: event history calendars.

Belli (1998) has argued that referring to autobiographical periods to aid recall in survey studies may improve the accuracy of reporting of events across long delays. In the Event History Calendar method, participants are asked to list different periods within several domains, such as work, relationship, and residence and also note transitional events such as child births and marriage. There is some indication that the Event History Calendar method yields more accurate reporting of life events than more traditional survey methods (Belli, Smith, Andreski & Agrawal, 2007; Belli, Shay, &

Stafford, 2001; Sayles et al., 2010; van der Vaart & Glasner, 2007). However, because the event history calendar includes a number of features, it is not clear from such comparisons whether it is autobiographical periods or some other feature of the method that helps participants recall events from their lives.

In summary, while the results of some studies are consistent with the notion that autobiographical periods facilitate the recall of specific memories, other studies suggests that this is not always the case. Some studies indicate that the effect of autobiographical periods on recall of specific memories may diminish when other cues are present, e.g. word cues, goals, and themes (D'Argembeau & Mathy, 2011; Dijkstra & Kaup, 2005; Schulkind et al., 2012). I will elaborate on this in the theoretical analysis.

Start and end point effect.

Several studies have shown that specific memories from the beginning and sometimes the end of autobiographical periods are more frequently retrieved. In two studies, Pillemer, Rhinehart, & White (1986), asked students to recall memories from their first term at university. They found that most memories were from the beginning of the first term. In a later study, Pillemer and colleagues also found the increased frequency of memories from the beginning of the first term in adults who had attended college 2, 12 or 22 years earlier (Pillemer, Goldsmith, Panter & White, 1988). Other studies have similarly shown an increased frequency of specific memories at the beginning and sometimes the end of the academic term (Kurbat, Shevell, & Rips, 1998, studies 1, 3 and 4; Robinson, 1986; Thomsen & Berntsen, 2005, studies 2 and 3; Thomsen, Olesen, Schnieber, Jensen & Tønnesvang, 2012). One study only found the higher frequency of specific memories from start and end points when the beginning and end dates of the academic term were mentioned explicitly before either the recall or the dating of memories (Anderson, 2005). This study used word cues rather than free recall and this may have reduced the use of the autobiographical period of the academic term as a cue (Anderson, 2005).

The start and end point effect is not limited to the recall of specific memories from periods that follow the calendar (university terms follow the calendar since they start and end at the same time each year). The effects has also been shown for the period

of a romantic relationship (Thomsen & Berntsen, 2005, study 1) and self-selected autobiographical periods (Thomsen et al., 2011; 2014). Note also that increased frequency of specific memories at the beginning of temporally extended self-images has been reported (Chessel, Rathbone, Souchay, Charlesworth, & Moulin, 2014; Rathbone, Conway, & Moulin, 2011; Rathbone, Moulin, & Conway, 2008).

In summary, specific memories from the start and end of autobiographical periods are more accessible when participants are asked to free recall specific memories or recall important/life story memories and when there is reference to the autobiographical period in the instructions. Biased dating does not seem to account for the effect (Kurbat et al., 1998; Thomsen et al., 2012; but see Anderson, 2005). In addition, the effect is not limited to periods that follow the calendar year and can therefore not be explained with reference to the use of internally generated calendar cues (Robinson, 1986; Thomsen & Berntsen, 2005).

Dating studies

Several studies have examined the role of autobiographical periods in the dating of specific memories. There is broad agreement that individuals rarely remember the exact dates of specific memories, but rather they reconstruct the dates of events using a variety of knowledge (e.g. Brown, Shevell, & Rips, 1986; Friedman, 2004; Shum, 1998). Examples of such knowledge are repeated activities occurring at specific times (e.g. Christmas), other specific events where the dates are known (e.g. landmark events such as child births) and knowledge of autobiographical periods (e.g. during college). While autobiographical periods may not help the individual estimate an exact date (because it only specifies a period), the combination of different autobiographical periods may help the individual narrow down the possible dates substantially (e.g. it was while I was in college, while dating Brian, but before my job as a bartender). Also, individuals typically use a combination of strategies when dating specific memories (Thompson, Skowronski & Betz, 1993) and the combination of autobiographical periods with other types of knowledge would help the individual construct dates. While there is agreement that autobiographical periods support the dating of specific memories, using autobiographical periods may also introduce systematic biases. This is because the boundaries of autobiographical periods constrain the direction of dating

errors. Thus, specific memories at the beginning of autobiographical periods cannot be misplaced backward in time, while specific memories at the end of autobiographical periods cannot be misplaced forward in time (Huttenlocher, Hedges, & Prohaska, 1988).

Thompson et al. (1993) asked participants to date events they had recorded in a diary and report the strategy they used for dating. Participants most often used autobiographical periods and this strategy yielded date estimates that were more precise than guessing, but less precise than when participants used other specific memories (see Betz & Skowronski, 1997; Skowronski, Betz, Thompson & Larsen, 1995 for similar results). Similarly, Friedman & Janssen (2010) found that participants often reported using autobiographical periods when judging the temporal proximity of news events. Studies using think aloud protocols (Holm, 2013) or other open-ended probes (Arbuthnott & Brown, 2009) when assessing individuals' dating of specific memories also showed that autobiographical periods were the most frequently used strategy.

Brown (1990, study 1) asked participants to date political events and non-political public events while thinking aloud. Consistent with the idea that autobiographical periods are often used to date associated specific memories, he found that the periods of Carter's and Reagan's presidencies were more often used in dating political events compared to public, non-political events. Reaction time data supported this conclusion (Brown, 1990). A more recent series of studies by Brown and colleagues also testifies to the importance of autobiographical periods in dating specific memories. The studies showed that individuals, who had experienced war first-hand and thus presumably developed autobiographical periods of the war, often used this period in dating specific memories from the war years (Brown et al., 2009; Brown et al., 2012; Brown, Schweickert, & Svob, under review; Zebian & Brown, 2014).

One study suggests that judgment of the relative time of pairs of specific memories (e.g. before/after) was neither more accurate nor faster when the memory pairs were from the same location (school, work) and thus presumably from the same autobiographical period (Skowronski, Walker, & Betz, 2003). However, the school and work autobiographical periods were probably referring to the same time span (e.g. running in parallel in participants' lives) which may have reduced their usefulness in before/after judgments. A later study by Skowronski et al. (2007) showed that participants were both faster and more accurate at making before/after judgments when

events were from different autobiographical periods that were serial (see Fuhrman & Wyer, 1988, for similar results). Thus, the usefulness of autobiographical periods in making before/after judgments may depend on a clear before/after relationship of the autobiographical periods in question.

In summary: Studies that rely on self-report provide strong evidence for the importance of autobiographical periods in drawing inferences about the dates of specific memories. Some studies using reaction times also show that autobiographical periods are involved in the judgment of temporal ordering of specific memories.

Autobiographical periods, life stories, personality, and well-being

Fewer studies have examined autobiographical periods in relation to life stories, personality traits, and well-being. I review this research below to demonstrate the broad relevance of autobiographical periods and to help guide theory and future research.

Life stories.

Autobiographical periods have been suggested to be central to the construction of life stories, which refer to internalized stories about the remembered past and anticipated future, characterized by temporal, causal, and thematic coherence (Bluck & Habermas, 2000; Conway, Singer, & Tagini, 2004; McAdams, 2001). Thus, selected autobiographical periods are organized into temporally, causally and thematically coherent life stories. Thomsen (2009) proposed that autobiographical periods may be more useful than specific memories, when individuals create temporal and thematic coherence in life stories. This is because individuals presumably have numerous specific memories but fewer autobiographical periods, making the use of autobiographical periods in the construction of life stories less cognitively demanding. Supporting this notion, Thomsen (2009) found that older individuals who were asked to tell their life stories in a free format included autobiographical periods more often than specific memories (see also Habermas & Diel, 2013; Habermas, Diel, & Welzer, 2013; Mackavey et al., 1991; Robinson & Taylor, 1998; Steiner et al., 2014).

Further examining the role of autobiographical periods in the construction of life stories, Chen et al. (2013) showed that older children/adolescent were more likely to use autobiographical periods when describing their life stories: “such that no-one above the

age of 18 organized their life story with SE chapters [chapters referring to specific memories]" (p. 6) (see also Habermas et al., 2013 and Steiner, 2014 for studies showing increased use of autobiographical periods in life stories across childhood and adolescence). Because the life story is thought to emerge and slowly become more sophisticated from late childhood to late adolescence (Habermas & Bluck, 2000), these studies suggest that being able to think of life in terms of autobiographical periods may be an important factor in the development of life stories.

Two recent studies suggest that individuals have knowledge about autobiographical periods in close others' life stories. In the two studies, Thomsen & Pillemer (under review) found that participants identified more chapters in their own life story and that these chapters were rated as more positive than chapters in the life story of their close other, but differences were generally small.

Personality traits

In an influential model of personality, life stories and personality traits have been suggested to represent different levels of personality (McAdams & Pals, 2006). Although these levels of personality are distinct, there are reasons to expect interactions between them (see for example McAdams et al., 2004). Thus, personality traits in terms of the big 5 (e.g., Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, McCrae & Costa, 2008) may interact with the construction of life story chapters. Consistent with this notion, individuals scoring high on Extraversion and Conscientiousness rated their life story chapters as more positive and individuals high on Neuroticism rated their chapters as more negative (Thomsen et al., 2014; Thomsen & Pillemer, under review). Interestingly, two studies show that Neuroticism was related to more negative accounts of a close other's chapters, suggesting that personality traits may be related to the emotional content of chapters in personal life stories as well as the emotional content of chapters in close other's life stories (Thomsen & Pillemer, under review).

Well-being

Personality is one of the strongest predictors of well-being (Diener, Oishi, & Lucas, 2003) and since life stories are a part of personality, they may predict well-being

(McAdams & Pals, 2006). Confirming this, several studies have found that well-being is related to life stories (e.g. Adler, 2012; McAdams, Reynolds, Lewis, Patten, & Bowman, 2001). These studies, however, have not singled out autobiographical periods that are a main component in life stories, and here I review studies that focus on autobiographical periods and well-being.

In three studies, Beike and Landoll (2000) examined whether recalling specific memories emotionally inconsistent with the associated autobiographical period would be related to subjective well-being. They reasoned that individuals would be motivated to maintain a consistent view of their life and that recalling specific memories that were emotionally inconsistent with the associated autobiographical period would lead to feelings of discomfort. Such feelings may then be reduced by cognitive processes directed at reducing the inconsistency (e.g. providing justifications for the inconsistencies). In all three experiments, they found that when individuals recalled specific memories that were emotionally inconsistent with the associated autobiographical period (e.g. recalling negative specific memories from a positive autobiographical period), those individuals that did not use cognitive processes reducing the inconsistency had lower scores on well-being than individuals who used cognitive processes aimed at reducing the inconsistency.

Thomsen & Berntsen (2009) found that older participants who had chapters directly concerned with WWII in their life story were more likely to report stress symptoms. This indicates that selecting a negative autobiographical period as central to one's life story may give rise to more stress symptoms (e.g. Berntsen & Rubin, 2006).

Dagleish, Hill, Golden, Morant, and Dunn (2011) examined the emotional content of past and future chapters in currently depressed individuals, individuals with depression in remission, and healthy individuals. The results showed that depressed individuals had life story chapters that were more negative, with similar negative themes across chapters and lacking similar positive themes across chapters. Comparisons of the remitted individuals with the healthy individuals showed almost the same pattern, suggesting that this pattern may be characteristic of individuals generally vulnerable to depression, rather than a sign of depression as such. Surprisingly, there were no group differences for future chapters.

To summarize, there is good evidence that adults use autobiographical periods when constructing life stories and two studies suggest that this may also be the case when they think about other peoples' life stories. Developmental evidence indicates that the ability to think of life in terms of autobiographical periods matures during late childhood and adolescence. There are few but consistent studies showing that Extraversion, Conscientiousness, and Neuroticism are related to the emotional tone of chapters. The emotional tone, emotional consistency, and centrality to life stories of autobiographical periods have been related to well-being.

Summary of the empirical findings

The studies in the review suffer from several weaknesses. First, the verbal material being coded does not always refer exclusively to autobiographical periods, but includes other types of autobiographical memory (e.g. Brown et al., 2009; D'Argembeau & Mathy, 2011; Pillemer et al., 1991). Second, autobiographical periods are sometimes assumed rather than directly measured (e.g. Sato, 2000). Third, associations between autobiographical periods and specific memories are not always assessed directly (e.g. Ball & Hennessey, 2009; Mace & Clevinger, 2013). Fourth, studies on life stories, well-being, and personality are all correlational, and prospective and experimental studies are needed. Despite these weaknesses, the following eight conclusions emerge from the literature review. First, individuals can identify autobiographical periods for both past and future, their own lives and other peoples' lives. Second, individuals report autobiographical periods for early childhood. Third, autobiographical periods are serial, parallel, hierarchical, and associated with abstract knowledge of for example people and places as well as narrative knowledge (that is, knowledge of temporal and causal links). Fourth, autobiographical periods may facilitate retrieval of specific memories, but the effect depends on the presence of other cues. Fifth, specific memories from the start and end of autobiographical periods are more often recalled when autobiographical periods are used as cues in the instructions. Sixth, autobiographical periods are used to date specific memories. Seventh, autobiographical periods are used by adults to construct life stories. Eighth, the emotional quality of autobiographical periods is related to personality traits and well-being.

Although some of these findings have been addressed by other theories of autobiographical memory (Barsalou, 1988; Brown et al., 2012; Conway, 2005; Shum, 1998), neither of these theories provide a comprehensive framework for understanding the eight findings outlined above. A comprehensive theory of autobiographical periods is needed to connect these findings, organize future research, and provide basis for novel predictions.

Central components of a theory of autobiographical periods

In this section, I will describe the central components of a theory of autobiographical periods. The section will start out by describing the central process involved in the construction of autobiographical periods. I will then outline how the construction of autobiographical periods is affected by socio-cultural processes, experience, and goals. Lastly, I will address how the theory explains the effects of autobiographical periods on retrieval and dating of specific memories as well as the relations between autobiographical periods, life stories, personality, and well-being.

A central assumption of the theory is that autobiographical periods are constructed by a process of thinking about life as periods. Such thinking may include rehearsal of the past as well as anticipation of the future, but it goes beyond mere repetition to include interpretation of lives as periods. For lack of a better term, I will label this process life period thinking. Life period thinking is a way of thinking of entities in time as categories. It is necessary because living objects, such as people change, and therefore cannot be understood solely by using atemporal categories useful to understanding non-living object (e.g. a chair). Life period thinking may be seen as conceptually similar to autobiographical reasoning, narrative processing, and meaning-making (Habermas & Bluck, 2000; Singer & Bluck, 2001; Singer, Blagov, Berry, & Oost, 2013), but with the difference that it emphasizes lives as consisting of periods rather than temporal and causal relations between events and selves.

Life period thinking is assumed to be the central process in the construction of autobiographical periods for several reasons. First, individuals construct autobiographical periods for their early childhood, from which they have few specific or categoric memories (Nelson & Fivush, 2004). This means that autobiographical periods are not constructed by abstracting properties from concrete specific or categoric

memories. Second, individuals construct autobiographical periods for their future. Although they may have knowledge of specific future events, anticipated specific future events are often centered around the near future (Spreng & Levine, 2006), and future autobiographical periods extend very far into the future (Thomsen, Lind, & Pillemer, in preparation). Thus, it is unlikely that future autobiographical periods are based on abstracting properties from specific future events. The same argument can be made for past and future autobiographical periods for other people. Socially shared life period thinking, that is, through conversations with others, is probably often involved when individuals construct autobiographical periods for other people (and their own early childhood; see Fivush, Habermas, Waters, & Zaman, 2011 for an example). Third, autobiographical periods are parallel, meaning that they are not just constructed with reference to continuous chunks of time. It follows, that some kind of reasoning must be present to construct the same time interval as two or more different autobiographical periods. Another reason for selecting life period thinking as a central process for constructing autobiographical periods is that the effects of rehearsal on memory are well-documented (e.g. Greene, 1987). Although autobiographical periods may become a part of life stories, and are related to personality and well-being, they are a memory phenomenon and hence memory processes should be assigned a central role in a theory about autobiographical periods.

Life period thinking is a dynamic process that may serve to both construct autobiographical periods, and to associate knowledge with such periods. Thus, through life period thinking, individuals may create serial and hierarchical relationships between different autobiographical periods. Life period thinking may also co-occur with narrative processes of causal and temporal analyses and thus associate narrative knowledge with autobiographical periods. Finally, specific and categoric memories may become associated with autobiographical periods through life period thinking. That is, thinking of a specific or categoric event (past or future) as a part of an autobiographical period will create an association between the event and the autobiographical period. Based on the accumulation of memories associated with autobiographical periods, the individual will perceive certain people, places, and activities as typical for the autobiographical period.

As individuals rehearse autobiographical periods and associated memories, autobiographical periods are shaped and consolidated. Like ad hoc categories, some autobiographical periods become more accessible and some associations between autobiographical periods and memories become stronger due to rehearsal (Barsalou, 1983; 1988). The most accessible autobiographical periods will be those that encompass many memories, that is, longer autobiographical periods at higher levels of abstraction. This is because rehearsal of each memory may include rehearsal of the autobiographical period, and including many memories will therefore increase the total rehearsal of the autobiographical period. In addition, autobiographical periods containing highly goal-relevant and emotional memories will become more accessible. Goal-relevant and emotional memories are more often rehearsed (Thomsen et al., under review) and because such rehearsal may include rehearsal of the autobiographical period, it will increase the accessibility of the period.

Life period thinking leads to the construction of autobiographical periods in both the present, in the future, and in retrospect. With respect to the present, specific memories may be rehearsed as a part of an ongoing autobiographical period. For example, a child's first school day may be rehearsed as a part of the child's school years (which may be an autobiographical period for both parents and the child). With respect to future autobiographical periods, the individual may think of the future in terms of autobiographical periods that have not yet begun, e.g. a young adult may anticipate a future period of university as well as certain specific and categorical events associated with the future autobiographical period. With respect to the construction of autobiographical periods in retrospect, the individual may realize during rehearsal of a temporally distant specific memory, that it was the beginning of an autobiographical period, which was just not realized at the time of the event.

Information affecting life period thinking

Life period thinking is the proximate process leading to the construction of autobiographical periods. The second assumption of the theory is that life period thinking is shaped by different types of information. Three general sources of information are assumed to influence life period thinking: Socio-cultural processes, periodic experience, and goals (see Figure 2 for an overview of processes involved in

the construction of autobiographical periods). Including these processes in a theory of autobiographical periods seems warranted because memory is a complex mental phenomenon that is affected by a multitude of processes, as evidenced by the literature on specific memories and life stories (e.g. Berntsen & Rubin, 2004; Conway, 2005; Habermas & Bluck, 2000; McAdams, 1996; Nelson & Fivush, 2004). Below, these sources of information are related to the construction of autobiographical periods.

Socio-cultural processes

Language contains terms that refer to periods in life, rather than circumscribed events, such as month, marriage, vacation, and employment. Such terms reflect culturally agreed upon knowledge that life consists of periods. There are several types of such knowledge. First, knowledge about calendar time includes knowledge of time as periodic, like weeks, months, seasons, and years (Larsen, Thompson, & Hansen, 1996). Second, the social niche that the individual is a part of may be associated with general knowledge about periods in the niche, e.g. semesters and vacations for teachers (Robinson, 1986). Third, there is broader, culturally shared knowledge that the life span includes different periods (Burns & Leonard, 2005; Conway & Bekerian, 1987). Such knowledge may derive from popularization of psychological theories of the life span, such as Erikson's (1959) psychosocial theory about periods in life and the challenges associated with each period (e.g. adolescence). Another source of such knowledge is the cultural life script, which is defined as "culturally shared expectations as to the order and timing of life events in a prototypical life course" (Berntsen & Rubin, 2004, p. 427; Thomsen & Berntsen, 2008). The cultural life script may be derived from culturally shared products, such as books, magazines, and movies. For example, culturally shared knowledge about the period of a romantic relationship contains knowledge of typical activities, like going out to restaurants and cinemas, kissing, and introduction to family and friends. Such shared knowledge may influence the individual's interpretation of a date as the possible beginning of the autobiographical period of a romantic relationship.

Fivush, Nelson and their colleagues have provided ample evidence that children learn to remember past events through verbal interactions with their parents (e.g. Nelson & Fivush, 2004). Likewise, children probably learn to think of life as consisting of extended time periods as a part of social interaction inspired by culturally transmitted

ideas about life as periodic. While interacting with parents, children may discuss past and future events as part of periods, e.g. "Do you remember when you were in kindergarten and you went on the bus trip to the natural history museum?" Such social interactions introduce children to the notion that life consists of periods and that specific past and future events are associated with such periods. Briefer autobiographical periods, like vacations, may initially be used in memory talk to introduce the notion of autobiographical periods and locating specific events with respect to these. As the child starts to retrieve/construct more temporally distant past and future events, memory talk may refer to relevant autobiographical periods, e.g. "while we lived in the apartment". Note that such memory talk depends on the parent attributing autobiographical periods to the child, underscoring the importance of representing autobiographical periods in close others' life stories.

Other peoples' autobiographical periods also provide a unique source of information that goes beyond culturally shared period knowledge. Socially shared life period thinking thus provides the individual with ideas about what life periods the future may hold as well as detailed knowledge about activities and people associated with such periods. For example, a student may develop detailed ideas about events and activities associated with the period of "studying for a Ph.D." by talking to people who have experienced such a period. Thus, knowledge of other people's autobiographical periods may guide the construction of personal future autobiographical periods.

Culturally and socially shared knowledge about periods and memory talk between parents and children provide the individual with rich sources of information that shape life period thinking (shown in Figure 2 by an arrow from socio-cultural processes to life period thinking and by an arrow from others' autobiographical periods to autobiographical periods for the self). Such knowledge means that individuals will think of life as periods; that individuals will know what events may signal potential beginnings and ends of periods; autobiographical periods in other peoples' lives; and what periods the future may hold. However, present or past autobiographical periods for oneself will be constructed only to the degree to which such non-personal period knowledge match experience and is used by the individual to shape thinking about his/her own life.

Periodic experience

Experience has a periodic nature, that is, it contains regularities that extend over prolonged intervals of time. Thus, aspects of individuals' experience may for a prolonged period include certain activities, certain people, certain places, and certain objects, while other prolonged periods feature other activities, people, places, and object (Brown et al., 2012). When individuals are aware of the periodic nature of experience it may be used to inform life period thinking and thus the periodic nature of experience will be constructed as autobiographical periods (shown in Figure 2 by an arrow from periodic experience to life period thinking). There are several types of periodic experiences. First, if experience varies with calendar time, like seasons and months, these may be used to think of life as periods, e.g. "in December I buy presents; make cookies; and attend Christmas parties" (Larsen et al., 1996; Robinson, 1986). Second, if experience varies with the periods that are a part of the individual's social niche this may affect life period thinking (Robinson, 1986). For example, if activities vary with semesters and vacations, this will inform life period thinking and the construction of autobiographical periods. Third, across their life span, individuals may experience transitions that will change the activities, people, places, and objects that the individual encounters as a part of experience, and such changes may be used to inform life period thinking (Brown et al., 2012). Brown and colleagues (2012) mention several types of transitions: Public transitions that affect communities (e.g., wars); social transitions that affect several individuals (e.g., parenthood); and private transitions that primarily affect the individual (e.g. illness). In addition, they pointed out that transitions may be normative or non-normative, expected or unexpected, positive or negative.

Such transitions signal periodic experience that is prolonged, sometimes years and decades, and are thus likely to result in autobiographical periods at higher levels of abstraction. Periodic experience following the calendar year or the individual's social niche are often less prolonged and thus lead to the construction of autobiographical periods at lower levels of abstraction. These periodic experiences are also repeated, for example months and semesters. Repeatedly using these experiences as a source of information for life period thinking is thus likely to lead the construction of categoric autobiographical periods, that is, period knowledge that is based on a summary of similar periods. For example, professors may have categoric autobiographical periods of

spring semesters (e.g., “During spring semesters I typically teach a seminar, supervise bachelor theses, and attend a conference”).

Goals

Individuals are agentic beings that organize their lives (Bandura, 2006). They set long-term goals that subsume shorter-term goals and make plans to achieve these (Bandura, 2006; Martin & Tesser, 1996). Researchers generally agree that goals are central for structuring autobiographical memory and future thinking (Barsalou, 1988; Conway, 2005; D’Argembeau & Mathy, 2011). Goals are also likely to influence the construction of autobiographical periods (shown in Figure 2 by an arrow from goals to life period thinking). First, goals affect behavior (Bandura, 2006) and are therefore instrumental in bringing about the regularities in experience, which through life period thinking may lead to the construction of autobiographical periods (although some regularities in experience are not the result of goal-directed behavior, e.g. illness). For example, having a goal to become a psychologist, leads the individual to apply to a program in psychology. Once accepted into the program, the individual’s experience will follow periodic patterns (e.g. semesters and vacations) and entry into the psychology program will be perceived as a transition signaling long-term changes in the activities, people, and places that are a part of the individual’s experience. Second, long-term goals may affect life period thinking directly. According to appraisal theories, events are continually appraised with respect to novelty and goal-relevance (Power & Dalgliesh, 2008). If events are appraised as relevant to the individual’s goals, emotion and rehearsal will increase (Martin & Tesser, 1996; Power & Dalgleish, 2008). Such rehearsal will be informed by the individual’s long-term goals. For example, having a goal to find a romantic partner will mean that a date is rehearsed as the possible beginning of a relationship period. Third, long-term goals will affect which future autobiographical periods individuals anticipate (Demblon & D’Argembeau, 2014). A central part of human agency is forethought, understood as the temporal extension of agency (Bandura, 2006). Because individuals know that the pursuit of long-term goals requires prolonged effort, they take this into account by constructing their future as consisting of extended periods. For example, having a goal to become pregnant, will shape future thoughts of a period of parenthood.

To summarize: Individuals possess culturally and socially shared knowledge that allow them to think of both their personal and others' past and future lives as consisting of periods. Such knowledge has a non-personal format, but it supports the recognition and anticipation of periodic experiences, that offset life period thinking leading to the construction of personal autobiographical periods. Goals affect life period thinking both indirectly by bringing about regularities in experiences and directly by influencing interpretation of events as a part of periods and anticipation of future periods.

Explaining the effect of autobiographical periods on retrieval and dating of specific memories

Retrieval

The effect of autobiographical periods on the retrieval of specific memories is assumed to rely on associations between autobiographical periods and specific memories. In general, if a specific memory becomes associated with an autobiographical period, it will be more likely to be retrieved because generating the autobiographical period through cue elaboration will facilitate the retrieval of the specific memory. But because autobiographical periods are associated with multiple specific memories, they are poor cues in terms of isolation (Berntsen, Staugaard, & Sørensen, 2013). However, when used in combination with other cues (e.g. general events, Conway & Bekerian, 1987), isolation of a specific memory may be faster and thus autobiographical periods can facilitate retrieval. Because specific memories are associated with many representations, like categoric memories and general concepts (Conway, 2005; Renoult et al., 2012), and such associations may be stronger than associations between specific memories and autobiographical periods, other cues may sometimes override autobiographical periods as cues (e.g. Schulkind et al., 2012). Thus, autobiographical periods may facilitate the retrieval of specific memories, but the effect depends on the strength of the associations between the autobiographical period and the specific memories and presence of other cues and their associations with specific memories.

Start and end point effect

Specific memories from the beginning and end of autobiographical periods may be more strongly associated with autobiographical periods than other specific memories and hence more often recalled when the individual is cued with autobiographical periods. The stronger associations between specific memories at starts/ends and autobiographical periods are established through rehearsal. First, specific memories at the beginning and end may be rehearsed more in relation to the autobiographical periods, either because the individual recognizes their significance to the autobiographical periods or because they are non-scripted and thus less likely to be processed in relation to categoric memories (Pillemer et al., 1986; Schank, 1999). Second, specific memories at the beginning and end of autobiographical periods may be more distinct, emotional, and goal-relevant and because of this rehearsed more (Pillemer et al., 1986; Thomsen & Berntsen, 2005). Because rehearsal includes relations between the specific memory and the autobiographical period, the association between them will be strengthened.

Dating

Knowledge of time may be associated with autobiographical periods through rehearsal of salient start and end dates that may serve as temporal landmarks (Friedman, 2004; Shum, 1998). For example children's birthdays, wedding anniversaries, and writing CVs provide ample opportunity to rehearse dates associated with beginnings and endings of autobiographical periods. Since most specific memories are associated with at least one autobiographical period, the dating of the specific memory can be narrowed down to have occurred during this time interval. However, autobiographical periods at lower levels of abstraction may not be delimited by such salient temporal landmarks perhaps leading individuals to estimate the time interval of an autobiographical period by using cross-linking with other more high-level autobiographical periods, where dates are known.

Explaining the association between autobiographical periods, life stories, traits, and well-being

Selected autobiographical periods are used to structure life stories. When individuals think about their life stories, autobiographical periods may be more accessible than specific memories, because they have been rehearsed more often (Barsalou, 1988). Such rehearsal may also include reflecting on causal links between autobiographical periods and between autobiographical periods and self-images, i.e. autobiographical reasoning (Habermas & Bluck, 2000). Because autobiographical reasoning is the process whereby material is selected into life stories, and autobiographical periods attract more autobiographical reasoning than specific memories (Jensen, 2014), autobiographical periods become central for organizing life stories. But not all autobiographical periods are selected as important to life stories. Academics may often think of academic terms as autobiographical periods and use these to structure activities, but academic terms are rarely featured in life stories. Rather individuals select longer autobiographical periods at higher levels of abstraction, capturing important transitions (Steiner et al., 2014; Thomsen & Berntsen, 2008). Such high-level autobiographical periods may be emotional and goal-relevant and hence be associated with more rehearsal and autobiographical reasoning.

Life period thinking dynamically shapes the construction of autobiographical periods. Since rehearsal processes are influenced by personality (e.g. Trapnell & Campbell, 1999), personality may also influence which aspects of autobiographical periods are rehearsed. For example, individuals high on Neuroticism may focus their rehearsal on negative aspects of autobiographical periods, leading the periods to be evaluated more negatively (e.g., rehearsing negative events from one's vacation more frequently than positive events may lead to negative evaluations of the vacation period). Additional processes maximizing self-consistency may polarize the emotional content of the autobiographical period further (Beike and Landoll, 2000). Individuals high on Neuroticism may also select negative autobiographical periods as more central to their life story and emphasize negative interpretations of the meaning of the autobiographical period (e.g., interpreting a failed relationship as being caused by one's general inadequacy).

Positive and negative emotions are important aspects of subjective well-being (Diener et al., 2003). Emotions result from a continuous appraisal process, where events are evaluated in terms of their goal-relevance and potential for coping. Potential for coping is assessed based on knowledge of the self (Power & Dalgleish, 2008). Autobiographical periods represent such knowledge and the content of these periods may thus influence the appraisal process and hence whether positive or negative emotions prevail. For example, if an individual has evaluated her university period as generally negative and interpreted the period as a sign of her academic incompetence, using this autobiographical period in the appraisal of ongoing events is likely to lead to negative emotions and reduced subjective well-being.

Summary of the theory and future directions

The construction of past and future autobiographical periods for both oneself and other people is a dynamic process that depends on life period thinking. When thinking of lives as consisting of periods, individuals associate different types of knowledge with autobiographical periods, such as abstract knowledge of people and places, narrative knowledge, and specific and categoric events (both past and future). Increased thinking about a given period and the associated material leads to higher accessibility of the autobiographical period and strengthening of associations. Life period thinking is shaped by socio-cultural processes, periodic experience, and goals. Because autobiographical periods are associated with specific memories, they may function as cues that facilitate the retrieval of specific memories. But the effect depends on the strength of the association between the autobiographical period and the specific memories, as well as the presence of other cues and their associations with specific memories. The start and end point effect occur because specific memories at start and end points are more strongly associated with autobiographical periods than memories from other time points. Temporal information may become associated with autobiographical periods through rehearsal of start and end dates of periods, and this information may be used to aid dating of specific memories associated with the period. Autobiographical periods become central to life stories because they are rehearsed more often and hence more accessible and associated with more autobiographical reasoning compared to specific memories. Personality traits affect how autobiographical periods

are thought about and their emotional quality, which becomes related to subjective well-being through appraisal processes generating emotions.

The theory complements existing accounts of autobiographical memory by providing a comprehensive framework for autobiographical periods, which has generally been ignored. The theory has borrowed insight from several theories, namely that social-cultural processes shape autobiographical memory (Berntsen & Rubin, 2004; Nelson & Fivush, 2004), that transitions offset autobiographical periods (Brown et al., 2012), that goals influence autobiographical memory (Barsalou, 1988; Conway, 2005), and that reasoning processes are crucial in the construction of life stories (Habermas & Bluck, 2000). The central propositions of the current theory are thus compatible with other theories in the area. At the same time there are some important differences between the current theory and existing theories. First, in delineating the theory I have not used the concept of the self extensively, a concept which is a central feature of the self-memory-system theory (Conway, 2005). The self is a very broad concept, where different aspects may interact with autobiographical periods in different ways. Thus, focusing on more well-defined concepts such as goals and personality traits (that are arguable aspects of selves) seemed a better strategy when analyzing relationships with autobiographical periods. Second, the current theory emphasizes life period thinking, which is a type of rehearsal or reasoning process, in the construction of autobiographical periods. Other theories of autobiographical memory place much less emphasis on rehearsal/reasoning processes (e.g. Brown et al., 2012; Conway, 2005). However, life period thinking seems as present the only process that can account for the variety of findings in the area, for example autobiographical periods for early childhood, the future, and other individuals.

With respect to directions for future research, it will be important to empirically test the central propositions in the theory. While some parts of the current theory are consistent with prior research, several ideas remain to be tested. The theory emphasizes life period thinking as the proximal process in the construction of autobiographical periods. However, there is no research directly examining the role of such thinking in constructing autobiographical periods. In autobiographical memory research, rehearsal is often measured on a single scale, focusing on degree of rehearsal rather than content (e.g. Thomsen et al., under review). To test the theory, studies need to focus more on the

content of rehearsal and examine whether rehearsal of specific memories includes thoughts about the autobiographical period that the specific memories are associated with. Studies should examine whether life period thinking predicts the construction of autobiographical periods and associations with specific memories. One possibility is to conduct an extended diary study where participants are asked to report events every week and assess whether they think of periods when rehearsing these events.

Participants could later be asked to identify autobiographical periods within the diary period, which could then be coded for overlap with diary reports of life period thinking.

With respect to the sources of information affecting life period thinking, further research is also needed. It will be important to establish 1) at what time parents begin to introduce autobiographical periods into memory and future event talk with children and what factors influence this (e.g. transitions, mental time travel abilities); 2) when children can think about their own and other peoples' past and future lives in terms of autobiographical periods and whether this depends on conversational practices; 3) the content of culturally and socially shared knowledge of periods, and the processes whereby individuals accumulate such knowledge and use it to think about their own and other people's lives; 4) how the periodic nature of experience is appreciated and used to think of life as periods; 5) and how goals structure life period thinking.

Another important goal for future research is to extend the range of variables related to autobiographical periods. As the review shows, autobiographical periods have been researched most extensively in connection with specific memories. Future research should examine autobiographical periods for the past versus the future, and for oneself and versus other people, in relation to personality and well-being. Studying these relations in clinical populations also seems promising, because several clinical disorders are characterized by related problems in self and other-understanding (e.g. Corcoran & Frith, 2003; Dimaggio, Lysaker, Carcione, Nicolò, & Semerari, 2008). Examining autobiographical periods as a way of organizing self and other knowledge in such populations may yield important insight into the nature of problems in self and other understanding that is not captured by studying specific and categoric memories. For example, researchers can use autobiographical periods to assess both coherence and complexity in the temporal patterning of autobiographical organization. This could be achieved by examining the degree to which individuals think of their entire life span in

terms of temporally and causally organized autobiographical periods, and the degree of parallel autobiographical periods. Thus, it could be examined whether clinical populations have less coherent and less complex autobiographical periods for both themselves and other people and whether there are correlations between characteristics of autobiographical periods for themselves and other people.

Based on the findings of future studies the current theory can be adapted and extended as necessary. Developing the theory and the concept of autobiographical periods will serve to emphasize the importance of a type of memory that has hitherto been overlooked in the literature. Because the concept of autobiographical periods is not easily encompassed in the existing typologies of memory (e.g., semantic versus episodic, Tulving, 1985, 2002), theorizing and researching autobiographical periods will contribute to re-thinking declarative memory.

Conclusion

In conclusion, autobiographical periods are distinct from other types of autobiographical memory. Individuals have autobiographical periods not only for the personal past, but for the future and for other people. Research has focused on the relationship between autobiographical periods and specific memories and found that 1) autobiographical periods can facilitate the retrieval of specific memories; 2) specific memories at the start and end of autobiographical periods are more often retrieved compared to memories from other time points, and 3) autobiographical periods are used to locate specific memories in time. The evidence concerning autobiographical periods in relation to life stories, well-being, and personality is less extensive, but it supports the idea that autobiographical periods are a prominent component of life stories and is related to well-being and some personality traits. While parts of the theory outlined above are consistent with past research, it also poses new questions that will only be answered by assigning a prominent role to autobiographical periods in future research and by combining perspectives from developmental, social, cognitive, and clinical psychology.

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Figure 1

Number of autobiographical periods across the life span

Note: Upper panel displays number of autobiographical periods from a sample of 59 old adults (mean age 78.04 years, note that autobiographical periods after this age have not been included in the graph) based on Thomsen & Berntsen (2008). The middle panel displays number of autobiographical periods from a sample of 159 middle-aged adults (mean age 50.01 years, note that autobiographical periods after this age have not been included in the graph). The lower panel displays number of autobiographical periods from a sample of 310 young adults (mean age 22.95, note that autobiographical periods after this age have not been included in the graph). The middle and lower panel are both based on Thomsen et al. (2014). The data were prepared in the following way: First, if a participant had an autobiographical period for a given year, a value of 1 was entered for that year; if the participant had two autobiographical periods for a given year a value of 2 was entered for that year etc.; Second, if no autobiographical periods corresponded to a given year, a value of 0 was entered, if the year was before the participant's current age and if autobiographical periods were given after the year in question. Thus, if a participant had an autobiographical period from age 6-14 and then autobiographical periods from age 17 until her/his current age, then 0 was entered for each of the years 0-5 and years 15-16. If a participant gave no end age for an autobiographical period, it was assumed that the autobiographical period was ongoing and hence the autobiographical period was entered for the start year and each year after until the current age of the participant. This procedure was considered reasonable, because participants in Thomsen et al., 2014 directly indicated that such chapters were "ongoing", Twenty percent, 13%, and 8% of all autobiographical periods in the old, middle-aged, and young sample respectively had a start year, but no end year (note that age differences may be due to differences in methodology).

Figure 2

Illustration of the central processes involved in the construction of autobiographical periods

Figure note: The lower parts of the figure illustrate that individuals represent parallel past, present, and future autobiographical periods for themselves and other people. The thin arrows illustrate the central processes involved in constructing autobiographical periods for oneself and other people: Socio-cultural processes, periodic experience, and goals shape life period

thinking through which autobiographical periods for both oneself and other people are constructed. Representations of autobiographical periods for oneself shape how one conceives of other peoples' autobiographical periods and vice versa.