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From individual memory to collective memory: A cognitive investigation of collective memories and collective future thoughts using behavioral and natural language processing methods

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INTRODUCTION

INTRODUCTION

Imagine walking through a bustling town square, resonating with tales and memories from various epochs: the horror of World War I and World War II, the awe of the moon landing, the euphoria of the Berlin Wall collapse, the despair following George Floyd's death or the 9/11 attacks, and the palpable anxiety of the COVID-19 pandemic. Each event, though unique, weaves a common theme that many people will remember, creating a collective memory. Overall, such events, whispered by the elderly, recalled by young generations, or lived by all, resonate in individuals. They are not just moments that impact a vast population; they are events that have woven themselves into our collective consciousness, individual by individual, including both personal and shared memories.

Let's discuss a specific collective event in the Belgian community that exemplifies this intricacy between personal and shared memories. On March 17th, 2020, the interim Prime Minister of Belgium Sophie Wilmès declared a national lockdown. I vividly remember the personal memories associated with that news and the following months such as writing my master's thesis, contracting the COVID-19 virus, baking, having family time, and so on. I am also drawn to the collective tableau associated with the COVID-19-related-events: a new Prime Minister, the linguistic medley of the presentations, the bewildering jargon of "lockdown", and that "Do people really need 50 rolls of toilet paper?" moment. Each piece of information contributes to a shared puzzle constituting collective memory.

In psychology, autobiographical memory, including memories and representations of personal events, has been examined for several years now in terms of content, cognitive structure, and the variables influencing their creation and retrieval such as aging and emotions. By contrast, little is known about collective memory (including shared memories and collective future thoughts)

from a cognitive perspective, which is surprising considering that nowadays we are almost always connected with others, through media and social media that constantly share news, and at a personal level through communication. Shared memories are present almost as much as personal memories. But it is only about two decades ago that psychologists started to tackle collective memory, whereas it has been examined for almost a century in sociology, history, philosophy, etc. This shift in psychology signifies a burgeoning interest in the social dimensions of memory.

In cognitive psychology, the understanding of cognitive mechanisms underlying the construction of collective memory is essential to explain how new events linked to important collective events will permeate our memories, form a collective representation of events, allow us to anticipate and prepare for similar future events, and impact relationships and collective identity. To examine these processes, this thesis is grounded in that social turn in psychology and examines the following questions: *How do shared memories evolve? Do they shape our views of the future?* These questions are examined through the combination of two dimensions. The first dimension relates to the type of representations (personal or collective). The second relates to their temporal dimension (past or future). Additionally, this thesis examines the following question: *Which variables influence shared memories?* Whereas the first question was examined through the combination of the two dimensions, the second question was examined by focusing specifically on shared memories and three variables influencing memories: the personal proximity effect, age effects, and identity effects. By combining these questions, this thesis approaches the theme of collective memory from a sociocognitive psychological perspective.

Given the nascent state of collective memory research in psychology, this thesis leans on the foundational knowledge of personal memories including their functions, their cognitive structure, and the variables influencing personal memories such as aging. The theoretical arc unfolds across three chapters. In the first Chapter, autobiographical memory is presented. Then to answer *"How personal memories are formed?"*, the Self Memory model is presented and is the basis of our main hypotheses. The following question *"Why do we remember personal events?"* is answered by discussing the functional approach of autobiographical memory. The second Chapter introduces the concept of collective memory and examines it by relying on similarities with autobiographical memory. Finally, Chapter 3 links personal and shared memories through the presentation of flashbulb memories of public events.

Encompassing five studies, this thesis offers a multifaceted exploration of collective memory. First, the type of memory dimension is examined by assessing personal and shared memories of public events in Study 1. The temporal dimension, the second dimension, is investigated by focusing on memories (past) and future thinking (future) in personal and shared memories in Study 1. These dimensions are examined through the cognitive structure of autobiographical memory and collective memory. Additionally, a specific focus is given to the impact of the COVID-19 pandemic on autobiographical memory organization in Study 2. The following studies examine various variables influencing shared memories, ranging from age effects to social identity effects and communication processes through Studies 3, 4, and 5. Because studies are presented as articles including a precise introduction, the theoretical introduction of this thesis is a general introduction that lays the ground and the general context in which the studies were developed.

THEORETICAL INTRODUCTION

CHAPTER 1
Autobiographical memory
Cognitive and functional approaches

In this first chapter, autobiographical memory is introduced as a type of long-term memory involving both episodic and semantic memories. First, the cognitive processes underlying personal memories are described. Then, the functions of autobiographical memory are presented to understand why we remember personal memories. Finally, for both the functional and cognitive approaches, we focus on aging and emotions as variables influencing personal memories.

1. Long term memory

It is widely accepted that there are two types of long-term declarative memory: episodic memory and semantic memory (Squire et al., 1993; Tulving, 1972). Semantic memory stores knowledge about the world, facts, ideas, and rules devoid of contextual details about the learning experience. For instance, one might know that Brussels is the capital of Belgium without remembering the details of when, where, or how one acquired that information. These memories are context-free, as opposed to episodic memories. In contrast, episodic memory includes memories of personal events and experiences anchored in a context. One can experience that memory through what Tulving (1985) named "autonoetic awareness" – which allows one to mentally travel across time (in the past, present, or the future). For example, someone can remember their last birthday party, including the clothes they wore, where it was, the people invited, the cake they ate, and their thoughts and feelings while blowing out the candles. These memories recalled by mentally traveling back in time, involve episodic details associated with the context of the experience, and reveal the importance of phenomenology in episodic memory (Klein, 2015; Wheeler et al., 1997).

While these types of memory have been explored separately, autobiographical memory involves both episodic and semantic components. Autobiographical memory refers to memories of experiences and events that happened in one's life relying on episodic details and semantic knowledge about the self (Conway, 2005; Conway & Pleydell-Pearce, 2000).

This manuscript presents two complementary approaches to investigate autobiographical memory. First, we explore the cognitive mechanisms underlying the encoding and retrieval of personal memories through the cognitive approach of autobiographical memory. Subsequently, through the functional approach of memory, we delve into why personal events are remembered. We then examine the influence of two important variables

influencing memory: aging and emotions. These factors, among others, are known to influence how events are encoded in memory and how they are retrieved from memory. For instance, emotions can enhance memory processes (Kensinger & Kark, 2018), whereas healthy aging is associated with episodic memory decline (Balota et al., 2000).

2. The cognitive approach of autobiographical memory

In this section, we present the cognitive approach of autobiographical memory to answer the question "*How do we remember personal memories?*". This approach focuses mainly on the creation and retrieval of personal memories in terms of quantity and content (Roediger et al., 2007). To start, we explore the organization of autobiographical memories, providing information on their hierarchical structure through the exploration of the most popular model of autobiographical memory. Finally, we discuss psychological phenomena in autobiographical memory.

2.1 The Self Memory System

The cognitive structure of autobiographical memory has mostly been investigated by Martin Conway and colleagues and is represented through Figures 1, 2, and 3 (Conway, 2005; Conway et al., 2019; Conway & Pleydell-Pearce, 2000). In this model, known as the Self Memory System model of autobiographical memory, three fundamental processes underscore the construction of personal memories. The first process posits that memories are not fixed representations but transitional constructed ones relying on a hierarchical structure. The second process emphasizes the role of cues in activating memories. Lastly, central control processes enhance and regulate the activated memories. These three processes are strongly associated with the self (Conway, 2005; Conway & Pleydell-Pearce, 2000).

Furthermore, the model combines two distinct types of memory at different levels. Episodic details, associated with specific events, are stored at the *'episodic memory level'* (see the lower part of Figure 1). The *'autobiographical knowledge'* base includes notably semantic information about oneself (see the upper part of Figure 1). The autobiographical knowledge component is structured in three levels, each representing more or less abstract knowledge: general events, lifetime periods, and the life story schema. Finally, the *self* component includes two sub-components: the working self which encompasses goals, values, and self-images, and the conceptual self which includes personality traits, and physical characteristics.

A recent revision of the model involves a second temporal dimension in autobiographical representations, the future, that shares the same structure as the past temporal counterpart (Conway et al., 2019) (see right side of Figure 2). In this section, we focus on the construction of personal memories relying on the hierarchical structure of the Self Memory System model. How personal memories and future thinking are associated is a question investigated in section 2.2 of this chapter.

Figure 1

The Self Memory System (Conway, 2005)
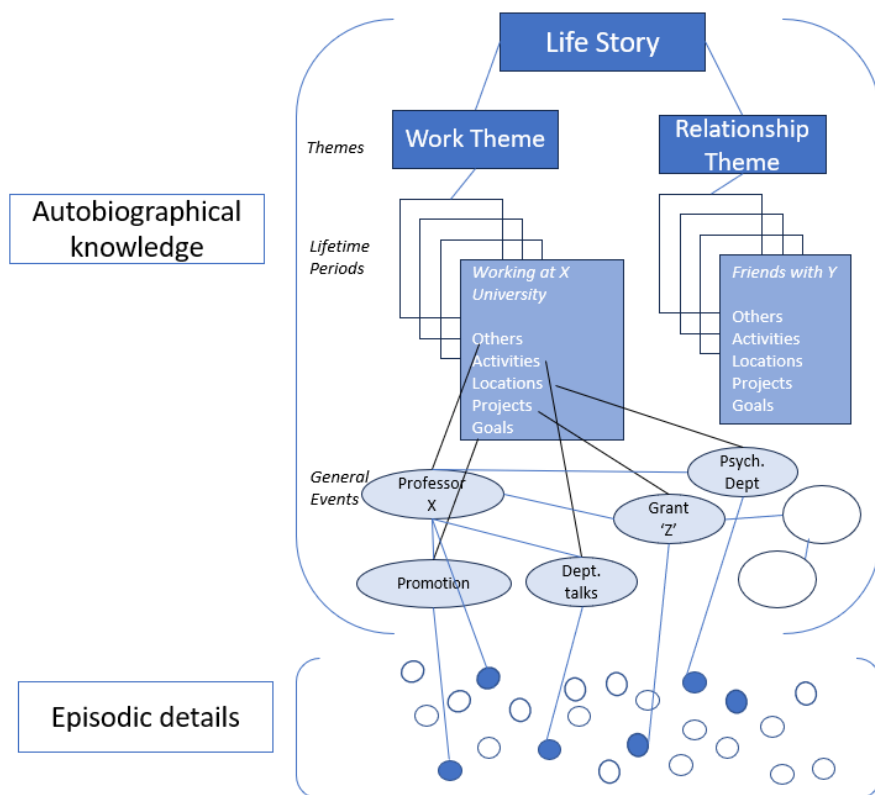
2.1.1 The self component

The Self Memory System model of autobiographical memory is centered on a bi-directional relationship between memories and the self (Conway, 2005; Conway et al., 2019; Conway & Pleydell-Pearce, 2000) (see Figure 2). According to this model, memories are not isolated entities but are influenced by personal goals, self-images, and knowledge integrated within the self (Conway, 2005; Conway & Pleydell-Pearce, 2000). In turn, identity influences the memories stored and retrieved in autobiographical memory (Conway et al., 2019). Memories are linked to identity through aspects of personality (McAdams, 1982; McAdams, 2016), goals, and emotions (Stein et al., 1999). As mentioned earlier, the self component encompasses the conceptual self and the working self.

The conceptual self includes semantic information related to autobiographical memories, such as personality traits, characteristics, and expected roles about the self from the past, the present, and the future (see Figure 2).

The working self component is a dynamic structure that comprises a goal hierarchy, values, and self-images (see Figure 3). It facilitates the encoding and the reconstruction of memories from autobiographical knowledge components and episodic memories (Conway & Pleydell-Pearce, 2000) (see Figure 3). The goal hierarchy of the working self serves as a control process, facilitating the encoding and maintenance of memories in the long-term. Recent memories follow a natural forgetting trajectory unless evaluated as important to goals and values (Conway, 2005; Conway et al., 2019). Over time memories are recalled in more general representations and focus more on significant personal events (see section 2.2). Moreover, the working self is underlined by two principles. First, the coherence principle suggests that personal memories are encoded and reconstructed in coherence with our goals and beliefs (i.e., our identity). The correspondence principle implies that autobiographical memories are in line

with our perception of reality (Conway, 2001; Conway, 2005; Conway et al., 2004).

Figure 2

The Self Memory System includes the conceptual self and the future dimension
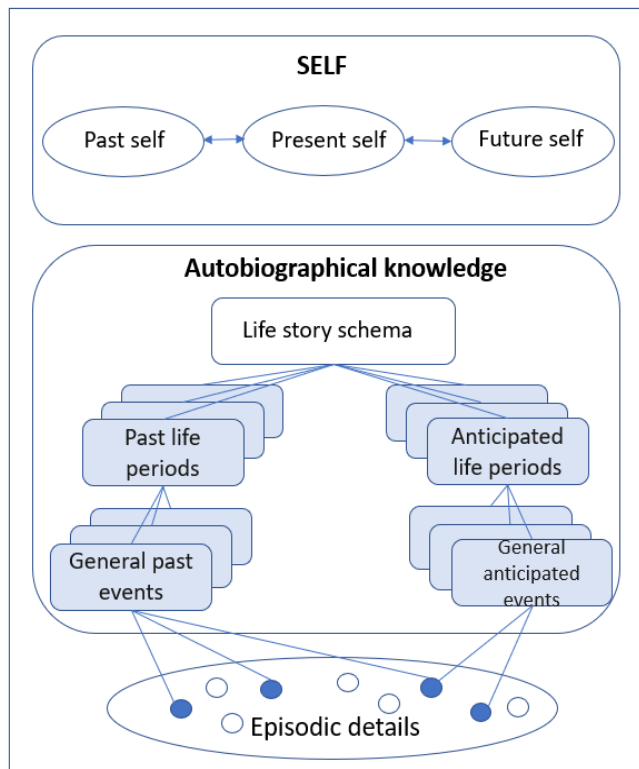
2.1.2 The autobiographical knowledge

The autobiographical knowledge component of the model operates at three different levels of specificity. Each level is associated with levels above and below in the hierarchy. It also encompasses conceptual personal knowledge and representations about the personal future (Conway, 2005; Conway et al., 2019).

The most abstract level is the life story schema. It includes knowledge about the self over an entire life including the future (Bluck & Habermans, 2000; Conway et al., 2019; McAdams, 2001). These schemas are available for different dimensions of our life such as life stories about friendships, relationships, or professional stories for the past and future. The narrative self (our story) is rooted in life story schemas.

Life story schemas evolve around lifetime periods, which constitute a more specific level. These periods incorporate characteristics of a specific period including knowledge about locations, people, goals, emotions, and thoughts, as illustrated in Figure 1 (Brown, 2016; Conway et al., 2019; Thomsen, 2015). For example, one lifetime period could be when I was a PhD student at Liege University. Different life periods can sometimes overlap with each other. The content of these periods includes thematic knowledge and temporal knowledge. Thematic knowledge refers to the fact that life periods are linked to higher representations of themes such as work or family. The temporal knowledge can be seen through transitions between these periods which are marked by personal events creating a cut and a shift from one period to another. These transitions are events that create a permanent change in our daily lives (Brown, 2016; Brown et al., 2009). For example, one transition could be when I move out from my parents' house to my place. These transitional events structure and organize autobiographical memory.

General events are shorter periods than lifetime periods and are included in lifetime periods (level above). It is also the level directly linked to specific events and episodic details. It includes repeated events (e.g., movie night on Fridays), and extended events (e.g., one-week holiday in Spain). This level allows the generation of cues to activate episodic details associated with the event.

2.1.3 Episodic memory level

The richness of personal memories is derived from the episodic details retrieved from the most specific level of the model. It includes various details of personal experiences contributing to the vividness of memories. These details can be related to sounds, smells, thoughts, feelings, visual details, and so on (Conway et al., 2004). Over time, episodic details are naturally expected to fade and be forgotten unless they are associated with and relevant to personal goals and values (Conway, 2009; Conway & Pleydell-Pearce, 2000). The episodic details are further discussed in section 2.2.

2.1.4 Process of activation and retrieval

An important feature of the model is that personal events are not stored in autobiographical memory as an exact recording of how they were experienced (see the specific case of flashbulb memories in Chapter 3). Instead, memories of personal events are constructed by cues activating higher levels in the autobiographical knowledge component, leading to a chain reaction activating the lowest other levels and connecting with other items/information from personal knowledge (Collins & Loftus, 1975). Finally, central control processes, associated with the goals, access the items activated by cues in autobiographical knowledge and assess the relevance of this activation (Anderson & Conway, 1993; Conway et al., 2004; Conway & Pleydell-Pearce, 2000). Beyond that assessment, it can refine the activated cues allowing them

to activate other knowledge. Following this process, a memory description is available (Norman & Bobrow, 1979) and activates other autobiographical memories (Mace & Clevinger, 2013). Most of these processes are unconscious. However, some can be voluntarily activated. For instance, cues can be voluntarily activated such as in studies using the cue-word method (see Box 1) (Conway, 2001; Conway et al., 2019) (see Figure 3).

Figure 3

Retrieval of personal memories
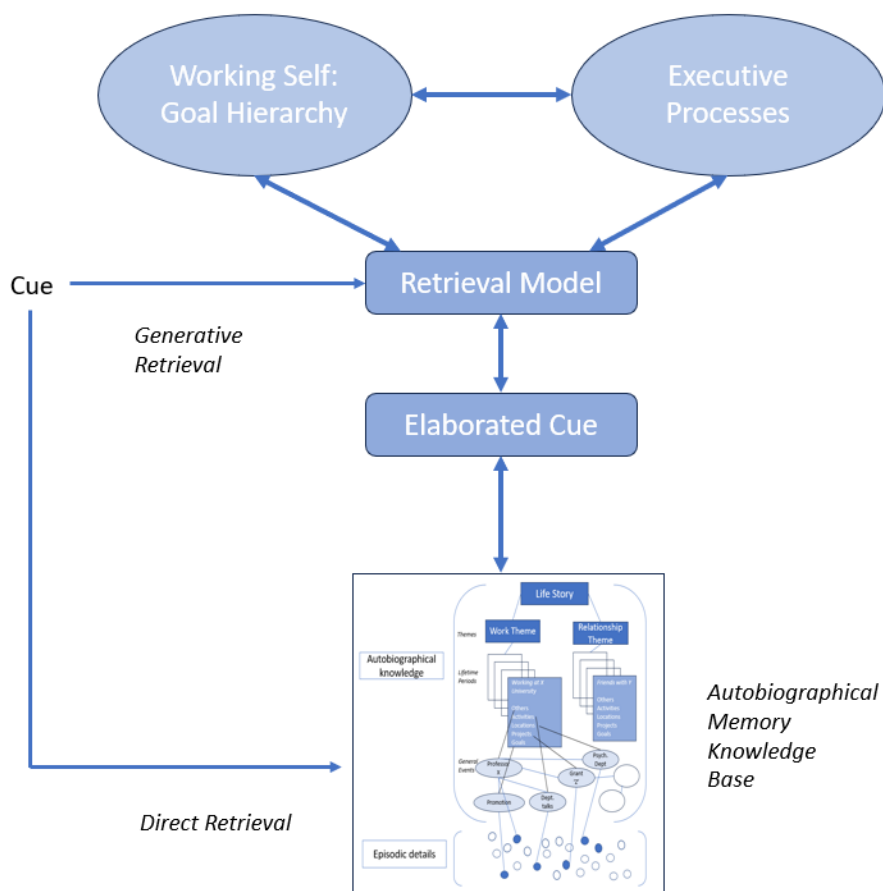
Box 1. Methods of investigation of autobiographical memory retrieval: the cue-word method & the autobiographical interview

One way to examine the retrieval of personal memories is by using the **cue-word method.** Researchers provide cue words to participants. Participants are asked to recall a specific personal memory associated with the presented word. For example, when presented with the word "university" someone might think of the day they graduated. Then, they are asked to date these events and verbalize everything they think about while doing so. See for example Brown et al., (2016), and study 3 in this thesis.

The **autobiographical interview**, developed by Levine et al. (2002) is a method that quantifies the amount of episodic and semantic information related to personal memories. It is also used to assess the imagination of future personal events. Memories and imagined events are examined in terms of internal or external details. Internal details are details describing the unfolding of the event and its context and are considered episodic information. Thus, internal details provide information about the event, time, place, perceptual, thoughts, and emotions. External details are not related directly to the specific event and describe general events, other events related to the central episode, semantic information, or metacognitive appraisal, and are considered semantic (or non-episodic) information (Levine et al., 2002). This assessment aims to evaluate the specificity of memories with internal details associated with a more phenomenological perspective of memories, and external details associated with a semantic perspective of memory. For instance, one memory could include internal details such as "*The car accident happened in 2020. I was in my house, with my family when I got the call.*" And external details associated with that memory could be added such as "... *I remember it very well*". This method has been used through studies 1, 3, and 4 in this thesis.

2.2 Psychological phenomena

It is important to highlight that the quantity and quality of autobiographical memories can be influenced by multiple variables. We will only consider here two of them. First, time has a natural influence on memories and their organization. This will be explained in subsection 2.2.1 through several theories and phenomena. We also discuss future thinking as a second temporal dimension in memory (subsection 2.2.2). Then, we examine individual variables that can also influence personal memories, focusing on aging and emotions (subsection 2.2.3).

2.2.1 Time related modifications of memories

The influence of the passage of time on memories is a well-known phenomenon. As time progresses, most memories naturally tend to fade and be forgotten (Gluck & Bluck, 2007; Schuman & Corning, 2014). The consolidation theories show that memory traces are strengthened through rehearsal which helps to consolidate memories in long-term memory (Duday et al., 2015; Squire et al., 2015). For example, the decay theory suggests that memories fade over time if not reinforced by rehearsal (see Sadeh et al., 2014 for a review). Rehearsal can happen through strategic (indirect) or associative (direct) retrieval that activates memories, which leads to reinforcing the memory trace. Strategic retrieval involves a conscious effort to search memory for components that will reconstruct a specific event. Associative retrieval corresponds to memories that spontaneously resurface in response to a cue, such as a visual cue for the environment. Both strategic and associative rehearsals reactivate a memory trace that is therefore strengthened (Moscovitch & Winocur, 2002). Therefore, old memories are more likely to be rehearsed than recent ones, making them more likely to be held in long-term memory than recent memories.

More specifically, the trace transformation theory posits that with time the original experience is recalled with less detail and less specificity, and in a more general way to recall the gist (Moscovitch et al., 2016). Indeed, studies revealed that participants recall more the gist (i.e., key elements of the story) and fewer details about a story as time elapses (Conway et al., 1991; Furman et al., 2012). Memories are remembered with central elements important to the coherence of the event (Rumelhart & Orthony, 1977; Thorndyke, 1977). The loss of episodic details over time can be seen through studies examining the recall of the plot and the recall of episodic details. Furman and his team (2007, 2012) conducted several studies in which participants were asked to watch a short documentary film and then answered questions about it. They found that questions related to the plot remained accurate over time, while the recall of contextual details based on a cued recall declined over the following weeks. Additionally, Sekeres et al. (2016) examined the time effect on memories of naturalistic events through film clips by asking young adults to recall them over 7 days. The results reveal that the peripheral details underwent a significant loss, whereas central elements (the gist) were less significantly affected by time. Similar results were also found when participants were asked to read a narrative and recall it (Bahrick, 1984; Conway et al., 1991).

From another perspective on time's influence on memories, the life span retrieval curve identifies three main periods: childhood amnesia (from birth to 5 years old), the reminiscence bump (from 10 to 30 years old), and the recency period (from now to the reminiscence bump) (Rubin et al., 1986). The widely demonstrated reminiscence bump corresponds to the fact that events that were lived between the ages of 10 to 30 years old are usually remembered more frequently than memories from other periods (for a review see Munawar et al., 2018). Studies show a bump at that period in the reminiscence of personal memories in participants older than 40 years old.

Three main explanations for the reminiscence bump are discussed in the literature. The first is associated directly with the formation of identity with memories of that period being more self-defining memories (Rathbone et al., 2008). Self-defining memories represent memories highly relevant to identity (Conway, 2005). These memories are specific due to their vividness, emotional intensity, and frequency of rehearsal (Blaglov & Singer, 2004; Singer et al., 2007). Building on these results, the self-image hypothesis suggests that memory is enhanced for events that happened during the period around adolescence and early adulthood, when identity is constructed (Rathbone et al., 2008). The second hypothesis suggests that this period is associated with several new experiences associated with a novelty effect that enhances the encoding of these events (Demiray et al., 2009; Pillemer, 2001; Wolf & Zimprich, 2020). Finally, the third hypothesis delves into the content of memories within this bump, noting that they predominantly include positive personal experiences rather than negative ones. This observation prompts an exploration into the influence of cultural life scripts. These scripts or schemas are semantic knowledge representing societal norms and expected events associated with specific life periods. Building on a collective influence, researchers have proposed that cultural life scripts may play a pivotal role in shaping the reminiscence bump of positive memories. These scripts can help organize autobiographical memory, influencing the recall of events fitting cultural expectations and favoring positive events (Berntsen & Rubin, 2002; Dickson et al., 2011; Rubin & Berntsen, 2003). Personal events that align with a cultural life script are more easily remembered (Glück & Bluck, 2007). Since memories retrieved during the reminiscence bump are mostly of positive valence, Berntsen & Rubin (2002) suggested that these scripts might act as guides when retrieving memories.

As previously discussed, the cognitive structure of autobiographical memory includes several life periods such as "When I lived with my parents" or

"When I worked at Liege University" (Brown, 2016; Conway et al., 2005). Boundaries between life periods are called transitions. Transitions are created by events that have enough intensity to change the fabric of daily life (Brown, 2021). These transitions can in turn be used as a temporal landmark when recalling one's life (Brown, 2016). Transitions encompass several dimensions. First, the normativity dimension refers to the fact that transitions can be life script consistent or not. Some transitions are expected in our society such as getting married, having children, and so on, whereas other events do not fit into expected life patterns (Brown, 2023; Gu et al., 2017). Secondly, the scope dimension encompasses the idea that transitions can be seen on a continuum from personal such as moving to a new place, to collective such as wars and natural disasters (Brown, 2023; Gu et al., 2017) (see Chapter 2). Thirdly, the impact dimension relates to the impact and consequences of the transitional events in someone's life (Brown, 2023; Gu et al., 2017; Shi & Brown, 2021). Overall, this phenomenon offers tangible evidence of how personal events significantly influence memory organization.

2.2.2 Future thinking

Having explored the phenomena anchoring autobiographical memory in the past temporal dimension, we now pivot to examine its counterpart: the future dimension (see Figure 3). This shift allows us to discover the intricate interplay between past experiences and future thoughts.

Episodic future thinking corresponds to the ability to imagine experiences that could occur in one's future (Atance & O'neill, 2001; Schacter & Addis, 2007; Schacter et al., 2017; Szpunar et al., 2007). Research on that topic has increased significantly over the last decade. The underlying cognitive mechanisms of future thinking are mainly discussed in the literature through the constructive episodic simulation theory (Schacter & Addis, 2007). This theory

includes autobiographical memories and suggests that to imagine future events, one relies on past personal memories and knowledge. These elements that make up individual memories are reassembled to simulate scenarios for possible future events. More precisely, when constructing personal future events we rely first on general personal knowledge to which we add specific episodic details (D'Argembeau & Mathy, 2011; Schacter et al., 2007; Szpunar et al., 2007). The semantic memory acts as the architecture for constructing scenarios (also known as the semantic scaffolding hypothesis; Schacter et al., 2007; Szpunar et al., 2007).

Related to that theory, numerous studies in psychology and cognitive neuroscience showed similar patterns between the past and future dimensions of autobiographical representations (D'Argembeau et al., 2015; Schacter & Addis, 2007; Schacter et al., 2012; Szpunar & McDermott, 2008). Here, we will discuss some of them. On the one hand, fMRI studies have shown that a core network of brain regions including the medial temporal lobe, the retrosplenial cortex, the medial prefrontal cortex, the lateral temporal and parietal regions are activated both when recalling past events and imagining future events (Benoit & Schacter, 2015; Stawarczyk & D'Argembeau, 2015). These regions are usually known as the default network (Raichle, 2015). Moreover, several studies have demonstrated an expanded activation of brain regions during future thinking compared to memory recall, implying reliance on schema-based processes in imagining future events (Addis et al., 2008; Szpunar et al., 2007). Behavioral studies, particularly through autobiographical interviews prompting participants to recall and imagine personal events, showed how they were similar in terms of internal and external details (Levine et al., 2002) (see Box 1). Given the involvement of internal details in both temporal dimensions, researchers posit that episodic memory plays a shared role across past and future temporal perspectives.

2.2.3 Variables influencing autobiographical memory

While several factors can influence memory, our discussion now narrows its focus to two significant variables: emotions and aging.

2.2.3.1 Effects of emotions on autobiographical memory

Emotions play an important role in autobiographical memory influencing the encoding and retrieval processes (Luminet, 2022). Under the scope of "effects of emotions on autobiographical memory" we can find two different levels of emotions' examination.

First, emotions can be examined at the memory level, through the valence of the memories and the events. For example, a wedding is usually a positive memory, whereas a death is usually a negative and sad memory. Building on that first examination level, the positivity bias in memory suggests that personal memories tend to be recalled with positive valence (Walker et al., 2003), shaping and maintaining a positive self-image (Walker & Skowronski, 2009). This emotional influence extends also to future thoughts with studies revealing that imagined personal events tend to be positive events, an effect also called optimism bias (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; Deng et al., 2022).

Secondly, emotions can be examined at the individual level through the emotions felt during the event or when recalling memories. The emotion enhancement memory effect posits that emotional events are usually remembered more vividly, more frequently and with greater accuracy than neutral events (for a review see Kensinger & Ford, 2020). On the other hand, emotions felt when recalling memories can influence how these memories are recalled. For instance, psychological well-being was also associated with autobiographical memory (Conway & Pleydell-Pearce, 2000). In more pathological contexts, anxiety and depression have been associated with a

negative bias in memories and future thinking (see Dalgleish & Werner-Seideler, 2014 for a review). There is a specific case where these emotions are too intense and can lead to a modification of memories, to experience intrusive thoughts, flashbacks of the traumatic event, and to suffer from memory difficulties, as evidenced in individuals with post-traumatic stress disorder (PTSD) (Park et al., 2012; Samuelson et al., 2022).

2.2.3.2 Age effects

Aging is associated with a natural decline in memory, particularly affecting certain aspects of episodic memory and personal memories (Balota et al., 2000; Drag & Bieliauskas, 2010). Older adults face difficulties recalling specific episodic details associated with an event and the context related to the event (Balota et al., 2000). In autobiographical memory, age-related differences in recalling specific episodic memories have been demonstrated with a method that examines internal and external details included in memory descriptions. Studies show age differences in these categories, where older adults recall more external details and fewer internal details compared to young adults (Levine et al., 2002; Mair et al., 2017; Mair et al., 2019). Older adults forget specific information (Greene & Naveh-Benjamin, 2020). In that line, studies showed that, when recalling memories, older adults tend to be more off-topic, which is characterized by a lack of coherence in their speech (Arbuckle & Gold, 1993; Pushkar et al., 2000; Trunk & Abrahams, 2009; Wills et al., 2012), especially by sharing personal opinions and memories (Barber & Mather, 2014; Bluck et al., 2016; Brandao & Parente, 2009). In cognitive psychology, this phenomenon is linked to the inhibitory deficit hypothesis (for a review see Hasher & Zacks, 1988; Zacks & Hasher, 1994), which posits that older adults have difficulties inhibiting irrelevant information, making them more likely to share it.

While episodic memory declines with age, semantic memory seems to stay stable (Craik & Jennings, 1992). Older adults can therefore rely on autobiographical knowledge to retrieve personal memories. Indeed, some researchers suggest that older adults rely more on the gist (the schemas) than the episodic details of these events compared to young adults (Flores et al., 2017; Grilli & Sheldon, 2022).

Memories can be subject to bias (see Schacter et al., 2023 for a recent review). For instance, studies show that memories' emotional content changes with aging. In aging, the positivity effect represents how older adults tend to recall more positive memories than their younger counterparts (Carstensen, 1993; Carstensen, 2006; Charles et al., 2003; Mather & Carstensen, 2005) and reinterpret negative memories through a more positive lens compared to younger adults (Charles et al., 2003; Comblain et al., 2005; Mather & Carstensen, 2005). This positivity effect is explained through the socioemotional selectivity theory. This theory highlights how the limited time horizon with aging influences goals and emotional regulation toward well-being (Carstensen, 2021). Therefore, this positivity effect appears to stem from increased attention to emotion management with aging, which is seen by cognitive mechanisms enhancing positive and diminishing negative information (Mather & Carstensen, 2005). This positive reappraisal is also considered a coping strategy for stressful events.

Regarding future thinking, research highlights that older adults retain the ability to project themselves in the future, using the same neural network to recall past experiences (autobiographical memories) and imagine future events (Viard et al., 2011). However, older adults tend to use less episodic details for future events than younger participants (Addis et al., 2008). For example, several studies showed that healthy older adults provide fewer episodic details (internal) and more external details compared to younger adults for future

imagined personal events (Anelli et al., 2016; Terrett & al., 2016). In line with these findings, age effects in episodic future thinking were associated with cognitive decline including working memory, executive functions, and episodic memory (Abram et al., 2014).

3. The functional approach of autobiographical memory

Several decades ago, Baddeley (1988) asked a ground-breaking question in the field of memory in his paper entitled "But what the hell is it for?". This question led to a new approach in memory studies forcing psychologists to shift the focus from "what" information is stored and "how" they are remembered to "why" we store and remember personal memories (Baddeley, 1988; Mahr & Csibra, 2018; Pillemer, 1992). Since then, researchers never stopped conducting studies aimed at identifying and assessing the various functions of personal memory (Baddeley, 1988; Bluck et al., 2005; Bluck & Alea, 2011; Bruce 1991; Hyman & Faries, 1992; Nairne et al., 2007; Neisser, 1978; Schacter, 2022; Webster, 1993).

Before the widely accepted tripartite model highlighting the main functions of autobiographical memory, which we present below (see Table 1), the first studies revealed a multitude of functions (see Table 2). Hyman and Faries (1992) asked participants to recall a memory and when it happened. Then, they were asked to estimate how often they talked about it and describe when and why they talked about it. Based on the results, the authors extracted 10 functions of memory. For instance, some memories are used to solve problems (problem discussion category), while others are used to entertain (entertainment category). Concurrently, Webster (1993) developed a scale encompassing forty-three possible reasons for recalling memories by asking participants to share two reasons why they recalled memories and two reasons why other people recalled memories. The forty-three functions were then condensed into eight

functions. These results are encapsulated in the Reminiscence Function Scale (Webster, 1993) (see Table 2). At the same time, Pillemer (1992) was the first to narrow the number of functions to three: the self function, the communicative function, and the directive function (Pillemer, 1992). Later, Bluck and her team (2005) created the TALE questionnaire (Thinking About Life Experiences), which has since become the foundation for numerous studies investigating memory functions (see Table 3). The shortest version of the questionnaire includes five items for each of the three psycho-social functions: the self function, the social function, and the directive function (see Table 1 for a general definition of each function).

Table 1

Definitions of the three main functions of autobiographical memory

Functions	Definitions
Self	To use memories to bear on one's identity
Social	To use memories to create or enhance relationships with others
Directive	To use memories to solve present issues or to imagine future events

The three functions highlighted in the tripartite model of memory have been demonstrated among several cultures such as the USA (Bluck et al., 2005; Bluck & Alea, 2011), Japan (Maki et al., 2015), Denmark (Rassmussen & Habermas, 2011), Croatia (Vranic et al., 2018) and France (Fritsch et al., 2021). The three functions were also found to be associated with well-being. Specifically, higher well-being was observed when memories were used more to fulfill these functions (Waters et al., 2014). Studies also stressed age effects and the influence of emotions on the use of memories for each function (Bluck & Alea, 2008; Rasmussen & Berntsen, 2009). In the following subsections, each function is defined and linked to age and emotional effects.

Table 2

Number of functions and functions by authors and scales

Authors and/or scale	Number of functions	Category/ functions
Hyman & Faries (1992)	10	- What's up - My experience with X - Reminiscing - Testifying - Self-description - Other description - Entertainment - Problem discussion - Point illustration/advice - Daydreaming/associative thought
Webster (1993) *Reminiscence Function Scale*	8	- Boredom reduction - Bitterness revival - Death preparation - Intimacy - Identity - Problem-solving - Conversation - Teach/inform
Pillemer (1992)	3	- The self - The communicative - The directive function
Bluck et al., (2005) *The TALE questionnaire*	3	- The self - The social - The directive

Table 3

The TALE questionnaire 15 items (Bluck et al., 2005)

Functions	Items
	I think back over or talk about my life or certain periods of my life...
Self	1. When I want to feel that I am the same person that I was before 2. When I am concerned about whether I am still the same type of person that I was earlier 3. When I am concerned about whether my values have changed over time 4. When I am concerned about whether my beliefs have changed over time 5. When I want to understand how I have changed from who I was before
Social	6. When I hope to also find out what another person is like 7. When I want to develop more intimacy in a relationship 8. When I want to develop a closer relationship with someone 9. When I want to maintain a friendship by sharing memories with friends 10. When I hope to also learn more about another person's life
Directive	11. When I want to remember something that someone else said or did that might help me now 12. When I believe that thinking about the past can help guide my future 13. When I want to try to learn from my past mistakes 14. When I need to make a life choice and I am uncertain which path to take 15. When I want to remember a lesson I learned in the past

3.1 The self function

The self function of autobiographical memory is tied to the process of recalling personal events and experiences to bear on one's identity and allow a sense of continuity in the self (Bluck & Alea, 2011). Of note, this idea is also central in the Self Memory System, presented previously, as self-defining memories are highly associated with identity processes (Blagov & Singer, 2004). Autobiographical memory stores information related to the self which serves to create a stable representation of ourselves as time passes. Indeed, identity is formed through life (Kaufman, 1986; Orona, 1990), but the feeling of being the same person remains continuous (Bluck & Alea, 2008; Conway, 2003). This stable identity is underlined by autobiographical narratives, starting in the teenage days (Habermas & Bluck, 2000) and through the life span (Waters et al., 2014). This function allows self-continuity, and coherence (Bluck & Alea, 2002; Habermas & Bluck, 2000).

Building on that, the self function has been associated with the concept of self-clarity (Bluck & Alea, 2008; Campbell et al., 1996; Jiang et al., 2020). Individuals with a less precise representation of their selves (i.e., less self-clarity) experience a lower feeling of self-continuity (Jiang et al., 2020) and are more likely to engage in the process of using memories to reinforce this sense of coherence (i.e., self function) (Bluck & Alea, 2008; Campbell et al., 1996). From a cognitive perspective, Walters and colleagues (2014) asked participants to recall memories of specific events, repeated events, and extended periods. Narratives were then coded for memory functions (as seen in Table 1). Results show that specific memories referred more to self function, compared to memories about repeated events and extended periods which serve self and social functions of memory. Additionally, a recent review revealed that memories remembered to foster a sense of continuity are more precise and

include more episodic details compared to memories used for social bonding and directive functions (Sow et al., 2023).

Emotions play a role in the self function. Positive memories are more likely to be used to fulfill the self function than negative memories (Rasmussen & Berntsen, 2009). Yet, some negative emotional events can also make it to our long-term autobiographical memory and become part of our identity. For example, traumatic events can influence one's identity (Berntsen & Rubin, 2006). Furthermore, memories are prone to bias and can be positively exaggerated to ensure a positive self-image (Walker & Skowronski, 2009).

Some authors suggest that cognitive aging might influence the use of memories to help self-continuity feeling (Bluck & Alea, 2009). Studies relying on the TALE questionnaire revealed mixed results. For instance, Vranic et al. (2018) did not find differences between young and older adults regarding the use of personal memories related to the self function. However, Bluck & Alea (2009) showed that young adults use more personal memories to bear on their sense of self-continuity compared to older adults. The inconsistent findings could be explained to some extent by age differences in studies. While both studies examined young adults, Vranic et al., (2018) examined memory function in young adults aged around 28 years old, while Bluck & Alea (2009) focused on young adults around 19 years old. Thus, teenagers who have a less clear concept are more likely to use memories for self-continuity purposes (Bluck & Alea, 2008). Moreover, it was found that memories recalled by older adults to serve the self function were more positive than the ones recalled by younger adults, highlighting a link with the positivity bias in aging (Alea et al., 2013).

3.2 The social function

The second function of autobiographical memory is the social function where personal memories play a role in the creation of new relationships or in nurturing old relationships (Bluck & Alea, 2008; Pasupathi, 2003; Sow et al., 2023). Studies showed that 62% of recorded events in a diary by participants were told to someone else by the end of the day (Pasupathi et al., 2009). In a relationship, sharing personal memories fosters a sense of intimacy and connection with partners (Alea & Bluck, 2007; Alea & Vick, 2010; Pasupathi, 2003), as well as a feeling of closeness with friends or strangers (Beike et al., 2016). Moreover, a recent review demonstrated that personal memories shared with others for social bonding goals tend to be more general and contain less episodic details than memories associated with the self function (Sow et al., 2023).

Emotions also play a role in the social function. Positive memories are more likely than negative memories to be shared with others to enhance relationships (Alea et al., 2013; Rasmussen & Berntsen, 2009). Sharing positive memories contributes to a positive atmosphere in relationships, enhancing a sense of connection and social bonds, mainly achieved by discussion, and sharing narratives (see Boxes 2 and 3 for links between social function and communication processes).

Regarding the impact of aging on the social bonding process, empirical studies present inconsistent findings. Some findings suggest that young adults remember more personal events to share them with others, compared to older adults (Vranic et al., 2018). However, another research did not find significant differences between young and older adults regarding the use of personal memories shared to connect with others (Bluck & Alea, 2008). For both studies, results are based on the TALE 15-items questionnaire with ratings on a Likert scale from rarely (1) to frequently (5) (see Table 2) *(e.g., I think or talk about my*

life, or period of my life when I want to know another person and what they are like) completed by young and older adults. One study found that older adults recalled more positive memories to fulfill the social function compared to younger adults, which is in line with the socio-emotional theory and the positivity bias discussed previously.

Box 2. Communication as the main tool for social function: a sociocognitive perspective of communication

The social function of memory is mainly achieved through communication. Sharing memories with others relies on sociocognitive systems (Bietti, 2010; Harris et al., 2014). The sociocognitive theories suggest that social and cognitive factors are involved and influence the memory process through factors such as social context, social norms (Bietti, 2010), the dynamics and roles between people engaging in a conversation (Hirst & Manier, 1996), or even cultural and age differences (Adams et al., 2002). As Welzer (2008) suggests, this phenomenon is characterized by interactive and interpersonal features.

Box 3. Sharing memories through narratives

When sharing a story, elements are recalled following a specific template (in chronological order) starting with the beginning and finishing with an end (Bruner, 1990; Teigen et al., 2017).

Wertsch (2008) distinguished two types of narrative templates. First, the specific narratives involve many specific details related to the characters, the unfolding of the event, and the date of a specific event, which rely heavily on episodic memory (e.g., the lockdown of the COVID-19 pandemic in 2020 was announced on the 17th of March in Belgium. It was announced by Sophie Wilmès. She was wearing a white dress.) Second, schematic narrative templates are abstract forms of narrative representations which can be used to narrate several events, independently of their unique actors or settings.

Schemas are believed to be common knowledge (Schank & Abelson, 1975), relying more on semantic memory. In this case, schemas are about the sequence of events (e.g., the context, the causes, and the consequences of an event). As such, they can be considered as basic building blocks of narrative (Wertsch, 2004), above which the specific narrative can be grafted.

3.3 The directive function

The third function of autobiographical memory is grounded on the idea that past experiences are stored in memory to be used to solve a current issue or to plan for future actions, often achieved through the mental simulation of similar future events (Bluck & Alea, 2005; Pillemer, 2003; Sow et al., 2023; Schacter, 2012; Vranic et al., 2018). As previously mentioned, the process of using past personal memories to imagine the personal future is discussed through the episodic constructive simulation theory (Schacter et al., 2017). Additionally, a link has been made between the ability to mentally travel to past experiences and solve problems, as individuals with limited capability to travel mentally to past experiences have more difficulties in using personal memories to solve issues (Kuwabara & Pillemer, 2010).

As for the two other functions, emotions are also associated with the directive function of autobiographical memory. Studies found that negative memories are more likely to be remembered to serve the directive function than positive memories (Alea et al., 2013; Lind et al., 2019; Rasmussen & Berntsen, 2009) and that traumatic events can also fulfill adaptative functions (Pillemer, 2003). One explanation is that negative memories are more likely to be associated with learning from past mistakes than positive memories (Lind et al., 2019).

As opposed to the other two functions, research shares consistent findings about the age effects on the directive function, revealing that young adults use more personal memories to solve a current issue or plan for the future compared to older adults (Bluck & Alea, 2008; Vranic et al., 2018). These findings can be explained as young adults are less experienced in life's challenges than older adults, making them likely to seek guidance from past experiences. Moreover, the future ahead is longer and uncertain for younger adults, leading them to be more likely to rely on past experiences to adapt to future situations

(Bluck & Alea, 2009; Vranic et al, 2018). As for the other functions, older adults recall more positive memories than younger adults to fulfill the directive function of memory (Alea et al., 2013).

Chapter 1: Summary

Chapter 1 reviewed the concept of autobiographical memory by offering an examination from two different and complementary perspectives: the cognitive and functional approaches.

The cognitive approach focused on two points:

a) A cognitive model of autobiographical memory discussing the importance of the self and a hierarchical structure.

b) Psychological processes associated with autobiographical memory such as time, emotions, and age effects.

The functional approach suggests three main functions of autobiographical memories.

a) The self-function: personal memories bear on the personal identity

b) The social function: personal memories can be shared and therefore enhance relationships with others

c) The directive function: personal memories can be used to imagine future personal events

For each function, aging and emotions effects on memories were investigated.

This chapter lays the foundations for the theoretical hypothesis of this thesis (see Chapter 4) and describes variables assessed through the different studies.

CHAPTER 2

Collective memory

The second chapter focuses on collective memory. It begins with a brief review of the multidisciplinary perspectives and key concepts associated with collective memory. Then, the psychological processes underlying collective memories are presented. Finally, through the functional approach, collective memory functions are described.

This chapter lays the groundwork for the investigation of flashbulb memories (Chapter 3) and frames the aims and hypotheses of the thesis within the broader context of collective memory research (Chapter 4).

1. Introduction to collective memory

Collective memory has been a subject of extensive research across various disciplines including sociology, anthropology, philosophy, history, and psychology (Hirst et al., 2018; Olick et al., 2011; Wertsch, 2002). Halbwachs (1950), a pioneer, emphasized the intrinsic connection between memory and social frames (i.e., the social context). Through his statement "It is the individual, as a group member, who remembers" (Halbwachs, 1950, p.46), he included the individuals within a group and linked personal memories with collective memories (Halbwachs, 1925).

The multidisciplinary interest in collective memory has led to several definitions of the concept (Heux et al., 2022; Orianne & Eustache, 2023; Roediger, 2021). In 1995, Assmann and Czaplicka introduced a crucial distinction within collective memory by distinguishing communicative memory and cultural memory. Communicative memory is shared between individuals through everyday interactions with friends and family (Baek et al., 2017; Cordonnier et al., 2021), while cultural memory refers to long-lasting and publicly available memories preserved in various forms such as objects, museums, and memorials (Assmann, 1995; Hirst & Echterhoff, 2012; Olick, 1999) (see Table 4).

Building on this social perspective of memory, cognitive and social psychologists have taken the lead in investigating collective memory within psychology. From a psychological perspective, collective memories are individual memories shared by members of a community shaping the community's identity (Coman et al., 2009; Hirst & Manier, 2008; Roediger & Abel, 2015; Wertsch & Roediger, 2008). Therefore, collective memory is not the same as history (Roediger & Abel, 2015; Roediger, 2021), but refers to "individual systems of consciousness" (Orianne & Eustache, 2023).

Additionally, Hirst and Manier (2008) distinguished collective memories from shared memories, regarding their links with collective identity. If the memories bear on the collective identity, these memories can be labeled as collective memories. If not, the memories shared with others are referred to as shared memories (Hirst & Manier, 2008; Merck, 2020). All collective memories are shared memories, but not all shared memories become collective memories (see Table 4). Also, a specific type of shared memories are vicarious memories, where individuals remember events that happened to others, influencing their identity without directly experiencing these events (Hirst & Merck, 2022; Pillemer et al., 2015).

Two main types of processes lead to shared memories. Firstly, they can be formed passively simply by learning about or experiencing the same public event. This process mainly relies on media. For example, people all over the world share memories about the events of the 9/11 attacks because they learned about them through the media (Paèz, 2015). Secondly, shared memories can be actively formed through communication processes, referring to communicative memory (Assman & Czaplicka, 1995). Communicative memory can be observed in groups of strangers, friends, and within families (i.e., intergenerational transmission of memories).

Another distinction is made between lived collective memories and distant collective memories (Hirst & Manier, 2002; Manier & Hirst, 2008). Lived collective memories represent memories held by individuals about an event that occurred during their lifetime (Hirst & Manier, 2002). Distant collective memories are events that occurred in the past when individuals were not born yet. For all of us, the COVID-19 pandemic can be considered as lived collective memories, whereas distant collective memories could be memories of World War I, for instance. Unlike distant memories, lived collective memories are recalled as more specific events, whereas distant memories are remembered in

a more general representation (Zaromb et al., 2014). Additionally, lived collective memories are recalled with more personal memories associated with the event than distant collective memories (Muller et al., 2016; Muller et al., 2018). Finally, lived collective memories seem to be more emotionally intense compared to distant collective memories (Muller et al., 2018). These results align with the temporal construal theory, a social psychology theory, that posits that representations are more abstract when the psychological distance to the object is important (Liberman & Trop, 1998; Manier & Hirst, 2008).

In the following sections, we delve into collective memory through the cognitive and functional approaches, followed by an exploration of the psychological processes underlying collective memory.

Table 4

Definitions of the main concept of collective memory

Concept	Definitions
Collective memories	*"Widely held memories of community members that bear on the collective identity of the community" (Hirst & Manier, 2008, p. 184)*
Shared memories	*Memories shared across a community that does not necessarily inform community identity (Hirst & Manier, 2008)*
Communicative memory	*Memories that are based on and transmitted through everyday communications (Assmann & Czaplicka, 1995; Muller et al., 2018)*
Cultural memory	*Long-term and stable memories that are maintained through cultural formations and that inform cultural identity (Assmann, 1995)*

2. The three facets of collective memory

Roediger (2021) described three facets of collective memory: collective memory as the body of common knowledge, collective memory as an attribute of a group of people, and collective memory as a process.

Collective memory as a *body of common knowledge* corresponds to the semantic knowledge shared in a community. This knowledge is not static and can be influenced by generational effects. For instance, Desoto & Roediger (2019) conducted a study where young and older participants from three generations (Baby Boomers, Generation X, and Millennials), were asked to recall the names of US presidents, which is supposed to be a body of semantic knowledge shared by Americans. They were asked to recall them in the correct chronological order if possible. The results revealed primacy and recency effects across different generations, indicating that collective memory shares the same phenomenon as seen for the recall of a list of words, following a serial curve. The results also showed that all participants shared knowledge about it confirming that collective memory encompasses a body of knowledge (see Fu et al., 2016 and Neath & Saint-Aubin, 2011 for other examples). For instance, different generations of participants recalled better the more ancient US Presidents but also significantly recalled Lincoln as a President (DeSoto & Roediger, 2019). The findings also underscored that different generations may forget certain aspects of this body of knowledge, through forgetting curves as seen for presidents from Truman to Ford, raising questions about collective forgetting. Related to this forgetting in collective memory, studies have shown that not all collective events are remembered. It seems that collective events that make it to our long-term memory are events that are commemorated such as wars, and attacks whereas natural disasters are not widely remembered (Liu et al., 2005). This idea of commemoration as a driver of long-lasting collective memories relates closely to the concept of cultural memory.

Collective memory as an attribute of a group of *people,* represents the image reflected by the group within the society ("Who we are"). It relies therefore on narratives of the group's origin, which answers the following question: "How did my group start?" (Yamashiro et al., 2022). As seen previously in Chapter 1, memories can rely on schematic narrative templates, a structure upon which a story is built. In the case of the groups, these stories often highlight the heroic and mythic elements (Wertsch, 2002), contributing to the maintenance of a positive social identity (Roediger et al., 2019).

The third facet is collective memory as a *process*, specifically through collective remembering. Memories are not static, but are actively reconstructed, shaping and reshaping the past (Bartlett, 1932; Roediger, 2021; Roediger & Abel, 2015). Building on that reconstructive nature of memory, several phenomena influencing collective memories are described in more detail in section 3 such as the time influence on memory, age effects, and emotions effects.

3. The cognitive approach of collective memory

In this section, we describe two approaches to study collective memory (i.e., top-down, and bottom-up). Then, we present several psychological phenomena in collective memory, like those underlying autobiographical memory. We also examine emotions and age effects in collective memory, as we did for personal memory in Chapter 1.

3.1 Different approaches to examine collective memory

The *bottom-up* approach in psychology delves into the processes through which individual memories contribute to the formation of memories shared within a group. This approach initiates its investigation from a dynamic individual perspective, aiming to understand the trajectory through which individual experiences evolve into shared memories within a community (Cordonnier et al., 2022; Hirst et al., 2018; Hirst & Merck, 2022). Social psychologists mainly lead research into the bottom-up approach, often examining the verbal exchanges between pairs of individuals. Dyadic exchanges can be extended to a broader network of individuals and are representations of what can happen at a higher level of communication (Hirst et al., 2018). For instance, studies examined how memories are shared or forgotten across networks (Coman et al., 2009; Coman et al., 2016; Sozer et al., 2023; Stone et al., 2022).

The *top-down* approach in psychology directs its attention to external factors and their influence on collective memory formation. This approach focuses on how specific collective memories are shaped within a community (Hirst & Merck, 2022). The strategy underlying the top-down approach involves recognizing collective memories, discerning which aspects have been retained, and then examining the cognitive principles and processes behind the encoding and long-lasting nature of these memories (Hirst et al., 2018). The top-down

approach is used in studies examining memories at national levels, such as studies examining memories of the 9/11 attacks in 3,000 Americans over time (Hirst et al., 2015). In that study, researchers found that memories about the event, and the memories of the reception context (e.g., where one was when hearing the news) were associated with loss of details up to one year after the event. Then, memories tend to stabilize. Moreover, 10 years after the attacks, the authors examined the influence of factors such as media and the amount of discussion and found that these variables influenced the accuracy of memories of the event, but not personal memories.

Unlike the bottom-up approach that starts with the individual representations, the top-down approach focuses on broader processes that impact the collective memory (Cordonnier et al., 2022; Hirst & Merck, 2022). This thesis integrates both bottom-up and top-down approaches to investigate collective memory.

3.2 Psychological phenomena in collective memory

In this section, we describe the influence of time on collective memory through studies revealing several similar phenomena as seen in autobiographical memory in Chapter 1. Then, we present aging and emotions as variables also influencing the creation of collective memories.

3.2.1 Time-related modifications of memories

Building on the time-related modification of personal memories explored in Chapter 1, this section highlights how shared memories are similarly influenced by time. We describe here three types of influence of time on shared memories: the recency effect, the reminiscing bump, and the Living-in-History effect.

As seen previously through the recall of the US Presidents (Roediger & DeSoto, 2014), retrieval of shared memories shows a recency effect. Accordingly, recent personal memories and recent shared memories are more likely to be recalled than remote ones (Conway & Holmes, 2004; DeSoto & Roediger, 2019; Fu et al., 2016; Roediger & DeSoto, 2014). The recency effect in collective memory has also been seen in Chinese Leaders, songs, and biographies (Candia et al., 2017; Fu et al., 2016). DeSoto and Roediger (2019) also found a primacy effect on the recall of US Presidents, revealed through several generations.

Similarly to personal memories, adults older than 40 years old remember more public events that happened when they were teenagers and young adults, known as the "critical period" or "critical years" (for a review, see Koppel, 2013; Meier, 2021; Schuman & Corning, 2012). This phenomenon is observed not only in the recall of historical events but also in other domains such as music (Schuman et al., 1997) and sports (Janssen et al., 2012).

Another phenomenon is grounded in the Transition Theory (Brown, 2016, 2023), revealing that public events such as wars and natural disasters can elicit collective transitions (Brown, 2016; Bohn & Habermas, 2016; Brown & Lee, 2010). Collective transitions, like personal ones, create boundaries between different lifetime periods (Brown et al., 2012; Brown et al., 2016). These lifetime periods are also referred to as Historically Defined Autobiographical Periods (H-DAPs). Building on these collective transitions, the Living-in-History effect posits that important collective events can be used as temporal landmarks and influence the temporal organization of autobiographical memory. For instance, one study found the 1999 earthquake in Turkey (Izmit) was used as a temporal landmark to date personal memories (Brown et al., 2009).

3.2.2 Collective future thinking

A few years ago, research ventured into exploring the future-oriented dimension of collective thinking, revealing that collective representations are not confined to past events but also encompass future collective events (Szpunar & Szpunar, 2016; Topçu & Hirst, 2020). Collective future thinking defined as "the act of imagining an event that has yet to transpire on behalf of, or by, a group" (Szpunar & Szpunar, 2016, p.378), offers a glimpse into how groups envision upcoming events. For example, each of us can imagine how a nation would navigate a future pandemic a decade from now.

Drawing on autobiographical memory research, researchers have proposed an interconnectedness between collective past and collective future representations (de Saint-Laurent, 2018; Merck et al., 2016). This proposition aligns with the notion that personal future thinking relies on personal memories (see the constructive episodic simulation theory in Chapter 1) (Schacter et al., 2017). For example, in terms of content, research showed that past and future collective representations in memory share the same topics (Öner & Golgüz, 2020; Topçu & Hirst, 2020). Öner & Gugloz (2020) asked participants to retrieve collective events that happened in the past and imagine future collective events. They found that the themes imagined were similar to the collective events that were recalled such as Presidential elections, economic crises, and coup. Additionally, in two studies by Topçu and Hirst (2020), American participants were asked to recall and imagine events related to the United States. They were also asked to assess factors such as emotional valence (on a Likert scale from negative (-3) to positive (+3)) and emotional intensity (scale going from not intense (1) to very intense (7)), phenomenology via the Memory Characteristics Questionnaire (Johnson et al., 1988), and perceived agency through several questions. It appeared that past and future collective representations correlated in terms of phenomenology, valence, and perceived agency.

Additionally, memories and projections were examined through the content and the specificity. The categories included violence, environment, finances, politics, war, human rights, sports, culture, science, health, and energy. Results revealed that memories referred more to violence and terrorism than projections. Future projections referred more to financial, human rights, sciences, and health compared to memories. The specificity was coded through three different levels from the least specific to the most specific. Level 1 refers to events that are continuous or recurring, lacking a clear start or end. Level 2 encompasses events whose duration was longer than 24 hours. Level 3 (specific) comprises events that have a precise time and place, occurring within a 24-hour time frame. Results reveal that future representations were less specific than memories. Building on the specificity of future thoughts, the remembering-imagining system highlights that the specificity of future thoughts depends on the time interval (Conway et al., 2016). Consequently, the more the time interval to imagine an event is further, the more likely these representations will be general and with fewer episodic details (Conway et al., 2016).

3.2.3 Variables influencing collective memory

3.2.3.1 Effects of emotions on collective memory

As for personal memories, the assessment of emotions' influence on memories can be done through two levels. The first is through the emotional valence of the events, and the second is through the emotions felt at an individual level that can be triggered by belonging to a group.

Emotional valence. As presented in Chapter 1, both personal memories and future thoughts are subject to a positivity bias, as personal memories are usually recalled positively (positive bias), and personal future events are imagined positively (optimism bias) (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; Deng et al., 2022; Salgado & Berntsen, 2020). In cognitive

psychology, studies examining the emotional valence of collective memories and future thinking generated inconsistent results regarding collective future thoughts, revealing either a negative bias, no bias, or a positive bias (Deng et al., 2022: Mert et al., 2023; Shrikanth et al., 2018; Topçu & Hirst, 2020). Indeed, Topçu & Hirst found that future representations were more positive than memories. The authors explain, to some extent, this positive bias through the higher scores of perceived collective agency for future events compared to past events. Moreover, several studies have shown a negative bias where participants recalled more negative national memories (Liu & Szpunar, 2023). A recent study revealed how this bias could be influenced by the culture as found with the Chinese population who imagine more positive collective events about their country than Americans and Turkish (Mert et al., 2023).

Group-based emotions. In the context of collective memory, group-based emotions play a pivotal role, representing a crucial component in social psychology. These emotions emerge among individuals who share a social identity associated with a particular group. The elicitation of these emotions is often linked to the behaviors or values exhibited by the group (Figueiredo et al., 2016; Klein et al., 2011). For instance, individuals who strongly identify with a specific group may experience group-based emotions in response to the actions and values of that group. A pertinent example from social psychology involves the emotions of guilt and pride experienced by Belgians concerning their nation's historical involvement in the colonization of Congo (Klein et al., 2011). This emotional response is intricately tied to the shared identity and historical context of the group. Moreover, it's noteworthy how these group-based emotions can vary across generations. Research indicates that younger generations in Belgium might feel more guilt regarding their country's historical actions compared to older generations (Licata & Klein, 2010).

3.2.3.2 Aging effects on collective memory

Despite a long line of research highlighting the natural cognitive decline that is associated with aging, up to this day little is known about age's effects on collective memory from a cognitive perspective. Some studies examined age differences in the emotional valence of collective memories, and the amount and specificity of collective memories retrieved.

Regarding the emotional valence of collective memories, a recent study showed that older adults focused more on the positive aspects of the first moments of the COVID-19 pandemic than younger adults, but no differences were seen in reporting negative aspects of the pandemic (Ford et al., 2021). It seems that the positivity effect in aging may also extend to experiences related to collective events (Comblain et al., 2005; Ford et al., 2021).

Regarding the amount of memories recalled, findings are inconsistent. While some studies found no age-related differences in shared memories of public events, the 9/11 attacks, in terms of the number of details recalled (Wolters & Goudsmith, 2005), other studies revealed that younger adults recalled more details compared to older adults (memories of the pandemic, Mustapha et al., 2021). Additionally, Zaromb et al. (2014) asked younger and older Americans to recall ten events that happened during three wars: the Civil War, World War II, and the Iraq War. The results revealed that younger and older adults recalled the same amount of public events such as the attack on Pearl Harbor, the D-Day, and the atomic bombs dropped during World War II. However, the emotional assessment of these events was different. Young adults tended to evaluate it negatively and older adults more positively. This can be explained by the fact that generations differ in their interpretations of the event. While older adults saw the bombing as a way of ending the war, the younger generation interpreted it as a tool leading to the death of innocent civilians. Moreover, this study showed that older adults recalled collective events with

less specific details and more generally, suggesting the use of schematic narrative templates (Umanath & Marsh, 2014; Zaromb et al., 2014).

Regarding collective future thinking, one recent study examined it throughout the adult lifespan (Burnett et al., 2023). Young, middle-aged, and older adults were asked to recall personal and collective past events that happened in 2019 and to imagine personal and future events that could happen in 2021. Participants were seen in 2020 during the COVID-19 pandemic, considering that period as a threat that shortened the time horizon. The results were consistent with the literature showing a collective negativity bias across all groups.

In this thesis, we developed a new method to examine the extent to which memories are similar within a group (see Box 4). This method brings a complementary perspective to the classical methods that assess the amount of episodic memories retrieved. Our method allows us to analyze the quantity of similar details between each participant and the other members of her/his group. Instead of simply reporting the number of details recalled among a group, this method allows us to appreciate to what extent the memories are similar within a group. In the case of aging, our method could bring a new perspective than the one considering a decline in episodic memory in older adults based on the amount of retrieved memories.

Box 4. Inter-subjects similarity measures

The computation of how similar the memories of participants from a group are, was inspired by works in cognitive neurosciences. In the field of visual perception, fMRI studies have shown an inter-individual similarity in the neural patterns of brain activity when participants view the same visual stimuli (e.g., movies), suggesting that individuals who experience the same event create similar perceptual representations (Chen et al., 2017). In these studies, young participants watched a film or short videos and then recalled the content of these sequences. Both the visualization and the recall took

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place in the MRI scanner. The analysis of the similarity of patterns of brain activity between individuals during the recall of the same video or the same part of the film highlighted a similarity of neural representations within the Default Mode Network (DMN). Intriguingly, in the study of Chen and colleagues, the brain similarity across individuals during recall was greater than the similarity between the brain pattern associated with recall and the pattern associated with encoding within the same individual. The authors interpreted this finding as evidence that memories of the experienced events were systematically transformed into high-level abstract and conceptual representations, a way that promotes the similarity of representations between individuals.

From a functional perspective, this pattern of findings suggests that individuals remembering the same events can have a common/shared memory representation, which has been suggested to facilitate exchanges and communications between interlocutors (Mahr & Csibra, 2018). However, these studies did not assess to what extent the recalled content was similar across participants from a behavioral point of view.

Building on the similarity concept, we created a new method to examine inter-subjects similarity. Our goal is to examine the similarity between the memories of participants by coding the presence or absence of predefined items such as details related to the spatial and temporal context, or the consequences of the events. Then, each participant is compared to every other participant in their group. Each comparison is based on the number of common details recalled by two participants. This number is divided by the total number of details recalled by at least one of the two individuals. For instance, two participants are asked to recall memories of the Russian-Ukrainian war. Participant 1 recalls 15 events, while participant 2 recalls only 10. 8 events related to the war are recalled by the two participants. The similarity of memories about that event for this duo is 53% (8 similar events / 15 total memories recalled).

This method has been used in studies 3, 4, and 5 of this thesis.

4. The functional approach of collective memory

The functional approach of collective memory examines the following question: "Why do individuals remember collective memories?". It has been suggested that collective memory shares the same three functions as autobiographical memory (Burnell et al., 2023; Heux et al., 2022; Liu & Hilton, 2005). In this section, the three main functions described in Chapter 1, namely self, directive, and social functions, will be examined from a collective perspective (see Table 5).

4.1 The self function: social identity function

As seen previously through the autobiographical memory model, identity, and memory influence each other (Conway, 2005). Similarly, the definition of collective memory entails the idea that one principal function of collective memories is to bear on the group identity (Hirst & Manier, 2008; Wertsch, 2002). Moreover, research in collective memory highlighted the importance of historical events in identity creation (Assman & Czaplicka, 1995; Hirst et al., 2018, Wertsch & Roediger, 2008).

Whereas the psychological definition of collective memory refers to "collective identity" (or group/community's identity), the literature mainly examined it through the concept of "social identity". Social identity refers to "those aspects of an individual's self-image that derive from the social categories to which they perceive themselves belonging" (Tajfel & Turner, 1979, p.40).

In cognitive psychology, social identity and its link with collective memories has been studied through the concept of flashbulb (see Chapter 3) (Hirst & Phelps, 2016; Kopp et al., 2020). These studies revealed that the likelihood of forming a flashbulb memory is influenced by group membership such as nationality (Curci & Luminet, 2009), religious groups (Tinti et al., 2009),

or sports groups (Merck et al., 2020; Zaromb et al., 2014). Other studies revealed that shared memories and social identity influence each other (Merck et al., 2020). For instance, several studies highlighted a national narcissism effect (Roediger et al., 2019; Zaromb et al., 2018). This national narcissism describes the behavior of participants that tend to overestimate their group contribution to a historical event (e.g., World War II, U.S, or world history), which allows them to keep a positive view of the group (Roediger et al., 2019; Sahdra & Ross, 2007). This effect is especially true for individuals who highly identify with their group (Sahdra & Ross, 2007). Additionally, as seen through the reminiscence bump for collective memories, some studies showed that the memories retrieved during the reminiscence bump period encompass more public events that are important for the collective memory of the group (Tekcan et al., 2017). Therefore, collective memories can also be influenced by ingroup bias.

4.2 The social function: intergroup relation

Sharing memories helps to maintain cohesion in the group (Wertsch, 2002), and enhances bonds across members of a community (Burnell et al., 2023; Wang, 2008), but also with other groups (Burnell et al., 2023).

It has been found that even if collective events were not lived (but formed through vicarious memory), they can be used to fulfill each memory function of collective memory (Lind & Thomsen, 2018; Pillemer et al., 2015). In families, for example, grandparents who survived the war shared memories of that experience with their children and grandchildren. Cordonnier et al. (2021) have examined how memories of the war, including personal stories, fade through new generations.

> **Box 5. Schematic narratives templates**
>
> The narratives we share are usually coherent and follow a schema (Bartlett, 1932). Schematic narrative templates are also considered cultural tools for remembering the past (Wertsch, 2008). Consequently, these templates can be culturally dependent (Bartlett, 1932; Wertsch, 2008) and bear specificities as a function of nationality (Wertsch, 2008) or other group memberships (Rimé et al., 2015).

4.3. The directive function: the means of actions or a political decision-making tool

The directive function of collective memory has been discussed by several researchers (Burnell et al., 2023; Heux et al., 2022; Liu & Szpunar, 2023; Wang, 2008). Some authors focused on the directive function of collective memory through its implication in means of action or as a political decision-making tool (Heux et al., 2022). The directive function at a collective level is also in line with the episodic constructive memory, which posits links between the past and the future. From an adaptative perspective, remembering past experiences and historical events could serve as lessons to guide future choices and actions allowing us to avoid making the same mistakes if a similar situation were to happen again. For example, recalling the COVID-19 pandemic could trigger an immediate response among the community to avoid making the same mistakes (see for instance the 9/11 case, Gigerenzer, 2004).

Table 5

Definitions of the three functions of collective memory

Functions	Definitions
Identity	To use collective memories to bear on the collective identity
Social	To share collective memories to maintain cohesion
Directive	To use collective memories to solve present issues or remember them as a lesson to adapt to future similar situations.

4.4 Autobiographical and collective memory: similar but not identical

While several research highlight the similarities in terms of the function of collective and personal memories, Burnell et al. (2023) argue that care must be taken when relying on autobiographical memory to understand collective memory. First, collective memories, as opposed to personal ones, are more prone to be influenced by social and political perspectives. Secondly, collective memory functions are less frequently used than autobiographical memory functions (Burnell et al., 2023). Indeed, most collective memories are memories of events that were not lived by individuals (i.e., distant collective memories) such as World War II. Therefore, the feeling of reliving these events cannot be as intense as the feeling of reliving personal memories, and collective memories usually include fewer episodic details. The authors mentioned preliminary results suggesting that the only collective event lived by the participants (9/11 attacks) had a higher score for the directive and identity functions compared to the other collective events presented. We argue that the extent to which collective memories are used to fulfill one of the three functions might vary depending on the nature of these events. For instance, it seems that lived historical events and collective events shared through vicarious memory might not be used with the same frequency. Moreover, building on the temporal

construal theory previously described, we argue that distant collective memories might be less used to fulfill the self-function of collective memory because they are recalled in less detail (Liberman & Trop, 1998; Schacter & Madore, 2016; Zaromb et al., 2014).

Box 6. The COVID-19 pandemic as a collective event

The COVID-19 pandemic, a global health crisis of unprecedented magnitude, has unfolded as a complex collective event. While individuals have faced the challenges of the pandemic on a personal level, leading to personal memories, the shared experiences and conversations about this extraordinary worldwide event contribute to the formation of shared memories. Therefore, the memories created through individual experiences and those actively and passively shared with others are the perfect research object to understand how collective memories are created, evolve, and are used to adapt to future events.

Chapter 2 : Summary

In this chapter, collective memory has been introduced through cognitive and functional approaches. Beyond the functions and facets of collective memory, psychological processes like the one underlying autobiographical memory were presented. Finally, this chapter highlighted the influence of emotions, and aging, on collective memory.

In the next section, we present the specific case of flashbulb memories.

CHAPTER 3

Flashbulb Memories

Chapter 3 focuses on flashbulb memories linked to public events, exploring them as a specific type of autobiographical memories, at the interconnection of autobiographical memory (personal memories of the context) and shared memories.

This chapter is structured in 4 main sections. The first section relates to the conceptual framework and emphasizes the distinction between reception memories and shared memories. The second section examines the cognitive processes underlying the formation and retrieval of flashbulb memories. The third section presents a specific model of flashbulb memories. Finally, the last section links the Self Memory System model and flashbulb memories.

1. Conceptual framework

Memories of collective events, particularly public events, encompass personal and shared memories allowing them to be studied through two lenses. First, they can be examined from an individual perspective since people individually learn and encode the news of the public event. People can remember the personal memories associated with the context of learning the news, referred to as reception memories, and in specific cases flashbulb memories (see below) (Merck et al., 2020). In addition to individual memories associated with the reception context (i.e., reception memories), people also encode memories about the events, the facts of what happened independently of the reception context (i.e., event memories) (Curci, 2017; Finkenauer et al., 1998). Secondly, memories of collective events (i.e., event memories) can be examined through a collective lens. By rehearsing event memories through different means such as media and discussions with others, people can form shared representations around the event, referred to as shared memories (Hirst & Phelps, 2016; Merck, 2020). For instance, regarding the 9/11 attacks, shared memories could encompass recalling that planes collapsed into buildings, on the 11th of September. Figure 4 visually represents shared memories within the continuum of autobiographical memory to collective memory.

Figure 4

A continuum from autobiographical memory to collective memory
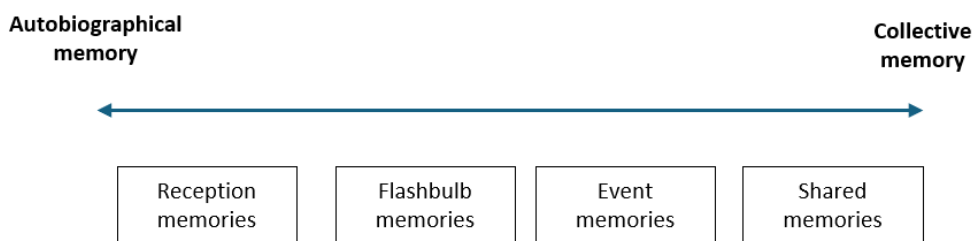
Table 6

Definitions of the main concepts associated with shared memory

Concept	Definitions
Reception memories	*Memories for the context of encoding (Merck, 2020)*
Flashbulb memories	*Vivid and long-lasting memories of the personal circumstances in which one heard the news about an event (Brown & Kulik, 1977)*
Event memories	*Memory for the facts about the event (Merck, 2020)*
Shared memories	*Memories shared across a community that does not necessarily inform community identity*

In the following section, we will discuss flashbulb memories of public events as a specific case that encompasses both personal and shared memories by relying on the concepts previously defined in Table 6.

Flashbulb memories, a subset of specific autobiographical memories, are vivid, detailed, long-lasting memories of the reception context when learning emotionally charged news, and are recalled with high confidence (Brown & Kulik, 1977; Luminet & Curci, 2017; Merck, 2020). Flashbulb memories can be induced by personal events (Pillemer, 2009) but are mainly studied in the context of public events. Initially, Brown & Kulik named these memories "flashbulb memories" to highlight the fact that these memories are very visual, where people have the impression of taking a snapshot of the situation when learning the news (Brown & Kulik, 1977; Muzzulini et al., 2022). Compared to reception memories, an important characteristic of flashbulb memories is their long-lasting and vivid characteristics (see Table 6).

Flashbulb memories were initially characterized by several canonical features of the reception context such as places, time, ongoing activity, informant, presence of others, personal reaction including own affects and thoughts, and the aftermath (see Box 7) (Brown & Kulik, 1977; Kizilöz & Tekcan, 2013). Studies typically examine the creation of flashbulb memories by assessing five canonical variables including time, place, informant, other people's presence, and ongoing activity (Brown & Kulik, 1977; Luminet & Curci, 2009). The most common example in the literature, due to the worldwide impact of the events, is associated with the 9/11 attacks in New York (Conway et al., 2009; Hirst et al., 2015; Luminet & Curci, 2009; Pezdek, 2003; Wolter & Goudsmit, 2005). The recollection of where one was, what one was doing, and what one thought when learning the news of the attacks of September 11 might constitute signs of flashbulb memory creation. Studies also examined natural disasters such as earthquakes (Er, 2003) or political events such as the O.J. Simpson verdict (Schmolck et al., 2000). Regarding that political event, results revealed that 80% of participants remember the personal reception context 32 months after the event (Schmolck et al., 2000).

Box 7. Flashbulb memories: examples of the canonical features assessment

Places: "Where were you when you heard about the events?"
Time: "What time of the day did you hear about the events?"
Ongoing activity: "What were you doing when you heard about the events?"
Informant: "Who told you about the news?"
Presence of others: "Who was with you when you heard about the event, or were you alone?"
Personal reaction (affect and thoughts): "What did you felt when hearing the news about the event?" "What did you think about when hearing the news about the event?"
Aftermath: "What happened during the aftermath of the event?"

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2. Cognitive processes associated with flashbulb memories

In the earlier days of flashbulb memory studies, it was suggested that these specific memories relied on a separate memory system. However, according to other research, it seems that flashbulb memories are a specific case of autobiographical memories, different from other autobiographical memories by some characteristics rather than a separate memory system (Conway et al., 1994; Hirst & Phelps, 2016; Kvavilashvili et al., 2003; Luminet & Curci, 2017; Tinti et al., 2014). Flashbulb memories share similar features as other autobiographical memories. For example, Hirst & Phelps (2016) showed that flashbulb memories and other autobiographical memories are similar in terms of consistency and forgetting rate. However, they differ in terms of vividness, confidence, accuracy, and social identity-related aspects. Flashbulb memories are more vivid, held with more confidence, accuracy and socially related than autobiographical memories (Conway, 1995; Curci et al., 2001; Curci et al., 2015; Curci & Luminet, 2009; Kvavilashvili et al., 2003; Hirst & Phelps, 2016; Pillemer, 2009; Talarico & Rubin, 2007, 2017).

Several variables can influence the likelihood of creating a flashbulb memory and remembering the event. The following subsection presents the main variables known to enhance flashbulb memory creation: emotions, consequentiality, social identity, and rehearsal. For a comprehensive overview of the variables assessed in flashbulb memories studies see Luminet & Curci (2017).

2.1 Encoding

As previously stated in Chapter 1, emotions play a crucial role in memory by enhancing the encoding of memories (Kensinger & Ford, 2020; McGaugh, 2018). In the case of flashbulb memories, emotions enhance the memorization of the reception context associated with the shocking event (Finkenauer et al., 1998). Flashbulb memories are usually studied in the context of negative public events such as natural disasters (Luminet & Curci, 2017), or terrorist attacks (Hirst et al., 2015), but positive events, such as winning a football game, can also trigger flashbulb memories (Bohn & Berntsen, 2007; Stone & Jay, 2017; Tinti et al., 2014). A long line of research linked specifically the emotion of surprise, through the appraisal of novelty associated with flashbulb memory creation (Coluccia et al., 2010; Conway et al., 1994; Pillemer, 1984) (see section 3).

Consequentiality, reflecting the personal and collective impact of an event, is another important component in flashbulb memory creation (Brown & Kulik, 1977; Rice et al., 2017; Talarico & Rubin, 2017). This has been assessed in two ways. First, consequentiality, investigated through the physical distance to the events shows incongruent results on flashbulb memory formation (Conway et al., 1994; Curci & Luminet, 2006; Pezdek, 2003), but seems to enhance the vividness of the memories (Kvavilashvili et al., 2003). Second, appraisal theories suggest that to develop a strong emotion associated with an event, that event should be assessed as personally important (Lazarus & Smith, 1988). Building on these theories, consequentiality was investigated through the personal consequences and personal significance of the events and the link with flashbulb memories (Bohannon & Symons, 1992; Brown & Kulik, 1977; Conway et al., 1994; Kizilöz & Tekcan, 2013; Rice et al., 2017; Tinti et al., 2014). Yet, these results are incongruent in the literature with several research highlighting that a low appraisal of personal consequence or low personal significance related to

the public event does not prevent the creation of the reception context memories (Davidson & Glisky, 2002; Kvavilashvili et al., 2003; Otani et al., 2005).

Due to the collective nature of the public event, social identity seems to also influence the creation of flashbulb memories. Associated with the consequentiality variable in the formation of flashbulb memories, researchers examined the consequences at a collective level suggesting that the more one or one's community is impacted by the event, the more are the chances to form a flashbulb memory (Brown & Kulik, 1977; Hirst & Phelps, 2016). As seen previously, social identity is defined as "those aspects of an individual's self-image that derive from the social categories to which they perceive themselves belonging" (Tajfel & Turner, 1979, p.40). It is usually assessed through group membership (Brown & Kulik, 1977; Stone et al., 2013) and was associated with flashbulb memory formation, accuracy, and vividness (Berntsen & Thomsen, 2005; Brown & Kulik, 1977; Tinti et al., 2009).

Flashbulb memories were also examined in the context of aging. A recent meta-analysis found that aging was associated with a small to moderate decline in the formation of flashbulb memories (Kopp et al., 2020). For example, older adults formed less flashbulb memories about Prime Minister Thatcher's resignation compared to younger adults (Cohen et al., 1994). It is worth noting that other studies did not find age differences in flashbulb memories creation (Otani et al., 2005), such as in the formation of flashbulb memories related to the 9/11 attacks (Davidson et al., 2006; Wolters & Goudsmith, 2005)

2.2 Post-encoding variables

Rehearsal**,** an important process to maintain memories (Dark & Loftus, 1976), occurs at individual and societal levels. Rehearsal fosters flashbulb memories after encoding (Curci & Conway, 2013). Three main means of rehearsal are discussed in the literature: rumination, communication, and media exposure. At the personal level, rehearsal involves thinking about the events (also referred to as covert rehearsal). However, due to the usual negative nature of the events, it can also be referred to as ruminations– a cognitive process where people engage in recalling memories focusing on the negative aspects of the memories (Curci et al., 2001; Luminet et al., 2004; Tinti et al., 2014). Societal level of rehearsal involves sharing these memories with others through verbal communication (Cordonnier & Luminet, 2021; Gandolphe & El Haj, 2017) or by hearing/seeing the information related to these memories, assessed through media frequency (also known as overt rehearsal) (Hirst & Meksin, 2017; Koppel et al., 2013; Luminet, 2017; Paèz, 2015). Therefore, rehearsing the facts about the event helps to consolidates shared memories about the event (Tinti et al., 2014). As stated by Luminet (2017), how rehearsal influences flashbulb memories and event memory is a complex question. This complexity can be seen as different models of flashbulb memory agree on its implication, but the link between rehearsal and other variables is different depending on the model (Luminet, 2017). In the following section, we focus on the direct and indirect pathways to create flashbulb memories, including rehearsal.

3. The emotional integrative model of flashbulb memories

Finkenauer, Luminet & Gisle (1998) presented the emotional integrative model of flashbulb memory formation, which was later revised by Luminet & Curci (2009) (see Figure 5) (see Luminet, 2017 for a review). They relied on surprise, consequentiality, affective attitudes, and rehearsal as variables influencing flashbulb memory creation. The model posits two pathways to form flashbulb memories. The direct pathway represents the direct link between emotions and memory. This path leads to flashbulb memories creation through the activation of novelty and surprise. The second pathway represents the indirect effects of emotions. Flashbulb memories are created through the assessment of personal importance and consequences that lead to emotions. The intensity of emotions influences rehearsal, which as seen in Chapter 1 helps to consolidate the memories. Collective rehearsal enhances event memories, whereas personal rehearsal (thinking and talking) influences the reception context (Luminet, 2017). Finally, previous knowledge influences consequentiality, emotionality, and rehearsal.

Figure 5

Emotional integrative model adapted from Finkenauer et al., 1998, updated by Luminet & Curci, 2009. Retrieved and adapted from Luminet & Curci, 2017.
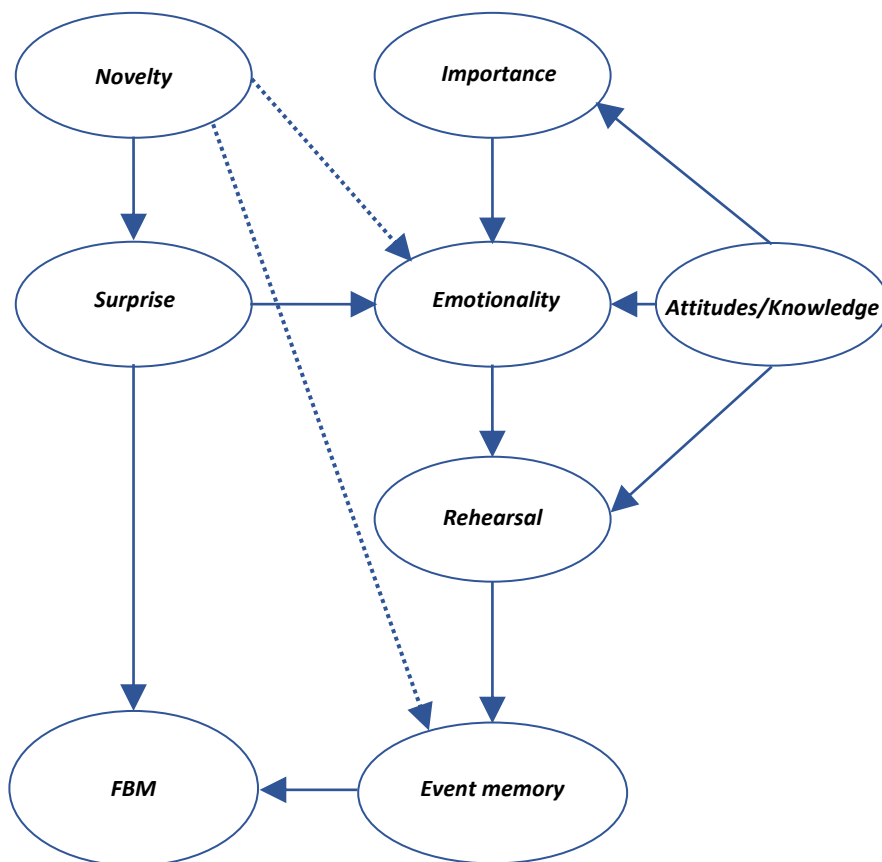
4. Self Memory System model and flashbulb memories

Flashbulb memories, a specific type of autobiographical memories, can be linked to the Self Memory System model of autobiographical memory through two temporal dimensions.

First, regarding the past, flashbulb memories – and their vividness - rely on episodic details, which are encompassed in the most specific level of the model (Conway, 2005; Curci, 2017; Tinti et al., 2014) (see Figure 1 Chapter 1).

Then, the links between flashbulb memories and the new dimension of the model, future thinking, are an avenue for further exploration. Up to this day, the relationships between the past and the future in the examination of flashbulb memories are quite rare. One study revealed that the creation of flashbulb memories could potentially mark a historical memory, that will be remembered by future generations (Luminet & Spijkerman, 2017). Except for this paper proposing a tentative link between flashbulb memories of public events and the future, to the best of our knowledge, no other study has examined this link.

As discussed in Chapter 1, personal memories can play a role in imagining future events through the directive function of memory. From an adaptative perspective, due to their distinctive characteristics, one might argue that these memories are recalled more vividly than other personal memories to help in adapting to future similar situations. Future thinking might be linked to the creation of flashbulb memories. Flashbulb memories are associated with several variables that could be influenced by the anticipation of the future. To fill that current gap in the examination of flashbulb memories and future thinking, we hypothesize that the way individuals imagine that event in the future – whether it will be remembered, should be remembered, or is deemed important to remember for adapting to future similar situations- might influence the creation of flashbulb memories. Additionally, emotions related to the group and the future, such as anxiety that this event will happen again in the future, could

also influence the formation of flashbulb memories. We aim to examine these links between flashbulb memories and future thinking through Study 5 of this thesis.

Chapter 3: Summary

The first chapter of this thesis discussed personal memories through autobiographical memory.

The second chapter developed collective memory through shared memories of public events.

This last chapter aimed to link personal memories (reception context memories) and individual memories of a collective event (shared memories) through the concept of flashbulb memories.

Chapter 4

Thesis overview

1. Aims and studies

As seen in Chapter 1, autobiographical memory includes memories of personal events and representations of future personal events (Conway et al., 2019). While existing literature has extensively explored the functions of autobiographical memory (Bluck et al., 2005) and its cognitive structure (Conway, 2005; Conway & Pleydell-Pearce, 2000; Conway et al., 2019), a critical gap persists in understanding the functions and the cognitive structure of collective memory. As seen in Chapter 2, collective memory represents individual memories shared by members of a community that bears on the community's identity (Hirst & Manier, 2008).

This thesis aims to bridge the gap between autobiographical and collective memory, by pioneering an exploration into the cognitive structure of collective memory and the psychological variables influencing collective memory, representing a new perspective in memory studies. More specifically, our work addresses two crucial questions in the domain of collective memory. First, "*How shared memories and future thoughts are formed?*". This research question is grounded in the examination of two dimensions of memory, and the interaction of these dimensions (see Figure 6). The type of memories is examined through the interplay between personal and shared memories. The temporal dimension is examined through memories and future representations. These two dimensions are examined in relation to public events. Second, we examine the following question "*What variables influence shared memories?*" (see part A of Figure 6).

To address these two questions, we investigate collective memory from a multidimensional perspective. Firstly, by examining the cognitive structure and the psycho-social variables influencing the creation of shared memories. Then, by combining a qualitative and quantitative approach to memory. Finally, by combining the assessment of the amount of memories and the similarity of

these representations in memory, using the inter-subjects similarity method (see Box 4 in Chapter 1).

The two following subsections refer to each of the main research questions cited above, which are linked to the studies presented in the empirical part of this thesis.

Figure 6

Representations of the different studies on the two memory dimensions examined
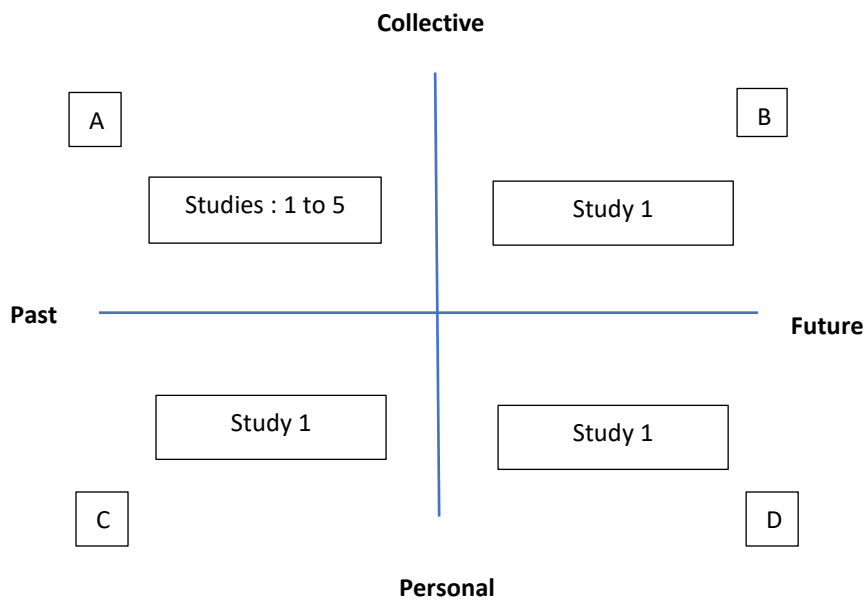
2. Collective memory's cognitive structure

The first part of this thesis is dedicated to the cognitive structure of collective memory and answers the following question: '*How shared memories and collective future thoughts are formed?*'. In Chapters 1 to 3, we delved into the intricate interplay between autobiographical memories and collective memories, highlighting their interconnectedness and reliance on similar psychological processes. This theoretical groundwork lays the foundation for the central hypothesis of the project suggesting that autobiographical memory and collective memory share the same cognitive architecture, which is illustrated in Figure 7. We extend the theoretical framework of the Self Memory System model of autobiographical memory to understanding the cognitive structure of collective memory. The dimension related to the type of memories is illustrated through the similar hierarchical cognitive structure of autobiographical and collective memory (A and B in Figure 7). The hierarchical structure of collective memory can be seen through the three main components (collective identity, shared knowledge, and episodic details), and within the shared knowledge component three different levels are presented. The second dimension (past and future representations) is presented within the shared knowledge component. Beyond the links between the different components within each type of memory, links between the two types of memories can also be highlighted.

This theoretical hypothesis implies that collective memories, like autobiographical memories, should be influenced by time, aging, and identity. **Study 1** aims to examine how shared memories evolve over time and are influenced by the personal importance of the event through a quantitative method. Regarding future thinking, this study examines the links between past and future representations and should provide information related to the directive function of memory. Studies 1 took the COVID-19 pandemic as a target

event because its recency allows us to observe the initial step of the creation of personal and collective memories about the events. The pandemic case is compared to a political event that took place at the same time, but which impacted participants' life to a lesser extent.

Following the examination of the cognitive structure of personal and collective memory, **Study 2** assesses the extent to which the COVID-19 pandemic can act as a transition, through the Living-in-History effect. As seen in Chapter 2, collective events can be used as temporal landmarks when recalling personal memories, and therefore acting as transitional events that organize and structure memories (Brown, 2021; Brown et al., 2016). However, little is known about the impact and the consequences of such events on one's life can influence the degree to which these collective events are used as temporal landmarks. Our study investigates how the collective events of the pandemic influenced memory organization in three groups of young Belgian adults that differ in the impact of the pandemic in their life (psychological and daily life impacts).

Figure 7

Autobiographical and collective memory model
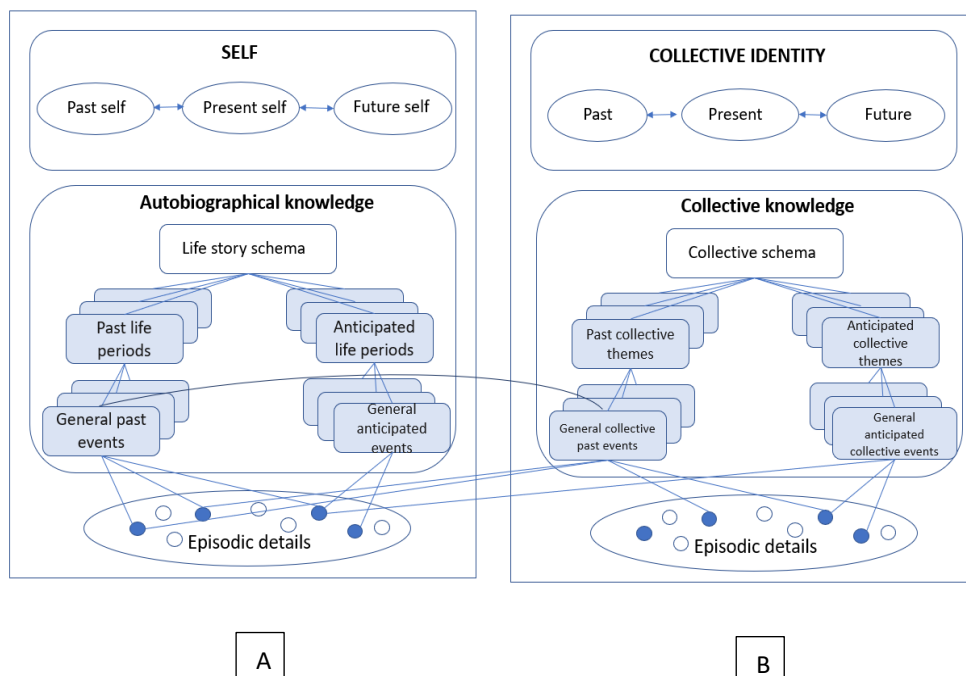
Notes.

Left side: Representation of the Self Memory System in autobiographical memory.

Right side: Representation of the Self Memory System adapted to collective memory. The level of "collective knowledge" includes three different levels: general events, past collective themes, and collective schema. The collective identity component encompasses goals and values held by the group. The episodic details level is similar to the one in autobiographical memory, encompassing episodic details associated with public events.

3. Variables influencing shared memories

The second focus of the thesis is on variables influencing collective memory, and the social and identity functions of memory. The following studies examined the effect of age (Studies 3 and 4), the effect of social identity (Study 5), and communication processes in collective memory (Study 4). Given the surprising and emotional nature of the public events examined in this thesis, we also assessed the creation of flashbulb memories (Studies 1, 3, 4).

3.1 Age effects on shared memories

While it is well-known that aging is associated with cognitive decline (Balota et al., 2000), little is known about how aging impacts collective memory. Moreover, up to this day, age effects in memory have been mainly examined through a traditional view of the number of details retrieved in a group of older adults compared to the one retrieved in a group of young adults. In this project, we propose to complete this view with a new perspective examining memories and future thoughts using an inter-subjects similarity method.

Study 3 aims to examine age effects on shared memories about a public event (the collapse of the Morandi bridge in Italy). Shared memories are examined in terms of the quantity of details recalled and in terms of inter-subjects similarity. Shared memories are also investigated through the concept of flashbulb memories.

Study 4. Usually, studies focus on the content of shared memories without considering the social influence of the context associated with communication processes on memory. This study aims to examine how the context might influence shared memories through communication processes in aging. This study examines memories about a fictional event shared by young and older adults to a young and older listener (audience effect).

3.2 Identity effects on shared memories

Study 5. In Study 3, we examined the memories of young and older Belgian adults about an event that happened in Italy. One question emerged regarding the possible influence of social identity. Would the results be different if participants were Italians and recalled memories about the bridge collapse that happened in Italy? As seen previously, memory can be influenced by identity (Berntsen, 2017; Conway, 2005). At a collective level, collective identity and collective memories also influence each other (Merck et al., 2020). Therefore, we conducted another study examining the effects of social identity on shared memories and flashbulb memories through a young population of Belgians and Americans about a public event that happened in Washington (the Capitol riots). Beyond examining the effect of social identity on shared memories, this study also examined the links between social identity, flashbulb memory, and collective future thinking.

EMPIRICAL PART

STUDY 1

The Effects of Time and Personal Importance on Lived Collective Memories and Collective Future Thinking

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Study 1 examines the effects of time and the personal importance on lived collective memories and collective future thinking.

The Effects of Time and Personal Importance on Lived Collective Memories and Collective Future Thinking

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Conflict of interest
The authors declare no conflict of interest.

1. Abstract

This study examined the influence of the passage of time and personal importance on memories of recent lived public events. Participants recalled their memories of both the COVID-19 pandemic and a political event at two different time points (in 2021 and 2022). To capture a spectrum of memory characteristics, from the most episodic to general themes, we measured: (1) the extent to which the representations of lived collective events are episodic; (2) the type of information that people remember (personal vs collective); (3) what most participants talked about (i.e., common themes) and which words were used to describe the event (lexical content analyses). Moreover, in 2021, participants were asked to imagine a future pandemic and a future political event (the dissolution of the EU) to assess to what extent the collective future relies on the collective past. The results provide evidence that personal importance influences the creation of lived collective memories over time. In fact, two years after the event, participants recalled as much personal information as collective information about the pandemic, whereas over time the political events were recalled with more collective information than personal information. Moreover, participants' narratives were overall shorter in 2022 than in 2021, but the sentences they contained were proportionally richer in detail; this effect of the passage of time was observed for the pandemic but not for the political memories. This might reflect a reorganization of the pandemic memories in the sense of denser but still rich representations of the events. Regarding future thinking, results revealed more episodicity when imagining a future pandemic than a future political event, and more collective than personal thoughts about future events. Additionally, themes related to a future pandemic were similar to the ones recalled about the past pandemic. Overall, these results emphasize the constructive nature of lived collective memories and collective future thinking.

2. Introduction

Personal memories are negatively influenced by the passage of time, notably in terms of their quantity and episodic details (Conway & Pleydell-Pearce, 2000). It is also well known that personal events associated with our goals and values are better remembered, as personal memories are influenced by the self (Conway, 2005). While these effects of the passage of time and personal importance are well documented in autobiographical memory, they have been rarely studied in collective memory (Hirst et al., 2018). Moreover, because of the intricacies between personal and collective memories of lived public events (Hirst & Manier, 2008), the investigation of the trajectory of collective memories, especially in tandem with personal memories, is essential but generally overlooked (Migueles Seco & Aizpurua Sanz, 2024). Similarly, while the role of personal past experiences and knowledge when imagining future personal events is increasingly well understood (D'Argembeau, 2020; Schacter et al., 2017), relatively little is known about collective future thinking (Öner & Gülgöz, 2020; Szpunar & Szpunar, 2016; Topçu & Hirst, 2020).

2.1 The influence of the passage of time on memory

Studies on collective memories often focus on distant collective events (e.g., historical events such as World War II or the Civil War; Zaromb et al., 2014). The fact that distant collective memories, memories of events for which people were not alive during their happening, are recalled even many years after they happened is a sign that they entered collective memory (Hirst & Manier, 2008; Hirst & Merck, 2022; Liu et al., 2022; Manier & Hirst, 2008; Roediger & DeSoto, 2014; Zaromb et al., 2014). On the other hand, studies have shown that lived collective events, memories of public events that happened during one's lifetime, are usually remembered with more personal information and more causal statements than distant collective memories (Hirst & Manier, 2002; Manier & Hirst, 2008; Muller et al., 2016; Muller et al., 2018). Currently, little is

known about the parallel evolution over time of personal and shared memories about lived collective events. The effect of the passage of time has only been considered in the context of flashbulb memories, with data suggesting a loss of memories for the event and associated personal memories over time (Hirst et al., 2015). Analyzing personal and shared memories in tandem would provide insights into the construction and evolution of lived collective memories.

The episodic nature of personal memories has been well studied (Conway & Pleydell-Pearce, 2000) and it has been shown that individuals forget episodic details unless these details are important for personal goals and values (Conway, 2009; Levine et al., 2002). By contrast, the level of detail of shared memories for a lived public event and its evolution with the passage of time are poorly understood. In addition, one can also wonder what people talk about when recalling collective events and how this evolves with time. One way to apprehend the content of collective memories is by analyzing the linguistic features of narratives, which provide information about emotional states, psychological distance, and cognitive processes (Pennebaker et al., 2003). Emotional words, pronouns, and verbs convey information about emotional states, social identification, and cognitive styles (Pennebaker et al., 2003). Words referring to cognitive processes, or mental activity, were found to reflect the cognitive elaboration of the event recalled by participants via words related to insight, causation, discrepancy, tentativeness, certainty, and differentiation (e.g., decision-making) (Boals & Klein, 2005; Kleim et al., 2018; Kvavilashvili & Fisher, 2007; Pennebaker et al., 1997; Pennebaker et al., 2015). Building on the collective coping theory (Pennebaker & Harber, 1993), emotions should be highly mentioned close to the event, whereas cognitive processes should increase over time. Another way to study collective memories is through the examination of topics, which points to themes that most individuals remember about a given event and represent the core of the story (Blei et al., 2003; Srinivasa – Desikan, 2018; Rouhani et al., 2023).

2.2 The influence of the personal importance of events on shared memories

Lived collective memories typically encompass personal and collective information (Muller et al., 2016). Importantly, the degree of personal involvement in events varies, with some people being actors (e.g., a person's house is devasted by flooding) and other people being spectators (e.g., a person watching the event on the news), and it is likely that the degree of impact affects how we remember collective events. Some studies examining memories of public events and historical events revealed that physical distance plays a role in shaping long-lasting memories, with greater physical involvement leading to better memories than hearing about it in the media or from others (Gold, 1992; Pezdek, 2003). In the case of flashbulb memories, it seems that the personal and collective consequences of the event on oneself or a community's life contribute to the shaping of memories of public events (Rice et al., 2017). While these findings seem consistent with the self-reference effect, whereby memories are better recalled if encoded with links to the self (Klein, 2012), little is known about the influence of personal importance on the episodic details (episodicity), the content, and themes of memories for public events, and whether this changes with the passage of time.

2.3 Collective Future Thinking

Collective future thinking refers to "the act of imagining an event that has yet to transpire on behalf of, or by, a group" (Szpunar & Szpunar, 2016, p.378). The psychological process of planning for the personal and collective future has been associated with the directive functions of memory (Bluck et al., 2005; Burnell et al., 2023). Studies have shown that the cognitive and neural mechanisms associated with remembering the past and imagining the future demonstrate striking similarities (for review, see Schacter et al., 2017). Drawing on these findings, it has been suggested that individuals rely on memories and

knowledge of past events stored in memory to imagine future events (D'Argembeau, 2020; Hassabis & Maguire, 2007; Schacter & Addis, 2007; Szpunar, 2010). While this view has been well examined at the personal level, there is a notable gap in understanding the links between past and future representations at the collective level (de Saint-Laurent, 2018; Merck et al., 2016; Szpunar & Szpunar, 2016). Few studies reported that past topics can be recalled when imagining the future (Öner et al., 2023) and that collective memory and collective future thinking show some similarities in terms of phenomenology (Öner et al., 2023; Öner & Gülgöz, 2020; Topçu & Hirst, 2020). Other studies also highlighted differences in the emotional valence of personal and future thoughts, which translates into the personal future being imagined more positively than the collective future (Shrikanth et al., 2018; Shrikanth & Szpunar, 2021). However, the characteristics of the memory details used to imagine future collective events are not fully understood.

2.4 The case of the COVID-19 pandemic

The COVID-19 pandemic is an ideal situation to study the nature of personal and collective memories and their evolution with time because it is a recent global event that impacted everyone, and that entailed a rich variety of events that were lived by individuals (e.g., the way a person's work was affected) as well as by the community (e.g., everyone had to deal with closed shops). Several studies examined how memory was influenced by the COVID-19 pandemic context (Fridman & Gensburger, 2023). It was found that the COVID-19 pandemic context influenced the content and the organization of autobiographical memory, which was usually linked to its impact on personal life in daily routines or emotional states (Brown, 2021; Folville et al., 2023; Muir & Brown, 2024; Rouhani et al., 2023). More specifically, one study examined how collective events shape personal memory. Participants either took part in the autobiographical memory task and were asked to recall personal memories of

2020 or 2021 (Rouhani et al., 2023) or took part in the collective memory task where they had to assess two different collective events that happened during each month of the year 2020 (e.g., How strongly do you remember the death of Kobe Bryant?). Results revealed a bump in personal memories for March 2020, which corresponds to the onset of the pandemic and the start of the lockdown. This bump was still seen one year after the first interview. In the collective memory task, participants remembered more the pandemic news than other news, revealing a personal importance effect (Rouhani et al., 2023).

Few studies focused on the memory of the pandemic itself. One study found that the COVID-19 pandemic was a collective event that was frequently recalled when participants were questioned close to its happening (i.e., memories were collected during the second wave of the COVID-19 pandemic in Malaysia) (Mustafa et al., 2021). Öner et al. (2023) examined whether the COVID-19 context influenced the nature of collective memories that people recalled, as well as collective future thinking. From April to June 2020, they asked participants to recall three remarkable events that happened in the world and three that happened in their countries since the disease appeared in China. Then, participants were asked to write three remarkable events that they expect to occur in the world and three events expected in their country. Öner et al. (2023) found that for memories, the lockdown and the infections were the most recalled themes; participants also recalled significant political and health systems impacts of the pandemic. Rouhani et al. (2023) found that topics such as COVID-19, social events and contacts, occupation, and elections were recalled regarding the year 2020. In particular, the topic of COVID-19 was the most mentioned in February, March, and April, which correspond to the period of the onset and first lockdown. To the best of our knowledge, no studies evaluated how time influences the characteristics of memories of the pandemic in terms of their level of episodic details, content, and themes altogether.

Regarding future thinking associated with the COVID-19 pandemic, Öner et al. (2023) found that topics such as the economy, lockdown, and a second wave of COVID-19 infections were topics mostly imagined by participants during the first semester following the COVID-19 pandemic onset. These results are interesting because they capture the fact that collective future thinking taking place during ongoing collective events involves the use of actual experiences for imagining future events, as expected in a constructive view of future thinking (Öner et al., 2023). Other studies examined how the COVID-19 context influenced future thinking. Results revealed that it was easier to retrieve memories of the pandemic than to imagine future events related to the pandemic (Lalla & Sheldon, 2021). Another study also found differences between memories and future thoughts related to the pandemic mainly in terms of phenomenology and emotional valence. The sense of (re)-experiencing the thought and sensory details (i.e., the sense of reliving assessed by the AMQ; Rubin et al., 2003) was higher for the past than for future thoughts, with a strong negative view of future events related to the pandemic (Niziurski & Schaper, 2023). Regarding the content of narratives, one study reported that, in the COVID-19 pandemic context, participants imagined more personal than collective future thoughts (Migueles Seco & Aizpurua Sanz, 2024).

2.4 Aims and Hypotheses

Given the lack of knowledge about the level of episodic details (episodicity), content, and themes of memories for recent lived public events and how this is influenced by the passage of time, the current study aimed to conduct a longitudinal assessment of memories for events related to the COVID-19 pandemic (interviews were conducted in 2021 and 2022). Memories of these pandemic-related events were compared to memories associated with a public event that happened in the same period but had comparatively less personal impact (i.e., a political event). To capture a spectrum of memory

characteristics from the most specific to more general levels of representations, we measured three aspects of memories: (1) the extent to which representations include episodic details (i.e., contains details about space, time, perceptual and emotional details); (2) the type of information that people remember (personal vs collective); (3) what most participants talked about (i.e., common themes) and with which kind of words (lexical content analyses).

The longitudinal design of the study allowed us to test the following hypotheses. First, we expected memories of the pandemic to include less information in general, fewer episodic details, and a loss of personal information over time (Conway & Pleydell-Pearce, 2000). Second, we hypothesized that topics that most participants mentioned about the pandemic would stay stable over time, including general themes such as lockdowns and infections (Öner et al., 2023). Finally, building on the collective coping theory that suggests that the thoughts and memories of an emotional event depend on the time that passed since the event (Pennebaker & Harber, 1993), we hypothesized a decrease in words related to emotions, social situations, COVID-19, and health in the second interview compared to the first interview (Cohn et al., 2004), and increased reference to cognitive processes over time (Pennebaker & Harber, 1993).

As the pandemic had an impact on every participant's personal life as well as on the community's life (Er, 2003; Klein, 2012; Pezdek, 2003), we expected memories of the pandemic to contain more specific details and more personal and collective information than memories about the political event. We also hypothesized that there would be more words related to emotions, cognitive processes, social situations, COVID-19, and health for the pandemic events compared to the political events. Additionally, we assessed individual differences in the personal importance of the event using questionnaires about the impact of COVID-19 on individuals' lives to consider the fact that each individual experienced the pandemic differently. Exploratory correlation

analyses were conducted to investigate whether the individual level of impact of the pandemic was related to characteristics of memories in terms of episodic details and content.

Finally, participants were also asked to imagine a future pandemic (and a future political event, as a control condition), and the characteristics of their representations were assessed following the same criteria outlined for memories above. In line with the view that memories and knowledge of the past play a key role in future thinking (Schacter & Addis, 2007), we hypothesized that participants would share more episodic details when imagining a future pandemic than a future political event. Moreover, we expected that topics used to recall the past pandemic would be used to imagine a future pandemic (Öner et al., 2023).

3. Method

3.1 Transparency and Openness

We share all the measures that were collected, as well as the computation to determine our sample size. Anonymized information and resources are available at https://osf.io/rt2mw/

3.2 Participants

We determined the sample size using a power analysis with G*Power (Faul et al., 2007). To test the main hypothesis of an interaction effect between time and personal importance in a 2 (interviews: 2021 and 2022) x 2 (event type: pandemic vs political) ANOVA, with a power of .80, an alpha of .05 and a medium effect size f = .25, the estimated sample size was at least 158 participants in total. We also considered the dropout rate in longitudinal studies, which is around 20% when the participants are over a large age range (Young et al., 2006). Thus, the estimated sample size needed for the first interview (in 2021) was at least N = 190 to reach at least N = 158 at the second interview (in 2022). In 2022, we also included a control group (N = 66) to control for test-retest effects.

Participants were aged between 18 and 80 years old. They were Belgian French speakers who lived in Belgium during the pandemic. Participants did not suffer from any neurological or psychiatric history nor were diagnosed with cognitive impairment. The announcement of this study was shared directly with staff members of the university; posts on social media (e.g., Facebook, official university account, LinkedIn); through the press (e.g., le 15ème jour, the University newspaper); flyers were posted in hospitals; two hospitals sent newsletters including this study to their staff. Ethical approval was obtained from the Ethics Committee of the Psychology Faculty at Liege University. Participants provided written and verbal informed consent at both interviews.

From February 2021 to June 2021, 258 Belgian citizens took part in the first interview. One participant was excluded because of non-residency in Belgium in 2020, and 8 participants were excluded due to low audio recording quality. The remaining sample consisted of 249 participants in 2021 aged from 18 to 79 years old ($M = 46.7$, $SD = 4.95$, 178 women).

From February 2022 to June 2022, participants were invited to take part in a second interview. 64 participants from the original sample did not participate in the second interview. 66 additional participants were recruited to only take part in the second interview (control group[1]). Twelve participants were excluded from the analysis due to issues with questionnaires or audio recordings. In total, 246 participants (including the control group) took part in the second interview. Participants were aged between 18 to 80 years old ($M = 47.9$; $SD = 4.96$, 174 women).

Participants took part in two interviews about their memories and future thinking (see section 3.3). For each event included in the memory task (pandemic vs political event), they rated the personal importance of the events using the Centrality of Event Scale (Berntsen & Rubin, 2006). Participants were interviewed individually via videoconference or exceptionally in a testing room (~ 4%) as the first interview was conducted at a time when in-presence meetings were still not recommended as part of the COVID-crisis management. The first interview took place in 2021 and participants were questioned about two types of events (i.e., pandemic and political) for two time periods (i.e., past and future). Only the past events (memories) were assessed in the second interview in 2022. At each interview, participants completed a questionnaire. The researcher could reply to clarify some points of the questionnaire if needed. The questionnaire

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[1] The group control was significantly younger than the original group ($t = -2.66$, $p = .009$). All statistical analyses were computed with and without the control group and results were not different. Therefore, the results in the manuscript include the control group.

included: demographic information, a self-report of the symptoms of COVID-19 disease, an evaluation of the proximity to COVID-19 contact, an evaluation of flashbulb memories, an evaluation of the personal impact of the COVID-19 pandemic and the attitudes related to lockdown and governmental rules, questions about the vaccines, an assessment of collective identity to Belgium and Wallonia, and a mental health assessment (specific or not to COVID-19) (see section 3.4). The interviews were audio-recorded and later transcribed for coding. The conditions (type of events x time period) were randomized across participants. During the memory task, participants could speak freely for as long as they wished. Interviews lasted from 1.5 hours to 4 hours.

3.3 Interviews about events

3.3.1 Memories

Participants interviewed in 2021 and 2022 were asked to recall as many memories as possible that happened regarding the COVID-19 pandemic during the year 2020. In 2020, the unfolding of events spanned from the time when the news mentioned the first coronavirus cases in Belgium to the news about the vaccine in December 2020. After describing all their memories, participants were invited to report in chronological order the events related to the COVID-19 pandemic in 2020 (these data are not reported here). For the political event, participants had to select one of the political events that happened in the world in 2020, among the following events: the American presidential elections (68.67% in 2021 and 67.47% in 2022[2]), the Black Lives Matter movement in the United States (22.08% in 2021 and 22.76% in 2022), or the formation of the Belgian government (9.23% in 2021 and 9.75% in 2022). As for the pandemic,

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[2] Percentage in 2022 include the choices of the control group

they were then asked to recall as many memories as possible in relation to that event.

3.3.2 Future thinking

Participants were asked to imagine future scenarios for two types of events (i.e., pandemic and political events). For the future pandemic, participants were asked to imagine what could happen if a future pandemic similar to the COVID-19 pandemic happened in ten years from that time. The delay of 10 years was chosen so that people should have returned to a normal life, free from current pandemic-related constraints. For the political event, participants were asked to imagine what could happen if the European Union dissolved in ten years from that time. This scenario represents an event of similar severity and consequences for Belgian citizens as the COVID-19 pandemic, for which they also have previous knowledge and collective representations. Moreover, this event was selected so that the two control events (past and future) involved political events. It was specified that both imagined events (pandemic and political) were unrelated.

3.4 Questionnaires

3.4.1 General questionnaires

The Centrality of Event Scale. This scale assesses the extent to which an event influences one's identity (Berntsen & Rubin, 2006). Participants answered the short version of the scale with 7 items rated on a Likert scale from 1 (totally disagree) to 5 (totally agree) (Berntsen & Rubin, 2006). This scale was presented when participants finished recalling their memories of the pandemic, their memories of the political event, their imagining of the future pandemic, and their imagining of the future EU dissolution. The items were grammatically adapted for future representations. The mean and standard error by interview time can be found in Table 1 in the supplemental material. Results revealed that

participants considered the pandemic (M = 3.3, SE = 0.06) to influence more their identity than the political event (M = 2.09, SE = 0.07), Yt = 13, p <.001. Results were similar in the second interview (Yt = 12.7, p <.001). No difference was found between the future pandemic and future political events (Yt = 0.25, p = .81).

Demographical information. Participants reported demographical information including gender, age, occupation, education, neurological history, psychological history, current medication, and number of children.

Proximity to COVID-19 contact. Several questions probed the physical contact with someone positive for COVID-19 in four different social circles (i.e., in their family, friends, professional contact, and due to their occupation, with their distant acquaintances); other questions assessed whether participants knew someone who had contracted COVID-19 (in their family, friends, professional contact, with their distant acquaintances); another question asked if they knew someone who passed away due to COVID-19. A mean score was computed based on the 3 questions for the family, friends, and acquaintances. For the professional circle, the mean score was computed based on 4 questions since two questions, rather than one, were asked for physical contact with COVID-19-positive people because of their occupation separating colleagues from customers/patients.

Personal impact of the COVID-19 pandemic. The following part of the survey used VAS from not at all (0) to a lot (100) where people had to judge to what extent the COVID-19 crisis impacted their life on several variables: daily routine, leisure, work, social life, familial life, mood, and life satisfaction feeling.

Attitudes related to lockdown/governmental rules. Participants assessed their attitudes towards the COVID-19 situation on a scale from "not at all" (0) to "a lot" (100) including: agreement with government decisions during the 1st lockdown, respect of the 1st lockdown, respect of health rules during the

1st lockdown, agreement with government decisions during the 1st end of lockdown, compliance with post-1st lockdown instructions, agreement with government decisions during the 2nd lockdown, respect of the 2nd lockdown, respect of health rules during the 2nd lockdown, agreement with government decisions during the 2nd end of lockdown, respect of post-2nd lockdown instructions, being at risk of contracting COVID-19, and feeling of confusion about the pandemic (political and health discourse).

Vaccines information. Two questions related to the vaccines. They were asked if they got vaccinated. If yes, they were asked to provide the date of the vaccination. If they didn't get vaccinated, they were asked if they intended to get it.

Collective Identity. Participants were asked to complete five items related to collective identity (Stone et al., 2020). The items were presented first to assess Belgium's collective identity and a second time to assess Wallonia's collective identity. In the analyses, Belgium identification is referred to as Belgium ID, and Wallonia identification is referred to as Wallonia ID. For example, Belgium identity items were: "I feel attached to Belgium"; "My destiny is linked to the one of other Belgians"; "I feel solidarity with all the other Belgians"; "I am proud to say to others I am Belgian"; "I identify closely to Belgium". These items are rated on a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). A mean score of the ratings of the five items was computed.

3.4.2 Mental health and cognitive assessment

COVID-19-related mental health assessment. Several questionnaires aimed to assess the anxiety, fear, and trauma associated with the coronavirus through the fear of COVID-19 scale (Ahorsu et al.,2020), the coronavirus anxiety scale (Lee et al., 2020), and the IES- COVID-19 (Vanaken et al., 2020).

Clinical assessment unrelated to COVID-19. Loneliness was assessed by the loneliness scale (De Grâce & Joshi, 1990). Depression was assessed by the BDI 13 items (Collet & Cottraux, 1986). Anxiety was assessed by the short version of the STAI (Marteau & Bekker, 1992). Since this test necessitates being read by the experimenter, it was the last questionnaire proposed and was not on the online questionnaire.

Cognitive assessment. Participants aged more than 60 years old were assessed by MMSE (Kalafat et al., 2003) to exclude participants with global cognitive impairment. No participant was excluded based on their score at the MMSE.

3.5 Data analysis

After transcribing [3] the audio recording, data were analyzed using 3 complementary methods for both memories and future thinking. First, we assessed the extent to which the representations (past and future) are episodic in nature through the examination of episodic details (internal, external, and episodicity scores). Second, we analyzed what type of information dominated memories and future thoughts through the coding of personal vs collective information. Finally, we examined the lexical content through the use of Linguistic Inquiry Word Count software (LIWC; Pennebaker et al., 2007), which highlights a specific examination of how people talk about collective events. Moreover, to examine how memories are used to imagine future collective events, we computed topic modeling analyses using the Latent Dirichlet Allocation model (LDA; Jelodar et al., 2019).

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[3] A robust ANOVA (2 interviews) x (2 time) x 2 (event type) was conducted on the word count. Results revealed a significant effect of the interview time ($p < .001$), the event type ($p < .001$), and the time (past vs future) ($p < .001$). We did not include the word count differences as a covariable since analyses are based on proportion/percentages or consider the amount of memories and therefore control for the word count.

3.5.1 Episodic details

According to Levine et al. (2002), the internal and external detail scoring system separates episodic details from the semantic aspects of memories by classifying each significant piece of recalled information as either internal (directly associated with the event and describing the context and specific details of the event) or external (not directly related to the event, including general repeated events and semantic knowledge). Automated scripts, adapted for French narratives, were used to compute internal and external scores (van Genugten & Schacter, 2024). The model identifies the amount of internal and external content per sentence, and then sums these numbers to estimate the internal and external content of narratives. This model has been compared to the manual coding of memories in previous studies (van Genugten & Schacter, 2024) and was found to perform well across several datasets. Additionally, we computed an episodicity score by dividing internal scores by the sum of internal and external scores. Moreover, we computed internal and external indices that corresponded to the internal and external raw scores obtained by the automatized analyses that were divided by the sum of personal and collective information recalled (obtained by the coding presented in 3.5.2). These indices should reflect the degree of episodicity versus "externality" of each segment of meaningful information.

3.5.2 Coding for personal vs. collective information

We performed manual coding of the memories and future thoughts for both interviews[4]. Each narrative was segmented into sentences. If the sentences were too long (usually because of the use of coordinating or subordinating

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[4] Narratives from the interviews were coded by NC and AL. Intra-class correlation (ICC) analyses were computed to test the reliability. ICC for personal memories was .97 and .99 for shared memories revealing excellent reliability.

conjunctions) they were segmented into significant pieces of information (see sentences 4 and 5 in Table 1). Segments were coded as personal information if they related to the participant's personal life and involved his/her nearest context such as family, friend, work, or neighbor. Information was coded as collective if it involved a community larger than family, friends, and professional groups, such as a society, city, or country (see Table 1 for a coding example) (see Migueles Seco & Aizpurua Sanz, 2024 for a similar coding). The total number of each type of memory (personal and collective) was computed (for memories and future thinking). To account for the word count differences between narratives, we also computed proportion scores taking each score divided by the sum of personal and collective memories.

Table 1

Example of coding memories as personal or collective information related to the past pandemic narratives.

		Personal information	Collective information	Other	Already mentioned
1.	I remember that very well!	0	0	1	0
2.	I made some pastries during lockdown	**1**	0	0	0
3.	Everyone was stuck at home	0	**1**	0	0
4.	We had to wear masks outside...	0	**1**	0	0
5.	... but I did not wear it	**1**	**0**	0	0
6.	Only one person from the family could go grocery shopping	0	**1**	0	0
7.	I did it for my family	**1**	0	0	0
8.	I want to insist that I did not wear the mask		0	0	**1**
Total		**3**	**3**	**1**	**1**
Proportion		**0.50**	**0.50**		

Participant's memories of the pandemic: "I remember it very well! During lockdown, I made some pastries. Everyone was stuck at home. Then, we all had to wear a mask outside, but I did not wear it. One important rule was that one person from the family could go grocery shopping. I did it for my family. I want to insist that I did not wear the mask."

3.5.3 Linguistic content analyses

Lexical content analyses were computed using Linguistic Inquiry Word Count (LIWC; Pennebaker et al., 2007). LIWC is a software computing the percentage of words in a text that fit into a grammatical or psychological category. Analyses were done using the French dictionary (Piolat et al., 2011). Overall, 5 categories were examined. The pronoun category includes the use of the first singular and the first plural pronouns. The emotions category includes words referring to positive emotions, and negative emotions, more specifically anxiety and anger. The social category includes family and friend references. The cognitive processes category includes 6 types of processes (i.e., insight, causation, discrepancy, tentativeness, certainty, and differentiation) which refer to mental activity (e.g., decision-making) (Pennebaker et al., 2015). The COVID-19-related words were based on a customized COVID-19 dictionary created by the researchers. This COVID-19 dictionary included words related to the COVID-19 pandemic in French (e.g., coronavirus, COVID, COVID-19, vaccines, lockdown, online meetings, AstraZeneca, Pfizer...) (see Table 2 in supplemental material). These categories were chosen as related to the emotional, social, personal, and collective characteristics of the COVID-19 pandemic. LIWC outputs scores are percentages of total words for each category within a text.

3.5.4 Natural Language Processing

We computed topic modeling analyses from natural language processing to reveal topics shared by individuals based on the narratives of 249 participants (1st interview) and 246 participants (2nd interview). Analyses were done separately for narratives of the past pandemic in 2021 and 2022, and the future pandemic imagined in 2021. Based on natural language processing, topic modeling analyses gather all the data and generate topics based on the co-occurrence of the words in the data set (Blei et al., 2003; Srinivasa – Desikan, 2018). A Python code was created for topic modeling analyses, using the package Spacy (Honnibal & Montani, 2017), and Gensim (Rehurek & Sojka, 2011). First, all data encompassed on different docx files were read. The stop words and punctuations were deleted from the corpus. Data were lemmatized and tokenized into a dictionary. Tokens were filtered based on their frequency in the corpus, excluding tokens whose frequency was less than 5% and more than 95%. The number of extracted topics was set at 7 topics. Results were visualized using the PyLDAvis library (Sievert & Shirley, 2014). The results were visually accessible including words that co-occurred in the same topic and their frequency through topics. We named each topic after the gist emerging from the combination of these words.

3.6 Statistical analysis of memories and future thoughts

Because the normality assumption was violated for most of the variables, robust statistical analyses were conducted (Mair & Wilcox, 2019).

For memories, a robust 2 interview time (2021 and 2022) x 2 event types (pandemic and political) x 2 types of information (personal and collective) ANOVA was conducted on the amount of memories recalled. Robust ANOVAs 2 interview time (2021 and 2022) x 2 event types (pandemic and political) were

conducted on the proportion of collective [5] information recalled, episodicity scores (internal, external, and specificity), and episodicity indexes (internal and external).

Regarding future thinking, a robust 2 (event type: pandemic vs political) x 2 (type of information: personal vs collective) ANOVA on the amount of future thoughts was performed. Then, robust t-tests were conducted to test the difference between the 2 types of events (pandemic and political) on the proportion of collective information, and episodicity scores (internal, external, and specificity), and episodicity index (internal and external index).

All robust ANOVAs and robust post-hoc tests (comparisons) were conducted using a trimmed means method, and the trimmed value was set at 20% (Wilcox, 2013). Robust ANOVAs were conducted in R studio version 2.1 (Rstudio Team, 2023), using the WRS2 package (Mair & Wilcox, 2020)

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[5] Information related to the whole society, groups and community, beyond his/her closest context (family, friends, colleagues, neighbors).

4. Results

4.1 Memories: A comparison of memory for the pandemic and a political event as a function of interview time

4.1.1 How much collective vs personal information do participants recall?

Table 2 presents the number of personal and collective information contained in the memories recalled by participants for each type of event, as well as the proportion of collective information recalled.

Table 2

Mean number and proportion of collective vs personal details contained in memories and future thoughts for the pandemic and the political event as a function of interview time.

Interview	Event type	Time	Type of memory representation	Quantity Perso and collective	Proportion of collective memories
1	Pandemic	Past	Personal	41.20 (2.37)	
			Shared	39.32 (1.99)	0.47 (0.02)
		Future	Personal	1.23 (0.22)	
			Shared	21.4 (1)	0.95 (0.009)
	Political	Past	Personal	3.51 (0.29)	
			Shared	22.9 (0.98)	0.86 (0.01)
		Future	Personal	0.78 (0.13)	
			Shared	19.9 (0.87)	0.97 (0.005)
2	Pandemic	Past	Personal	20.45 (1.38)	
			Shared	23 (1.51)	0.49 (0.02)
	Political	Past	Personal	1.11 (0.17)	
			Shared	14.7 (0.66)	0.93 (0.01)

Note. Standard errors are in parentheses.

Number of personal and collective information. A robust 2 event type (pandemic vs political) x 2 types of information (personal vs collective) x 2 interview time (2021 and 2022) ANOVA revealed a main effect of the event type (Q = 442.47, p <.001), showing that more information was recalled for the pandemic (M = 30.34, SE = 0.93) than the political event (M = 8.80, SE = 0.44). A significant main effect of the interview time (Q = 150.62, p <.001) revealed that more information was recalled in 2021 (M = 23.9, SE = 0.93) than 2022 (M = 13.2, SE = 0.55). A significant main effect of the type of memories (Q = 74.86, p =.001) indicated that participants globally recalled more collective information (M = 23.4, SE = 0.69) than personal information (M = 11.2, SE = 0.71).

A significant interaction was found between the interview time and the event type (Q = 46.80, p = .001), showing a higher loss of information over time for the pandemic than for the political event (see Figure 1). A significant interaction was also found between the event type and the type of memories (Q = 69.4, p = .001). Post hoc tests revealed that participants recalled more personal and collective memories related to the pandemic than to the political event, but there was a higher difference between pandemic and political events for personal information (*psi-hat* = 27.8, *p* <.001, *95% CI* [25, 30.5]), compared to collective information (*psi-hat* = 12.2, *p* <.001, *95% CI* [9.36, 15]). There was also a triple interaction (Q = 6.79, p = .01). This was due to a differential effect of the interview time on both types of information for the pandemic and the political event. For the political event, the number of information decreased with time, but the decrease was similar for personal and collective information, with the latter always dominating. In contrast, for the pandemic, in the first interview, participants recalled more personal than collective information; with time, both decreased, but more so for the personal information, which was recalled to the same extent as collective information in the second interview (*Yt* = 1.23, *p* = .22, *95% CI* [-6.52, 1.51], *ξ* = .08).

Figure 1

Representation of the amount of memories as a function of interview time, by type of information, and by event type.
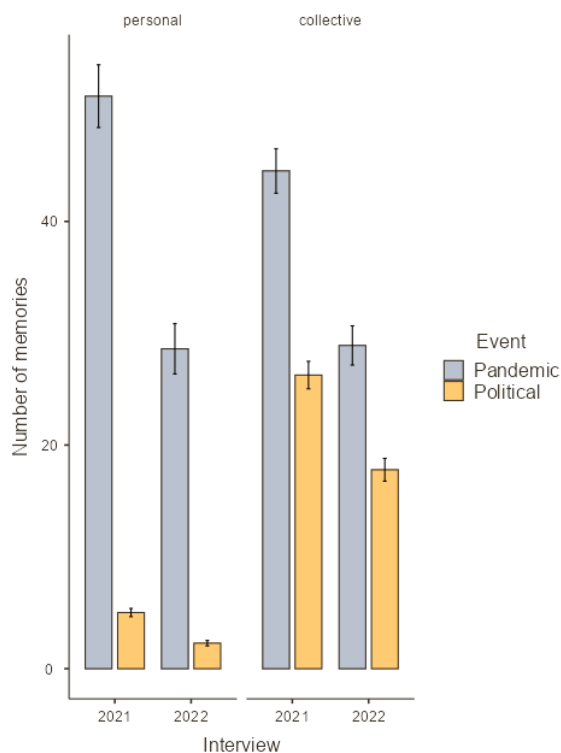
Proportion of collective information: What type of information dominates?

A robust 2 (interview time) x 2 (event type: pandemic vs political) ANOVA on the proportion of collective information contained in memories revealed a main effect of the interview time (Q = 12.51, p = .001) with a greater ratio of collective information in 2022 (M = 0.74, SE = 0.02) than in 2021 (M = 0.67, SE = 0.02). A main effect of the event type was also found (Q = 734.12, p = .001), revealing that memories of the political event contained a greater proportion of collective information (M = 0.90, SE = 0.008) than the pandemic event (M = 0.49, SE = 0.01). The means indicated that, whereas memories of the political event

were mostly collective in nature, those of the pandemic comprised an equal proportion of personal and collective information. We did not find a significant interaction between the interview time and the event type (Q = 2.60, p = .11).

4.1.2 To what extent are the content of memories episodic in nature?

We computed 2 (interview time: 2021 and 2022) x 2 (event type: pandemic vs. political) ANOVAs on the raw number of internal and external details provided by the automated analysis, as well as a ratio reflecting the relative episodicity of memories. Given that the first analyses on the number of information indicated that narratives varied in length as a function of interview time and type of event, we additionally computed internal and external indices by dividing the raw numbers by the total number of information recalled by participants (see method section). These indices should reflect the degree of episodicity versus "externality" of each segment of meaningful information.

4.1.2.1 Episodic details scores (raw data)

Internal details. A main effect of the interview time was found (Q = 146.3, p = .001), revealing significantly more internal details for memories recalled in 2021 (M = 436.84, SE = 20.07) compared to the ones recalled in 2022 (M = 229.56, SE = 20.20). There was also a main effect of the event type (Q = 294.3, p =.001), with more internal details for the pandemic memories (M = 523.58, SE =21.10) compared to the political memories (M = 192.84, SE = 7.42). There was a significant interaction between interview time and event type (Q = 41.1.6, p = .001), revealing more internal details lost over time for the pandemic memories (*psi-hat* = 366, p <.001 *95% CI* [293, 440]) than for the political memories (*psi-hat* = 113, p <.001, 95% *CI* [86.8, 139]).

External details. A main effect of the interview time was found (Q = 170.6, p = .001), revealing significantly more external details for memories

recalled in 2021 (M = 304.24, SE = 13.59) compared to the ones recalled in 2022 (M = 139.15, SE = 6.11). There was also a main effect of the event type (Q = 222.6, p =.001), with more external details for the pandemic memories (M = 332, SE = 14.86) compared to the political memories (M = 133.08, SE = 5.58). A significant interaction between interview time and event type (Q = 38, p = .001) showed that there were more external details lost over time for the pandemic memories than the political memories.

Episodicity scores. A significant main effect of the interview time was found (Q = 42.6, p = .001), revealing greater episodicity for memories recalled in 2022 (M = 0.63, SE = 0) compared to the ones recalled in 2021 (M = 0.59, SE = 0.004). There was also a main effect of the event type (Q = 7.14, p =.008), with greater episodicity for the pandemic memories (M = 0.62, SE = 0) compared to the political memories (M = 0.60, SE = 0). There was also a significant interaction between interview time and event type (Q = 6.92, p = .009), which was due to a significant difference in episodicity at the first interview between pandemic and political memories (*psi-hat* = 0.03, *p* <.001, *95% CI* [0.02, 0.05]), but no difference in the second interview (*psi-hat* = 0, *p* = .98, *95% CI* [-0.02, 0.02]).

4.1.2.2 Episodic details index

Internal index. A robust 2 (interview time: 2021 and 2022) x 2 (event type: pandemic vs. political) ANOVA showed a main effect of the interview time (Q = 38.8, p = .001), revealing a greater amount of internal details per segment for memories recalled in 2022 (M = 11.01, SE = 0.41) compared to the ones recalled in 2021 (M = 8.84, SE = 0.12). There was also a main effect of the event type (Q = 36.6, p =.001), with a greater amount of internal details per segment for the pandemic memories (M = 10.76, SE = 0.42) compared to the political memories (M = 8.94, SE = 0.14). A significant interaction was revealed between interview time and event type (Q = 48.6, p = .001), which is characterized by a greater amount of internal details per segment for the pandemic memories when

recalled in 2022 than in 2021 (*psi-hat* = -9.43, *p* <.001, *95% CI* [-12.2, -6.66]), but no significant difference for the political memories between 2021 and 2022 (*psi-hat* = 0.53, *p* = .06, *95% CI* [-0.03, 1.10]).

External index. A main effect of the interview time was found (*Q* = 23.5, *p* = .001) revealing a greater amount of external details per segment for memories recalled in 2022 (*M* = 6.94, *SE* = 0.28) compared to the ones recalled in 2021 (*M* = 6.19, *SE* = 0.13). There was also a main effect of the event type (*Q* = 30.5, *p* = .001), with a greater amount of external details per segment for the pandemic memories (*M* = 7.06, *SE* = 0.26) compared to the political memories (*M* = 6.08, *SE* = 0.14). A significant interaction was observed between interview time and event type (*Q* = 82.3, *p* = .001) revealing an increase in the amount of external details per segment at the second interview for the pandemic memories, but a loss in the amount of external details per segment for the political memories at the second interview.

4.1.3 Lexical content analyses of memories: What do participants talk about?

The percentage of words in different lexical categories (see Table 3) was submitted to robust 2 (event type: pandemic or the political event) x 2 (interview time: 2021 and 2022) ANOVAs. The results are presented below by type of effect (effect of event type, interview time, and interaction) to indicate which lexical categories were sensitive to the same variables.

Main effect of the event type: There were more words for the pandemic memories compared to political memories for the following categories: the use of pronouns: first singular pronoun (*Q* = 93.90, *p* = .001) and first plural pronoun (*Q* = 273.21, *p* = .001), the social category including references to family (*Q* = 274.07, *p* <.001) and friends (*Q* = 237.09, *p* = .001), positive emotions (*Q* = 57.73, *p* = .001) and anxiety (*Q* = 126.53, *p* = .001), cognitive processes (*Q* = 22.37, *p* = .001), and finally, as expected, for the COVID-19 category, COVID-19-related

words (*Q* = 804.99, *p* = .001), and health (*Q* = 134, *p* = .001). By contrast, more words related to anger were found for the political memories than the pandemic memories (*Q* = 43.6, *p* = .001). The main effect of the event type was not found for negative emotions (*Q* = 1.02, *p* = .32).

Main effect of interview time: There were more words used during the first interview (2021) compared to the second interview (2022) in the following categories: the first plural pronoun (we) (*Q* = 5.90, *p* = .02), family (*Q* = 4.70, *p* = .03) positive emotions (*Q* = 29.59, *p* = .001), anxiety (*Q* = 7.22, *p* =.008), and cognitive processes (*Q* = 115.06, *p* = .001). In contrast, more COVID-19-related words were used in the second interview (2022) than in the first interview (2021) (*Q* = 8.69, *p* =.004). No differences were found for the first singular pronoun (*Q* = 0, *p* = .95), friends (*Q* = 2.06, *p* = .15), negative emotions (*Q* = 0.04, *p* = .85), anger (*Q* = 1.66, *p* = .20), and health (*Q* = 0.54, *p* =.46).

Interactions event type × interview time: There was an interaction for the count of negative emotions (*Q* = 7.01, *p* = .009). Words related to negative emotions were more referred to in the narratives of political memories (in 2022) compared to the pandemic memories in the second interview (*psi-hat* = -0.19, *p* = .02, *95% CI* [-0.36, -0.03]), but not in 2021 (*psi-hat* = 0.09, *p* = .17, *95% CI* [-0.04, 0.21]).

The interaction was also significant for words related to Covid (*Q* = 16.73, *p* =.001), revealing more references to COVID-19 in the second interview than the first for the pandemic memories, (*psi-hat* = -0.29, *p* <.001, *95% CI* [-0.43, -0.16]), but not for the political event (*psi-hat* = 0.05, *p* = .30, *95% CI* [-0.04, 0.14].

Other interaction effects were not significant (*ps* >.05).

Table 3

Mean scores and standard error for the percentage of words fitting each linguistic category were found significant effect on the interview time for memories.

	Interview 1			Interview 2		
	Pandemic	**Political**	**Total**	**Pandemic**	**Political**	**Total**
I	5.45	3.83	4.67	5.34	3.96	4.70
	(0.15)	(0.15)	(0.11)	(0.16)	(0.17)	(0.12)
We	0.48	0.09	0.27	0.42	0.03	0.19
	(0.03)	(0.02)	(0.02)	(0.03)	(0.01)	(0.02)
Family	0.34	0.04	0.18	0.30	0	0.12
	(0.02)	(0.01)	(0.02)	(0.03)	(0)	(0.02)
Friends	0.21	0.009	0.10	0.18	0	0.07
	(0.01)	(0.005)	(0.01)	(0.02)	(0)	(0.01)
Positive emotions	2.43	2.07	2.27	2.19	1.66	1.95
	(0.05)	(0.06)	(0.04)	(0.06)	(0.07)	(0.05)
Negative emotions	1.42	1.33	1.38	1.27	1.47	1.36
	(0.04)	(0.05)	(0.03)	(0.05)	(0.07)	(0.04)
Anxiety	0.32	0.08	0.19	0.25	0.05	0.14
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Anger	0.28	0.42	0.34	0.18	0.44	0.27
	(0.02)	(0.03)	(0.02)	(0.02)	(0.05)	(0.02)
Cognitive	17.06	16.14	16.6	15.17	14.71	14.95
	(0.12)	(0.14)	(0.10)	(0.14)	(0.17)	(0.11)
Covid	1.33	0.3	0.81	1.63	0.25	0.91
	(0.04)	(0.03)	(0.04)	(0.06)	(0.04)	(0.06)
Health	0.36	0.05	0.64	0.82	0.37	0.6
	(0.02)	(0.01)	(0.02)	(0.04)	(0.04)	(0.03)

4.2 Characteristics of future thoughts as a function of event type

4.2.1 Personal versus collective information provided in future thoughts

Firstly, we conducted analyses on the amount of personal and collective information provided in the future thoughts imagined by participants for a future pandemic and the EU dissolution. Then, we analyzed the proportion of collective future thoughts imagined by participants, to assess the relative part of each type of information in the imagination of a future pandemic and the EU dissolution. Mean and SE are available in Table 2.

The number of personal and collective future thoughts. A robust 2 (event type: pandemic vs political) x 2 (type of information: personal vs collective) ANOVA revealed a significant effect of the type of information (Q = 857.28, p = .001), with participants reporting more collective information (M = 20.60, SE = 0.65) than personal information (M = 0.91, SE = 0.12), no matter the type of event. No main effect of the event type was found (Q = 1.99, p =.59), nor significant interaction (Q = 0.56, p = .45).

Proportion of collective information: What type of information dominates? A robust t-tests did not reveal any difference between the future pandemic and the future political event (Yt = 1.16, p = .25, *95% CI* [-0.03, 0.008], ξ = 0.09).

4.3.2 Internal vs external details: To what extent are the content of future thoughts episodic in nature?

Firstly, robust t-tests comparing the type of event were run on the raw number of internal and external details, as well as the episodicity score. Then, we analyzed the indices where the raw number of internal and external details are divided by the total number of meaningful information to assess the degree of specificity of each segment of information contained in future thoughts.

Number of internal and external details, and episodicity score. For internal details, there was a significant difference between the type of event (Yt = 3.33, p < .001, *95% CI* [16.91, 65.66], ξ = 0.22) with more internal details for the pandemic (M = 206.08, SE = 9.51) than the political event (M = 164.79, SE = 8.05). There was no significant difference in the number of external details (Yt = 1.42, p = 0.16, *95% CI* [-5.60, 34.54], ξ = 0.10). An effect of event type appeared for the episodicity scores (Yt = 2.24, p = .03, *95% CI* [0.003, 0.04], ξ = 0.16), with future thoughts containing a greater proportion of internal details for the pandemic (M = 0.59, SE = 0.007) than the political (M = 0.57, SE = 0.008).

Internal and external details indices. For the internal index, results revealed a significant difference between the type of event (Yt = 3.26, p = .001, *95% CI* [0.43, 1.74], ξ = 0.24) with a greater number of internal details per segment when imagining a future pandemic (M = 8.17, SE = 0.14) than the political event (M = 7.08, SE = 0.31). There was no significant difference for the external index (Yt = 1.15, p = 0.25, *95% CI* [-0.22, 0.84], ξ = 0.08).

4.2.3 Topic analyses of past and future: Do participants mention common themes in memories and future thoughts relative to the pandemic?

To test the hypothesis that information constituting memories is used to simulate future events, we assessed the thematic content of memories and future thoughts about the pandemic with topic modeling analyses. We report here a description of the most common topics in each set of narratives (see Table 4). The past representations of the COVID-19 pandemic in 2020 that were collected in 2021 reveal several distinct topics related to politics, the contact and lack of contact with family and friends, hospitals and consequences for the medical staff, restrictions, the virus, professional and school impacts (e.g., homeworking), and also include a topic related to the temporality of the events (e.g., clear references to specific months). Regarding the representations of a

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similar future pandemic that would happen in 10 years (collected in 2021), results reveal different topics. The most frequent is that participants share the need to learn from the past. Then, they share common representations related to management and actions, and distinctly a topic refers to medical management. Daily-life impacts are also imagined as well as a crisis in the population. Finally, a topic relates specifically to adaptation behaviors. The economic, geographical, and political levels are also mentioned.

In 2022, topics of the past COVID-19 pandemic referred to daily life impacts, hospitals, and medical consequences of the virus. School and professional impacts are still shared one year after the first interview. The virus evolution and political restrictions are referred to in the same topic. Participants recall the memories of the pandemic as follows "If we were into lockdown in September 2020, that means that the virus cases were high at that time", bridging two topics from 2021 in one topic revealing a more comprehensive view of the past and reconstructive processes of memories. Finally, whereas it was not mentioned for the memories collected in 2021, in 2022 participants shared memories related to the geo-political considerations of the COVID-19 pandemic. The geo-political level includes mentions of relationships with other countries such as China, the USA, and Russia in the context of the pandemic, but also politics within Belgium between the three regions (Wallonia, Flanders, and Brussels).

Table 4

Summary of the topic extracted for the memories of the pandemic event (collected in 2021 and 2022), and the future pandemic in 10 years.

Past representations of the COVID-19 pandemic (in 2021)	Future representations of a similar pandemic in ten years (in 2021)	Past representations of the COVID-19 pandemic (in 2022)
1. Politics 2. Contact and lack of contact with family and friends 3. Hospital & consequences for medical staff 4. Restrictions 5. The virus 6. Professional and school impacts 7. Temporality of the events	1. Learn from the past 2. Management and actions 3. Medical management 4. Crisis in population 5. Daily life impacts 6. Adaptation 7. Economy geo-political level	1. Daily life impact 2. Hospital 3. Medical consequences (death) 4. Virus evolution & political restrictions 5. School & professional impacts 6. Geo-political level

4.3 Additional analyses

4.3.1 Exploratory factorial analysis: impact of the COVID-19 pandemic on individuals' life

Whereas the comparison of memories of the pandemic versus a political event captures the influence of being directly concerned or not by the event (or having personally lived or not the event), it is noteworthy that individuals did not experience the COVID-19 pandemic similarly. While some were strongly impacted in their everyday life and/or presented with anxiety and depression, others were minimally impacted, or may even have enjoyed the situation. To capture such individual variability, the following analysis assessed whether the specific influence of the COVID-19 pandemic on people's lives indexed by the series of questionnaires administered was related to variation in the characteristics of memories for the pandemic.

First, to reduce data dimensionality, we conducted exploratory factorial analyses using IBM SPSS Statistics on fifteen variables with orthogonal rotation (Normalized varimax), using minimum eigenvalue = 1, and principal component analysis. The fifteen variables included in the analyses are the following and can be found in section 3.4: mean score related to the proximity to COVID-19 for each of the four circles (family, friends, professional, and acquaintances); mean score of the 11 VAS assessing the impact of the pandemic on participants' life; mean score of the 7 VAS assessing the extent to which they followed and agreed with governmental restrictions; score regarding the extent to which they considered themselves at risk of contracting the COVID-19 virus; score assessing the extent to which they were confused during the pandemic; mean score of the fear of COVID-19 scale (Ahorsu et al., 2020); mean score of the coronavirus anxiety scale (Lee et al., 2020); mean score of the IES-COVID (trauma related to COVID-19) (Vanaken et al., 2020); depression scores at the BDI scale (Collet & Cottraux, 1986) ; anxiety score at the STAI scale (Marteau & Bekker, 1992); score at the Loneliness scale (De Grâce & Joshi, 1990); and a mean score at the Centrality of Event Scale for the pandemic in 2020 (Berntsen & Rubin, 2006).

The results revealed the presence of four independent factors (see Tables 2 and 3 in the supplemental material). Of note, analyses were computed for each interview time separately. For both analyses, Bartlett's test was $p <.001$. Each factor was then used in robust correlation analyses. The four factors extracted for the first interview and the second are mostly similar. Factor 1 relates to the impact on one's life (daily life and psychological impact -depression and anxiety-, including loneliness for the second interview). High scores on Factor 1 correspond to high pandemic and psychological impact. Factor 2 relates to the contact with COVID-19-affected people. High scores on Factor 2 correspond to a high degree of contact with COVID-19-positive persons. Factor 3 relates to the psychological impact specific to the COVID-19 pandemic (including being at risk

of contracting the disease for the first interview). High scores on Factor 3 correspond to a high psychological impact of the pandemic. The fourth factor relates to the agreement with the governmental restrictions (including being at risk for the second interview). High scores on Factor 4 correspond to high agreement with and respect for the rules during the COVID-19 pandemic. Their feeling of confusion did not load on any factor in both interviews.

Next, correlations were computed between the four factors and memory measures, using robust statistical analyses equivalent to Pearson's correlations using percentage bend correlations (Mair & Wilcox, 2019). Robust correlations were conducted using beta = 0.2 and bootstrapping set at 2000. Robust correlations were conducted in R studio version 2.1 (Rstudio Team, 2023), using the WRS2 package (Mair & Wilcox, 2020). Robust correlations were computed on the amount of personal and collective information recalled, on the type and quantity of memories and future thoughts (4.3.2), the proportion of collective information (4.3.3), the internal and external details and index (4.3.4), the episodicity score (4.3.4), the lexical content of memories (4.3.5).

4.3.2 Type and quantity of memories and future thoughts: correlational analyses

We computed correlational analyses including the four factors extracted from the exploratory factorial analyses, with the number of collective information recalled and imagined (Table 5) and the number of personal information recalled and imagined (Table 6) (by interview time, and time). Results reveal no significant correlations after multiple comparison corrections, except a significant (but small) negative correlation between Factor 1 with the amount of collective future thoughts about a future pandemic. This result suggests that the more people were in contact with COVID-19-positive people in 2020, the less they imagined collective future events related to a future pandemic.

Table 5

Correlations between factors on the amount of collective information recalled and imagined for the pandemic event by interview time

Interview	Time	Factors			
		Factor 1	Factor 2	Factor 3	Factor 4
1 (2021)	Past	$p_{pb} = -0.03$	$p_{pb} = -0.04$	$p_{pb} = -0.07$	$p_{pb} = 0.06$
		$p = .32$	$p = .13$	$p = .01$	$p = .02$
	Future	$\boldsymbol{p_{pb} = -0.12}$	$p_{pb} = 0.02$	$p_{pb} = 0.04$	$p_{pb} = 0.11$
		$\boldsymbol{p = .007}$	$p = .73$	$p = .38$	$p = .02$
2 (2022)	Past	$p_{pb} = .0.03$	$p_{pb} = 0.04$	$p_{pb} = -0.07$	$p_{pb} = 0.06$
		$p = .33$	$p = .14$	$p = .01$	$p = .02$

Table 6

Correlations between factors on the amount of personal information recalled (past) and imagined (future) for the pandemic event by interview time

Interview	Time	Factors			
		Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
1 (2021)	Past	$p_{pb} = 0.01$	$p_{pb} = -0.05$	$p_{pb} = 0.04$	$p_{pb} = 0.01$
		$p = .82$	$p = .04$	$p = .14$	$p = .65$
	Future	$p_{pb} = 0.01$	$p_{pb} = -0.05$	$p_{pb} = 0.08$	$p_{pb} = 0.05$
		$p = .78$	$p = .25$	$p = .07$	$p = .26$
2 (2022)	Past	$p_{pb} = 0.01$	$p_{pb} = 0.05$	$p_{pb} = 0.04$	$p_{pb} = 0.02$
		$p = .82$	$p = .04$	$p = .14$	$p = .66$

4.3.3. Proportion of collective information: What type of information dominates?

Additionally, we computed correlational analyses including the four factors extracted from the exploratory factorial analyses with the proportion of collective information recalled and imagined (by type of event, interview time, and time). Results are available in Table 7 and reveal no significant correlation after multiple comparisons correction.

Table 7

Correlations between factors on the proportion of shared memories

Interview	Event type	Time	Factors			
			Factor 1	Factor 2	Factor 3	Factor 4
1 (2021)	Pandemic	Past	$p_{pb} = 0.08$	$p_{pb} = 0.02$	$p_{pb} = -0.09$	$p_{pb} = 0.05$
			$p = .21$	$p = .71$	$p = .15$	$p = .46$
		Future	$p_{pb} = -0.08$	$p_{pb} = 0.02$	$p_{pb} = -0.07$	$p_{pb} = -0.08$
			$p = .20$	$p = .81$	$p = .31$	$p = .22$
2 (2022)	Pandemic	Past	$p_{pb} = 0.07$	$p_{pb} = 0.01$	$p_{pb} = -0.11$	$p_{pb} = -0.16$
			$p = .34$	$p = .88$	$p = .15$	$p = .04$

4.3.4 Episodic details scores and index

Episodic details scores. Correlational analyses including the four factors with the episodicity scores (by interview time and event type) were computed and can be found in Table 8. Results reveal only one significant correlation after multiple comparisons correction, between Factor 4 and the episodicity scores for the political memories at the first interview ($p = .007$), revealing that the more participants followed the restrictions and agreed with the governmental restrictions the higher their score of episodicity was for their memories of the political event in 2020 when interviewed in 2021. Of note, we

did not hypothesize significant correlations between factors and memory indicators for political events. However, correlations were computed between factors and memory indicators for political events as a control measure.

Table 8

Robust correlations of episodicity scores (raw) with factors

Interview	Event type	Factors			
		Factor 1	Factor 2	Factor 3	Factor 4
Interview 1	*Pandemic*	$p_{pb} = 0.01$	$p_{pb} = -0.03$	$p_{pb} = -0.07$	$p_{pb} = 0.05$
		$p = .94$	$p = .61$	$p = .33$	$p = .47$
	Political	$p_{pb} = -0.07$	$p_{pb} = -0.01$	$p_{pb} = 0.04$	$\boldsymbol{p_{pb} = 0.18}$
		$p = .32$	$p = .86$	$p = .54$	$\boldsymbol{p = .007*}$
Interview 2	*Pandemic*	$p_{pb} = 0.07$	$p_{pb} = 0.07$	$p_{pb} = 0.03$	$p_{pb} = 0.05$
		$p = .48$	$p = .31$	$p = .69$	$p = .48$
	Political	$p_{pb} = 0.05$	$p_{pb} = 0.06$	$p_{pb} = -0.03$	$p_{pb} = 0.02$
		$p = .47$	$p = .37$	$p = .69$	$p = .82$

Episodic details index. Correlational analyses including the four factors with the internal and external details index (by interview time and event type) were computed and no significant correlation was found. Results are available in Table 5 and Table 6 in the supplemental material.

4.3.5 Lexical content analyses of memories: correlational analyses

We computed robust correlations between the four factors extracted from the exploratory factorial analyses and the lexical content of the pandemic memories and future thinking of the pandemic. For the first interview (in 2021), Factor 1 (i.e., impact on one's daily life and psychologically) correlates positively with the use of words related to negative emotions ($p_{pb} = 0.26$*, p <.001)*, anxiety ($p_{pb} = 0.22$*, p <.001),* and anger ($p_{pb} = 0.17$*, p = .008).* Factor 2 (i.e., COVID-19

contact) correlates negatively with the use of first plural pronoun (p_{pb} = -0.13, p =.04), words related to anxiety (p_{pb} = -0.17, p =.01) and negative emotions (p_{pb} = -0.17, p =.01). Factor 3 (i.e., psychological impact related to COVID-19) correlates negatively with the use of words related to anger (p_{pb} = -0.13, p =.03). Factor 4 (i.e., political rules and loneliness) correlates negatively with the references to positive emotions (p_{pb} = -0.17, p =.01).

For the second interview (in 2022), Factor 2 (i.e., COVID-19 contact) correlates positively with the use of the first singular pronoun (p_{pb} = .14, p = .04). Factor 3 (i.e., psychological impact related to COVID-19) correlates positively with negative emotions (p_{pb} = .15, p =.03). Other correlations were not significant (ps > .05).

4.5 Summary of results

Table 9

Memories: A comparison of memory for the pandemic and a political event as a function of interview time

Scores	Event type	Interview time	Interaction
Number of personal vs collective information: Nature of memories	Pandemic > political	2021 > 2022	Pandemic: personal > collective in 2021, but personal = collective in 2022 Political: collective > personal both in 2021 and 2022
Proportion of collective: what type of info dominates	Political (90%) > pandemic (49%)	2022 > 2021	
Internal details: raw number across the narrative	Pandemic > political	2021 > 2022	Pandemic: 2021 >> 2022 Political: 2021 > 2022
External details: raw number across the narrative	Pandemic > political	2021 > 2022	Pandemic: 2021 >> 2022 Political: 2021 > 2022
Episodicity across the narrative	Pandemic > political	2022 > 2021	2021: Pandemic > political 2022: pandemic = political
Internal index: Amount in each segment	Pandemic > political	2022 > 2021	Pandemic: 2022 > 2021 Political: 2022 = 2021
External index: Amount in each segment	Pandemic > political	2022 > 2021	Pandemic: 2022 > 2021 Political: 2022 < 2021
LIWC: what do people talk about?	Pandemic > political: I We Family Friends Positive emotions	2021 > 2022: We Family Positive emotions Anxiety Cognitive processes	Negative emotions: 2021: pandemic = political 2022: political > pandemic Covid: Pandemic: 2022 > 2021

| | Anxiety Cognitive processes Covid Health | 2022 > 2021: covid | Political: 2022 = 2021 |
| | Political > pandemic: anger | | |

Table 10

Characteristics of future thoughts as a function of event type

Scores	Event type	Type of details (if applicable)
Number of personal vs collective information: Nature of future thoughts	Pandemic = EU	Collective > personal
Proportion of collective: what type of info dominates	Pandemic = EU	
Internal details: raw number across the narrative	Pandemic > EU	
External details: raw number across the narrative	Pandemic = EU	
Episodicity across the narrative	Pandemic > EU	
Internal index: Amount in each segment	Pandemic > EU	
External index: Amount in each segment	Pandemic = EU	

5. Discussion

This study examined the influence of the passage of time and personal importance on lived collective memories. To do so, we explored 3 different aspects of memories: 1) the extent to which the representations in memory of lived collective events are episodic; (2) the type of information that people remember about a lived collective event (personal vs collective); (3) the themes most participants talked about and with which kind of words, as assessed by the lexical content analyses. We conducted a longitudinal assessment of memories of events related to the COVID-19 pandemic (events that all participants experienced as actors) compared to a political event that participants heard about in the media but did not live personally. Moreover, participants had to imagine a future pandemic and we investigated to what extent the collective future relies on the collective past.

5.1 Influence of personal importance in a collective context

As expected, because the pandemic had an impact on every participant's personal life as well as on the community's life (Er, 2003; Klein, 2012; Pezdek, 2003), it was rated as more important (as measured by the Centrality of Event Scale) than the control (political) event. We then found that memories of these two events differed in the amount and type of information recalled: memories of the pandemic contained more episodic details, and more personal and collective information than memories about the political event. Our results are in line with the self-reference effect in memory, stating that the more individuals are personally involved in the event, the more they hold personal memories and share episodic and semantic details about these events (Er, 2003; Klein, 2012; Sui & Humphreys, 2015). Also, greater physical involvement in an event leads to better memories than hearing about it in the media or from others (Gold, 1992; Pezdek, 2003). This study thus provides evidence that personal importance influences the creation of lived collective

memories. Interestingly, this appears as an enduring effect as, in 2022 (i.e., 2 years after the event), participants recalled as many personal memories as collective memories about the pandemic, whereas participants over time kept recalling political events with more collective information. Additionally, results highlight differences between memories of the pandemic and the political event mainly in terms of personal information. The personal importance associated with a lived collective event could influence the creation of strong links between personal and collective information related to that event.

The impacts of the collective event at individual and collective levels also drove specific characteristics regarding the words used in their narratives. Because of the stronger socioemotional nature of the COVID-19 pandemic for Belgians, as opposed to the political event, we found that memories of the pandemic encompassed more words related to emotions, cognitive processes, social situations, COVID-19, and health for the pandemic events compared to the political events (Haleem et al., 2020; Hiscott et al., 2020; Tarkar et al., 2020; Wollast et al., 2023).

5.2 Influence of the passage of time in collective memory: What do people talk about regarding lived collective events and what remains over time?

We hypothesized that with the passage of time the pandemic memories would include a smaller number of information, fewer episodic details, and a greater proportion of collective information over time (Conway & Pleydell-Pearce, 2000; Trope & Liberman, 2010). The results only partly supported these predictions. We found that, as time passed, participants recalled globally fewer information, as seen in the general loss of episodic and semantic details in the narratives, but overall narratives were more episodic over time. In other words, participants' narratives in 2022 were shorter, but the sentences were proportionally richer in detail. This was only true for the pandemic but not for the

political memories. This might reflect a reorganization of the memories of the pandemic in the sense of a denser but still rich representation of the events. With time, participants needed fewer sentences to describe events related to the pandemic during the year 2020 and could provide all details with fewer words.

Over time Belgians mentioned similar topics about the pandemic. These themes include general themes such as the virus, political restrictions, professional and school impacts, hospitals, and medical consequences. Our results recall those of a recent work on the COVID-19 pandemic revealing themes of lockdowns and infections (Öner et al., 2023) and social interactions and events (Rouhani et al., 2023). Moreover, we found that some topics were not recalled as such over time, like the specific lack of contact with family and friends but were encompassed in a new general theme about daily life impacts. While the restrictions and the virus were considered as two different themes one year after the pandemic, two years after the pandemic Belgian citizens shared a common memory of the evolution of the virus based on the restrictions imposed by politics. Interestingly, the geopolitical relationships between different countries and within Belgium appeared in the narratives only two years after the event. Altogether, two years after the events participants shared a more comprehensive view of the pandemic, possibly suggesting a reappraisal at a more general level when leaving the acute phase of the crisis. From a cognitive lens, the stabilization of themes, the evolution of specific themes into more general ones, and the emergence of new themes highlight the reconstructive nature of memory (Bartlett, 1932; Conway et al., 2004; Roediger & Abel, 2015).

Finally, the memories collected in 2022 referred more to the COVID-19 pandemic itself than the memories collected in 2021. This reveals more pandemic-oriented representations of memories with time and is consistent with the loss of personal memories with time. Interestingly, cognitive processes were found to be less used two years after the event, which might indicate that

in 2021 individuals' narratives reflected a high degree of complexity of language and thoughts (Van Swol et al., 2016; Van Swol et al., 2021), and organized thoughts (Cohn et al., 2004). This result is consistent with other research revealing less use of cognitive processes over time after the surprising events of the 9/11 attacks (Cohn et al., 2004), but inconsistent with other findings bearing on the collective coping theory that found differences in the use of cognitive processes three months to ten months after traumatic events such as flood, earthquake, or terrorist attacks (Pennebaker & Harber, 1993; Freitag et al., 2011). In this study, because higher scores for the cognitive processes category reflect organized thoughts (Cohn et al., 2004), this can also be linked with the temporal organization when recalling their memories of the pandemic in 2021 by referring to the months of the year to organize their thoughts (topic 7, Table 3), but not in 2022.

5.3 Links between past and future

In line with the constructive episodic simulation hypothesis (Schacter & Addis, 2007), we hypothesized that participants would share more episodic details when imagining a future pandemic than a future political event because they can rely on recent memories including episodic details and general knowledge about a pandemic (Conway et al., 2019). Consistent with our hypothesis, we found that future thoughts about a pandemic were more episodic than future political thoughts. This could indicate that participants used information about specific events to simulate what could happen in the future if a pandemic occurred again. Additionally, we found more collective than personal thoughts about future events, indicating that projections included more the community's actions than their own. These results differ from previous studies examining the personal or collective content of future thoughts related to the COVID-19 pandemic situation which showed that more personal than collective thoughts were produced and recalled (Migueles Seco & Aizpurua

Sanz, 2024). This difference might stem from the fact that we examined a future pandemic in 10 years, while Migueles Seco & Aizpurua Sanz (2024) examined the type of future thoughts (personal vs collective) related to the context of the pandemic during the pandemic.

We predicted that general topics used to recall the past pandemic would be used to imagine a future one (Öner et al., 2023). Consistently, thoughts about the future pandemic were influenced by past experiences, with topics reflecting the desire to learn from the past for better adaptation, specifically in medical management, economy, and political relationships all over the world. Collective future thoughts and their link with collective memories are still in the early stages of research. Congruent with our results, a few studies revealed that similar themes were shared about past and future public events (Öner et al., 2023; Öner & Gülgöz, 2020; Topçu & Hirst, 2020).

Finally, we acknowledge some limitations of this study and suggest future perspectives. Given that participants were free to recall personal and collective memories and imagine personal and collective events related to public events, the analyses of the episodicity and theme levels were run on their narratives without distinguishing personal and collective information. Future analyses could focus on the recall or future thinking of personal events related to public events separately from collective events related to public events, to ensure a specific examination of episodic details and themes of personal and collective events independently. Secondly, this study assessed memories of events over a period of one year (the year 2020) so that narratives mention many different events related to the pandemic. To avoid this, future studies should examine the cognitive structure of collective events that happened during a shorter time with less different events possible (such as the 9/11 attacks).

6. Supplemental material

Table 1

Mean and standard error for scores at the centrality scales at both interviews

	interview	all
Centrality scale related to the COVID-19 pandemic in 2020	1	3.36 (0.07)
	2	3.08 (0.07)
Centrality scale related to the political event in 2020	1	2.09 (0.07)
	2	1.80 (0.07)
Centrality scale related to the future pandemic in 10 years	1	3.11 (0.07)
Centrality scale related to the future UE dissolution in 10 years	1	3.09 (0.08)

Table 2

COVID-19 dictionary created in LIWC

apocalypse	infection
Rooms' ventilation	nurses
antibody	respiratory failure
Messenger RNA	isolation
asymptomatic	lockdown (EN)
Social bubble	Nursing home
contact case	sick
negative case	disease
positive case	mask
chaos	FFP2
cluster	doctors
collective	media
non-essential businesses	drugs
lockdown (FR)	microbe
physical contact	migraine
coronavirus	dead
online classes	pandemic
curfew	vaccination pass
covid	person at risk
covid safe ticket	loss of appetite
covid-19	loss of taste
health crisis	fear
CST	quarantine

End of lockdown	rules
screening	restrictions
disinfectant	sanction
social distancing	intensive care
distance	symptomatic
doctor	symptoms
loss of smell	homeworking
dose of vaccine	PCR test
epidemic	tests
epidemiologists	tracing
essential businesses	transmission
flu-like symptoms	vaccine
remote exams	vaccination
source of contamination	wave
hydroalcoholic gel	virus
barrier gestures	video
hospitals	
hygiene	
immunity	

Table 3

Exploratory factorial analyses computed based on the data collected at the first interview

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Centrality scale past COVID	0.567	-0.12	0.10	0.38
Family contact	0.113	0.69	0.04	-0.02
Friends contact	-0.157	0.74	0.17	0.10
Professional contact	-0.16	0.56	-0.17	0.20
Acquaintances contact	0.026	0.59	-0.13	-0.31
Impact on one's life	0.651	-0.26	0.17	0.11
Government rules	-0.24	-0.001	0.24	0.79
At risk	-0.132	-0.08	0.57	0.15
Confusion about the pandemic	0.48	-0.08	0.16	-0.18
Fear of covid	0.33	0.004	0.72	0.15
Trauma of covid	0.49	-0.04	0.57	-0.07
COVID-19 anxiety	0.24	0.06	0.78	-0.05
Loneliness	0.46	0.13	-0.08	0.55
Depression	0.77	0.05	-0.03	-0.09
Anxiety	0.66	0.08	0.17	-0.02
Expl. Var	2.78	1.8	2.01	1.33
Prp. Totl	0.18	0.12	0.14	0.09

Note.
Factor Loadings (Varimax normalized)
Extraction: Principal components
Marked loadings are >.500000

Table 4

Exploratory factorial analyses computed based on the data collected at the

second interview

	Factor 1	Factor 2	Factor 3	Factor 4
Centrality scale past COVID	0.61	-0.07	0.23	0.20
Family contact	0.04	0.59	-0.01	-0.07
Friends contact	-0.01	0.78	-0.03	-0.03
Professional contact	-0.15	0.59	-0.15	0.20
Acquaintances contact	-0.09	0.73	0.14	0.02
Impact on one's life	0.66	-0.10	0.24	0.25
Government rules	0.02	0.15	-0.13	0.82
At risk	-0.008	-0.11	0.28	0.70
Confusion about the pandemic	0.43	0.05	0.23	-0.03
Fear of covid	0.27	0.03	0.76	0.18
Trauma of covid	0.40	-0.01	0.63	-0.05
COVID-19 anxiety	-0.04	-0.04	0.85	0.01
Loneliness	0.62	-0.14	-0.23	0.12
Depression	0.76	-0.05	0.001	-0.29
Anxiety	0.62	-0.01	0.14	-0.14
Expl. Var	2.59	1.90	2.06	1.44
Prp. Totl	0.17	0.13	0.14	0.10

Note.
Factor Loadings (Varimax normalized)
Extraction: Principal components
Marked loadings are >.500000

Table 5

Correlations between the four factors from EFA and the internal details index

Interview	Event type	Time	Factor 1	Factor 2	Factor 3	Factor 4
Interview 1	*Pandemic*	*Past*	$p_{pb = 0.021}$ $p = .97$	$p_{pb = 0.04}$ $p = .58$	$p_{pb = -0.004}$ $p = .95$	$p_{pb = 0.01}$ $p = .83$
	Political	*Past*	$p_{pb = 0.07}$ $p = .27$	$p_{pb = 0.05}$ $p = .41$	$p_{pb = -0.07}$ $p = .27$	**$p_{pb = 0.07}$** **$p = .29$**
Interview 2	*Pandemic*	*Past*	$p_{pb = 0.027}$ $p = .81$	$p_{pb = 0.04}$ $p = .11$	$p_{pb = 0.04}$ $p = .60$	$p_{pb = 0.07}$ $p = .29$
	Political	*Past*	$p_{pb = 0.07}$ $p = .32$	$p_{pb = 0.03}$ $p = .69$	$p_{pb = 0.05}$ $p = .43$	$p_{pb = -0.05}$ $p = .43$

Table 6

Correlations between the four factors from EFA and the external details index

Interview	Event type	Time	Factor 1	Factor 2	Factor 3	Factor 4
Interview 1	*Pandemic*	*Past*	$p_{pb} = 0.01$ $p = .98$	$p_{pb} = 0$ $p = .99$	$p_{pb} = 0.02$ $p = .78$	$p_{pb =} -0.03$ $p = .67$
	Political	*Past*	$p_{pb} = 0.09$ $p = .17$	$p_{pb} = 0.05$ $p = .44$	$p_{pb} = -0.05$ $p = .49$	$p_{pb} = -0_{.07}$ $p = .26$
Interview 2	*Pandemic*	*Past*	$p_{pb} = 0.02$ $p = .72$	$p_{pb = -0.15}$ $p = .02$	$p_{pb = -0.07}$ $p = .32$	$p_{pb} = 0.06$ $p = .36$
	Political	*Past*	$p_{pb = -0.06}$ $p = .45$	$p_{pb = -0.08}$ $p = .21$	$p_{pb} = 0.07$ $p = .29$	$p_{pb = -0.03}$ $p = .63$

STUDY 2

Does the COVID-19 Pandemic Act as a Transition in the Recall of the Temporal Context of Autobiographical Memories?

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> **Study 2** examines the extent to which the COVID-19 pandemic act as a transitional event that helps to structure and organize memory.

STUDY 2

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Running title: COVID-19 and transition theory

Conflict of interest

The authors declare no conflict of interest.

Data Availability Statement

Data are openly available in OSF at https://osf.io/a2q4v/

1. Abstract

The Living-in-History effect suggests that important collective events are used as temporal landmarks that influence the temporal organization of autobiographical memory. In this study, we assessed whether the COVID-19 pandemic has such an influence on memory organization. We asked 170 young Belgian participants to recall and date autobiographical events. We examined the type of information used as temporal landmarks and references to the COVID-19 pandemic. We hypothesized that participants who were more impacted by the pandemic would refer more to this collective event when recalling personal memories. The 170 participants were divided into three clusters based on their degree of contact with COVID-19-positive persons and the impact of the pandemic on their life. Results show that young Belgian adults rarely rely on this collective event to date past experiences, regardless of the impact of the pandemic had on their life. Instead, they refer more to personal transitions as temporal landmarks.

Keywords : Transition Theory; Autobiographical Memory; Collective Memory; COVID-19 Pandemic

2. Introduction

Because of its major consequences in various areas of life, the COVID-19 pandemic will certainly remain in our memory. However, the extent to which this global event influences memory organization is not known. According to Conway et al.'s autobiographical memory model, of the multitude of events we experience every day only some events are retained in long-term autobiographical memory, in which they are organized hierarchically (Conway, 2005; Conway & Pleydell-Pearce, 2000). Details of everyday experiences are stored at the level of specific episodic memories, but these details are lost over time unless they pertain to long-term goals and are linked to a higher level of autobiographical memory (i.e., general representations of life events and periods). Lifetime periods (e.g., when I was working at University of Liège) involve period-specific knowledge that includes representations of typical places, objects, activities, and people characterizing a broad period of life (Brown, 2023; Thomsen, 2015). A shift from one lifetime period to another usually involves a major event that produces significant changes in one's life (e.g., moving to another city). These major events are also called transitions (Brown, 2016).

According to Brown's Transition Theory (Brown, 2016, 2023), transitions are events that produce significant changes in life circumstances (Brown, 2021; Gu et al., 2017; Uzer & Brown, 2015). They are "changes in the fabric of daily life" in terms of our relationships, habitual activities, and the places we frequent (Brown, 2016, 2023). These events can then be used as temporal landmarks, which help to structure the temporal organization of autobiographical memory (Berntsen & Rubin, 2004; Brown, 2016; Svob et al., 2014). Transitions have several dimensions. First, being grounded in autobiographical memory, transitions can be life script consistent or not (i.e., normativity dimension). Some transitions are expected in our society (e.g., getting married, having children, and so on), whereas others do not fit into known life patterns (Brown,

2023; Gu et al., 2017). Secondly, transitions can be seen on a continuum from personal (e.g., moving to a new place) to collective (e.g., wars) (i.e., scope dimension) (Brown, 2023; Brown et al., 2016; Gu et al., 2017). A third dimension relates to the impact of the transitional events in someone's life (i.e., impact dimension) (Brown, 2023; Gu et al., 2017; Shi & Brown, 2021).

Public events, such as wars and natural disasters, can elicit collective transitions (Bohn & Habermas, 2016; Brown & Lee, 2010). Collective transitions, like personal transitions, create boundaries between different lifetime periods (Brown et al., 2012; Brown et al., 2016). These lifetime periods are also referred to as Historically Defined Autobiographical Periods (H-DAPs). The Living-in-History effect (LiH) suggests that H-DAPs are used as temporal landmarks to date personal events (Bohn & Habermas, 2016; Brown et al., 2016, 2021; Zebian & Brown, 2014). Additionally, the LiH effect is generally more pronounced for people whose daily life was more impacted by the transitional event. Indeed, we recall more personal memories that happened around transitions (Enz et al., 2016; Pillemer et al., 1988) and unstable periods (e.g., wars) (Brown et al., 2016; Gu et al., 2017). Expanding on the impact dimension of transitions, several studies showed that personal involvement in collective events, such as the 9/11 attacks, led to better memories (Er, 2003; Neisser, 1996; Pezdek, 2003). Additionally, the emotional impact of events can influence the sharing of memories, which in turn enhances their consolidation in long-term memory and increases their likelihood of being recalled (Neisser, 1996; Tekcan & Peynircioglu, 2002).

The COVID-19 pandemic in 2020 formed a set of events that settled important modifications in daily life (Heanoy et al., 2021). As such, the pandemic, or at least the lockdown, could act as a transition because the changes produced by this event created a before and after in the fabric of daily life (Brown, 2021). Typically, changes associated with transitions consist of old

habits being replaced with new life elements (e.g., a new job) (Heanoy et al., 2022). In the case of the COVID-19 pandemic, the balance between old habits and new life elements mainly took the form of the disappearance of old habits (i.e., the lack of usual activities, contacts, and outside life during the lockdown) (Brown, 2021; Heanoy et al., 2021; Heanoy et al., 2022). Therefore, as opposed to classic transitions, such as starting a new job, the pandemic can be considered a "transition-by-omission" (Brown, 2021; Heanoy et al., 2022). Moreover, the modifications induced by the pandemic were usually not long-lasting, as most people resumed with their lives when vaccination against the virus generalized. Nevertheless, beyond long-lasting modifications (e.g., change of job), the pandemic had an affective impact. A recent study examined links between the transitional impact of the COVID-19 pandemic and its mental health consequences during the early stages of the pandemic, showing that the more participants were affected mentally by the COVID-19 events (depression, anxiety, and stress), the more they reported these events as transitional (Heanoy et al., 2021). However, the extent to which the pandemic acts as a temporal landmark in the organization of autobiographical memory is unknown.

The present study aimed to examine this question in the framework of the Transition Theory (Brown, 2016, 2021, 2023; Brown et al., 2012). We assessed to what extent the COVID-19 pandemic and related events such as the lockdown, vaccines, travel restrictions, and so on, functioned as a transition that is used as a temporal landmark for organizing memories for personal events. Participants took part in the study two years after the start of the pandemic and were asked to recall and date a series of personal events from the past five years. If the pandemic acts as a transition in people's life, participants should refer more to this collective event as a temporal landmark to date personal events. More specifically, we examined the impact dimension of transitional events. We hypothesized that participants who were more impacted by the COVID-19 pandemic at a personal level (e.g., through personal contact

with a COVID-19-positive person, mental health consequences, and daily life consequences) should refer more to the pandemic as a temporal landmark compared to people who were less impacted by the pandemic. Alternatively, it could be that participants do not use COVID-19-related events as a temporal landmark because of the lack of clear-cut "before-after" of the pandemic. In Belgium, the onset of the pandemic occurred with the first reported cases on February 1, 2020. Subsequently, on March 10, authorities announced the prohibition of visits to nursing homes, and by March 16, schools were closed. The official lockdown started on March 18 and extended until May 4, accompanied by measures such as mandatory masks in public transportation. Following a period of fewer restrictions during the summer, new measures were implemented on October 19, including a curfew that persisted into 2021. In 2021, the end of the lockdown and easing of restrictions was not clearly defined but occurred gradually through various phases, progressively lifting the restrictions, and granting more freedom. Given these variations in the measures that were taken by the government, the COVID-19 period involved more diffuse changes over time than other transitional events (e.g., a natural disaster), and could therefore be less used as a time reference in memory.

3. Method

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. This study was not preregistered.

Participants

An a priori power analysis carried out using the G*power software (Faul et al., 2007) suggested recruiting at least 146 participants to reach a statistical power of 0.85 to detect an interaction effect between clusters and categories (see below), with an alpha of .05 and a medium effect size (Cohen's f = .25).

From February 2022 to April 2022, 181 participants took part in the study. Eleven participants were excluded from the analysis for the following reasons: six participants because of a diagnosed psychiatric or psychological disorder or due to a score equal to or higher than 16 on the French version of the Beck Depression Inventory (BDI-13, Collet & Cottraux, 1986), and five other participants because they were under medication for neurological or psychiatric diseases. The final sample included 170 participants (95 women) aged between 18 and 40 years old (*M* = 21.8, *SD* = 3.95). All were Belgian and French-speaking and did not suffer from neurological, psychiatric history, or cognitive impairment. Ethical approval was obtained from the ethics committee of the psychology faculty at University of Liège. Participants provided written informed consent.

Memory Task

All participants took part in an autobiographical memory task. The task was similar to the one used by Brown et al. (2009) to assess the Living-In-History effect in a cross-national study with public events such as wars or natural disasters. Participants were given one word at a time and were asked to retrieve a specific personal memory related to that word. The event had to have lasted less than 24 hours and have occurred from five years to one week before the interview. The period between the onset of the pandemic and the study was two

and a half years (2019-2022). Thus, the period of five years was chosen so that the period from which participants would sample memories would be equivalent (two and a half years) before and after the pandemic. Furthermore, this ensured that the pandemic was included in a sufficiently long timeframe, five years, to be potentially used as a temporal landmark.

Then, participants were asked to write down a sentence that defined the memory retrieved for each word. In total, 20 words (from Brown et al., 2009) were presented randomly. The first two words were training items and thus were not analyzed. After writing down the 20 sentences, the experimenter asked the participants to recall the date (month and year) of each event and to report verbally everything they were thinking about when dating the event. This part was audio recorded and later transcribed.

Questionnaires

COVID-19-related questionnaires. Participants completed a questionnaire assessing several variables related to the pandemic. First, we assessed their COVID-19 proximity in their family, friends, professionals, and acquaintances circles since 2020. For each circle (family, friends, professionals, and acquaintances), they were asked to answer yes or no if they knew someone who contracted the COVID-19 disease, if they were in physical contact with someone positive, and if they knew someone who passed away due to COVID-19. A mean score based on each answer was computed for each circle (family, friends, professionals, and acquaintances). Then, participants completed 7 visual analogic scales (VAS) from "not at all" (0) to "a lot" (100) assessing the impact of the pandemic in their lives: on their daily routine, leisure, work, social life, familial life, mood, and life satisfaction. A mean score was computed based on the results of these 7 VAS and is referred to as the impact on one's life. Additionally, 11 VAS from not at all" (0) to "a lot" (100) assessed their compliance with the governmental restrictions. This part included the

agreement with government decisions during the first lockdown, the respect of the first lockdown, the respect of health rules during the first lockdown, the agreement with government decisions during the first end of lockdown, the compliance with post-first lockdown instructions, the agreement with government decisions during the second lockdown, the respect of the second lockdown, the respect of health rules during the second lockdown, the agreement with government decisions during the second end of lockdown, the respect of post-second lockdown instructions, and the feeling of confusion about the pandemic (political and health discourse). Loneliness was assessed by the loneliness scale (De Grâce & Joshi, 1990). The fear of COVID-19 scale (Ahorsu et al., 2020), the anxiety of COVID-19 scale (Lee et al., 2020), and the IES-COVID-19 scale (Vanaken, 2020) were also completed.

Questionnaires unrelated to the COVID-19. Participants completed the depression scale BDI-13 (Collet & Cottraux, 1986). Finally, participants completed the STAI 6-item scale which was the only questionnaire in which the questions were verbally presented to the participants (Marteau & Bekker, 1992).

Questionnaires and clustering analysis. As we hypothesized an effect of the impact of the pandemic for participants on the use of the COVID-19 pandemic as a transitional event when dating memories, clusters of participants were computed exclusively based on COVID-19-related measures. In total, 10 measures were used to compute the clusters: four mean scores of the proximity to COVID-19-positive people, one for each of the four circles (family, friends, professionals, and acquaintances); a mean score based on the 7 VAS on the impact in daily life; a mean score based on the 11 VAS on compliance with governmental restrictions; and the scores of the IES-scale (Vanaken, 2020), loneliness scale (De Grâce & Joshi, 1990), the fear of COVID-19 scale (Ahorsu et al., 2020), and the anxiety of COVID-19 scale (Lee et al., 2020).

The clustering analysis categorized the 170 participants into three clusters. This analysis was performed using Jamovi version 2.2 (The Jamovi project, 2021) and the snow cluster packages (Seol, 2022). Principal Component Analysis (PCA) revealed the existence of two dimensions (see Figure 1). The first dimension is related to contact with COVID-19-affected persons. The second dimension encompassed anxiety, fear, and trauma associated with COVID-19, feelings of loneliness, the impact of COVID-19 on one's life, and agreement with governmental restrictions. Cluster 1 demonstrated a high score in dimension 1 but an average score in dimension 2. This cluster strongly correlated with proximity to COVID-19-affected persons but exhibited average scores with psychological impacts, life impacts, and agreement with governmental restrictions. Cluster 2 was associated with low scores in both dimensions. This cluster showed a negative correlation with contact with COVID-19-affected persons, psychological impacts, life impacts, and agreement with restrictions. As the least affected, this cluster should be less likely to refer to the COVID-19 pandemic as a temporal landmark. Cluster 3 displayed high scores in both dimensions. This cluster had a strong positive correlation with contacts with COVID-19-affected persons and with psychological impacts, impact on one's life, and agreement with governmental restrictions, making it the most affected cluster. We hypothesized that Cluster 3 would refer more than Cluster 2 and Cluster 1 to the COVID-19 pandemic when dating personal memories and that Cluster 1 would refer more to the pandemic as a temporal landmark than Cluster 2. Figure 1 represents the clusters on the two dimensions previously described.

Figure 1

Visual representation of each participant grouped in the three clusters on two dimensions
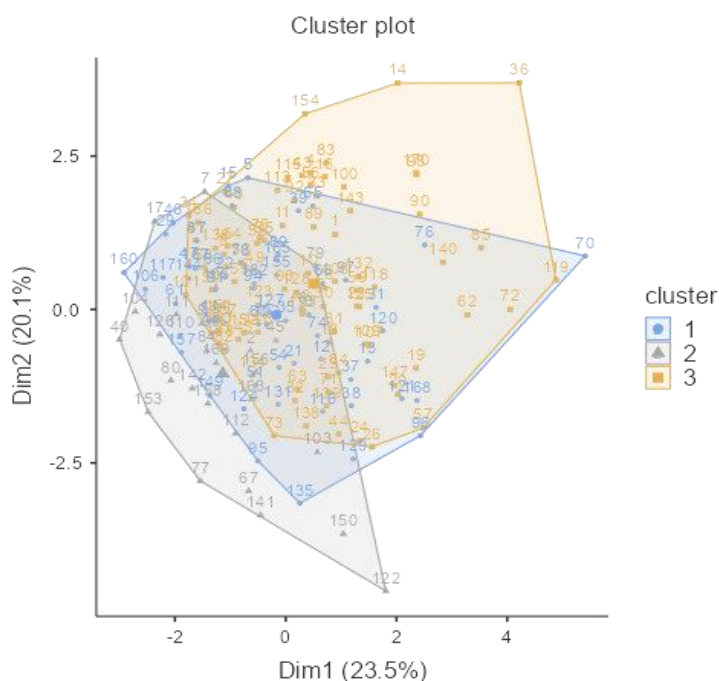
Note.

Dim 1: Corresponds to the first dimension generated by the PCA. It relates to the proximity with COVID-19-affected persons (family, professionals, friends, and acquaintance circles). This dimension explains 23.5% of the variance in the dataset.

Dim 2: Corresponds to the second dimension generated by the PCA. It relates to the psychological impact of the COVID-19 pandemic (anxiety, fear, and trauma associated with COVID-19, feelings of loneliness), the impact of COVID-19 on one's life (mean score of the 7 VAS), and the agreement with governmental restrictions (mean score of the 11 VAS). See section Questionnaires for more information. This dimension explains 20.1% of the variance in the dataset.

Table 1 outlines the characteristics of participants (age and emotional assessment unrelated to the COVID-19 pandemic) within the three clusters. Using ANOVAs no main effects of the clusters were found for age ($F(2,76) = 0.60$, $p = .55$) and anxiety scores ($F(2, 82) = 3.09$, $p = .05$). The ANOVA on the depression scores revealed a significant main effect of the clusters, $F(2, 74.9) = 11.59$, $p < .001$. Post hoc Tukey test showed a significant difference between Cluster 1 and Cluster 2, $t = 3.63$, $p = .001$, and Cluster 1 and 3 ($t = 4.20$, $p < .001$). No significant differences were found between Cluster 2 and Cluster 3 ($t = -0.27$, $p = .96$) (see Table 1).

Table 1

Mean (standard deviation) of participant characteristics by clusters

Characteristics	Cluster 1	Cluster 2	Cluster 3
N	84	29	57
Age	22.8 (4.88)	21.2 (2.98)	21.5 (3.72)
Anxiety scores	9.17 (2.30)	8.37 (1.92)	10.7 (3.72)
Depression scores	6.85 (3.95)	4 (3.79)	4.23 (3.02)

Data Coding

Data were analyzed using two complementary methods. First, we analyzed the type of events participants referred to spontaneously when providing a date for their memories and classified it as public, personal, or none[6] (*Type of temporal landmarks*) (for similar analyses see Brown et al., 2009). Public temporal landmarks are collective events spontaneously referred to when dating personal memories. It includes collective dates or periods known by the population (e.g., Christmas, 18th March 2020 (start of the lockdown in Belgium)).

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[6] Of note, the analyses were blindly coded by CB and NC. Inter-rater reliability was assessed by Cohen's kappa, $k = 0.69$ which suggests a substantial agreement.

Personal temporal landmarks are personal events spontaneously referred to date personal memories (e.g., birthdays, weddings, moving, break-ups, injuries). The third category (none) includes memories that were dated by using a date without providing a temporal justification (e.g., It was the 9th of January 2020).

Second, we counted references to the COVID-19 pandemic when dating their memories (*COVID-19 references*[7]). For each memory, if a word was related to the pandemic it was counted as 1, and 0 if not. Examples of stimuli and their coding are provided in Table 1 in supplemental material.

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[7] The analyses were blindly coded by NC and MD. Inter-rater reliability was assessed by Cohen's kappa, $k = 0.87$ which suggests an excellent agreement. COVID-19 references encompass words related to health associated with the COVID-19 symptoms, vaccinations (e.g., vaccines, Pfizer, Astrazena, first shot, second shot), COVID-19 infection, and related measures such as lockdown, masks, homeworking, travel restrictions,...

4. Results

Statistical analyses were computed using Jamovi version 2.2 (The Jamovi Project, 2021). Bayesian analyses were computed using the R package Jsq in Jamovi (Morey & Rouder, 2018).

Type of Temporal Landmarks

Table 2 displays the number of responses classified as references to personal, collective, or no temporal landmarks as a function of the cluster to which participants belonged. A 3 (clusters) x 2 (type of temporal landmarks: public, personal [8]) ANOVA was conducted on the number of landmarks mentioned when dating the recalled memories. Results indicated no main effect of the clusters, $F(2, 334) = 0.82$, $p = .44$, $\eta^2_p = .01$. However, a significant main effect of the type of temporal landmarks was observed, $F(2, 334) = 166.47$, $p <.001$, $\eta^2_p = .33$, indicating that personal events were more frequently used than public events to date memories. The interaction between clusters and landmarks was not significant, $F(2, 334) = 2.44$, $p = .09$, $\eta^2_p = .01$. To quantify the extent to which the data about the clusters' effect were in favor of the null hypothesis (i.e., the absence of clusters' effect on the use of personal and public temporal landmarks), Bayes factors were computed. The results suggest moderate evidence that the data were more likely under the null hypothesis than under the alternative hypothesis (i.e., the presence of the effect of the clusters) for both personal temporal landmarks ($BF_{10} = 0.11$) and public temporal landmarks ($BF_{10} = 0.29$).

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[8] For most memories, participants did not use a temporal landmark to date the recalled event (see the "none" category in Table 2). Since we were interested in the use of temporal landmarks, we only included the personal and public categories in the analyses.

Reference to the COVID-19 Pandemic

Table 2 shows how frequently participants mentioned the pandemic when dating memories, as a function of clusters. As can be seen, mention of the pandemic was rare. A one-way ANOVA[9] (clusters) on the amount of pandemic references showed no significant effect of clusters, $F(2, 167) = 0.63$, $p = .53$, η^2_p =.007 (BF$_{10}$ = 0.10). Additionally, only 6.4% of the memories referred to the COVID-19 pandemic.

Table 2

Mean (standard deviation) of COVID-19 references and the type of temporal landmarks as a function of clusters

		Cluster 1	Cluster 2	Cluster 3
COVID-19 references		1.29 (1.47)	0.98 (1.28)	1.19 (1.54)
Type of temporal landmarks	Public	2.83 (1.99)	2.44 (1.77)	2.50 (1.75)
	Personal	5.96 (3.57)	6.91 (3.89)	7.28 (3.71)
	None	8.87 (3.74)	8.69 (3.72)	8.28 (3.83)

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[9] Since depression scores differed significantly between clusters, we also ran an ANCOVA to test the effect of the clusters on the amount of pandemic references with depression scores as covariates. The results were similar to those obtained with the ANOVA.

5. Discussion

The aim of this study was to assess whether the COVID-19 pandemic contributes to autobiographical memory organization through the Living-In-History effect. Pandemic-related events should be used as temporal landmarks when recalling personal memories if they involve sufficient changes in life circumstances to influence the structure of memory organization (Brown, 2021; Heanoy et al., 2021). In this context, a stronger impact of COVID-19 on one's life should increase the use of references to pandemic-related events when recalling memories (Brown et al., 2016). The alternative hypothesis was that individuals do not use the pandemic as a transition in their autobiographical memory because the changes it involved were somewhat diffuse and it was not officially finished when we assessed the memories of young Belgian adults in 2022 (two years after the start of the pandemic). The results showed that the COVID-19 pandemic did not induce a Living-in-History effect. Young Belgian adults often did not use any event to date their personal memories and, when they did, they referred to a greater extent to personal than public past events, and they rarely mentioned the COVID-19 pandemic.

Collective events can trigger collective transitions and influence memory organization through the concept of H-DAPs and the Living-in-History effect (Bohn & Habermas, 2016). In this study, young Belgian adults did not often use public transitions, such as those induced by the COVID-19 pandemic and associated measures taken by the government, to date their memories. Indeed, in this study, participants referred to the COVID-19 pandemic for 6.4% of the memories. This is not an isolated result as some previous studies showed that some major historical events such as the Collapse of the Former Soviet Union were not used as temporal landmarks (Nourkova & Brown, 2015). Brown emphasized that collective transitions appear when a public event triggers irreversible changes in one's life (Brown, 2016; Opris et al., 2022). In this respect,

the COVID-19 pandemic can be considered a peculiar type of transition (Brown, 2021). Firstly, two years after the pandemic, most aspects of people's lives were back to normal, and the forbidden activities during lockdown were allowed again. As there were no irreversible changes in one's life, the two life periods delimited by the pandemic (i.e., 'before' and 'after' COVID-19 life periods) are not much different. Consequently, the COVID-19 pandemic may not have led to sufficiently lasting changes in people's life to be considered a transitional event. Secondly, the beginning of the pandemic was clear for the Belgian population via the lockdown announcement but its end is much fuzzier (i.e., no specific date marked the end of the pandemic, and different types of restrictions ended at different times in Belgium). Therefore, since the period is less clearly defined, one might not easily use the COVID-19 pandemic as a significant temporal landmark to organize memories. Finally, the effects of the pandemic at a personal level were different in intensity and duration compared to the collective levels (i.e., economic, social, and political), which also makes it a less clear-cut transitional event. An additional explanation for the limited use of the COVID-19 pandemic as a temporal landmark could be that it is still too recent. Indeed, lifetime periods, including H-DAPs, cover large periods that may be more effective for temporally positioning events when they are more distant in time. Hence, it remains possible that the COVID-19 pandemic will become a transition that helps to date events when more time has passed.

When participants used events to date their personal memories, they referred more to personal than public events. This is coherent with other studies (Brown et al., 2009; Brown et al., 2016; Friedman, 1993). However, the absence of evidence for the LiH effect in the present study should be put in perspective with the fact that previous studies investigating the LiH effect usually investigated older populations (Bohn & Habermas, 2016; Islam & Haque, 2021; Opris et al., 2022) or middle-aged adults (Camia et al., 2019). In the present study, participants were young adults and the number of collective events that

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could lead to H-DAPS within five years is relatively low compared to personal events that could lead to personal transitions at that age (e.g., high school graduation, driving license, moving out). One study assessing the LiH effect in ten samples of young adults from different countries showed the presence of the LiH effect in only two samples out of the ten young groups (Brown et al., 2009). In brief, the studies showing the presence of the LiH effect emphasize the life-changing characteristics of the events, considered as epoch-defining memories more than emotionally charged events (Brown et al., 2009).

Finally, we would like to acknowledge some limitations of the present study and propose future perspectives for investigating the LiH effect. Firstly, this study was conducted two years after the onset of the pandemic, which might be too short for these events to serve as transitions and organize memory. Secondly, studies examining the LiH effect used the Transitional Impact Scale (TIS-12, Svob et al., 2014) that evaluates life changes (material and psychological changes) following a specific event. While this study assessed the daily life impact of the pandemic through various scales, incorporating the TIS-12 could provide additional insights and facilitate comparisons with other studies. Additionally, we acknowledge that the clustering method could benefit from more precise personal information regarding health status, employment changes, and personal experiences during the COVID-19 pandemic.

In summary, this study did not provide evidence that changes in life circumstances associated with the COVID-19 pandemic led young adults to use this event as a landmark for organizing their autobiographical memories. Since this study focused on a recent collective event, these results should be considered with caution. A longitudinal study would help to understand when recent collective events - that will lead to a transitional event- start to be referred to as a transition and when they start to influence the temporal organization of autobiographical memory.

6. Supplemental material

Table 1

Coding example for the type of event and COVID-19-related words.

Word	Memories	Date	Event			COVID-19 related words
			Public	*Personal*	*None*	
Car	*When my car broke down the police helped me.*	*I remember that it was during the lockdown. So it should be around March 2020. My car broke down. I had to call the garage, but they were not working. So, I waited two hours outside until the police helped me.*	X			Yes
Dog	*When my mum gifted me our dog.*	*It was a couple of days after I broke my arm. I broke my arm in December 2018 skiing. I always wanted a dog and my mum brought a dog to help me feel better. It has been 4 years that we have him.*		X		No
Piano	*When I played piano in front of the whole school*	*It was in July 2019.*			X	No

STUDY 3

Shared event-memory for a public event in young and older adults

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Study 3 investigates age effects on event memory through the amount of details recalled and the inter-subjects similarity.

1. Abstract

This study examined the extent to which individuals can share similar memory representations of a public event and potential age-related differences in memory similarity. Fifty-three young and fifty-nine older Belgian participants completed an online survey, where they recalled the deadly collapse of a bridge in a neighboring country 7 months ago. Results showed no age-related differences in the number of details remembered or the amount of overlap of details within an age group. However, older participants mentioned the consequences of the incident more frequently than younger participants. These findings suggest that individuals who remember the same event can share common memory details and that across-participants memory similarity for a public event remains spared in normal aging.

Keywords: shared memory; collective memory; flashbulb memories; similarity; aging

2. Introduction

Collective and shared event memory

Although autobiographical memory accounts have mainly focused on memories proper to each individual, how these memories – particularly for public or historical events - are shared between individuals attracts research attention (Hirst & Manier, 2008; Hirst et al., 2018). Motivation to examine this question has arisen from the understanding that autobiographical and collective memory share similar theoretical assumptions. For instance, current models about autobiographical memory emphasize how memories about our personal experiences shape our identity (Conway, 2009). Similarly, collective memories can be considered an important part of the identity of a community (Coman et al., 2009; Öner & Gülgöz, 2000). Furthermore, like autobiographical memory, collective memories are organized hierarchically and contain specific details and general conceptual knowledge about the unfolding of an event (Abel et al., 2019; Conway, 2009).

In collective memory psychology, attention has been paid to the shared nature of memories for public events, and a few studies have compared retrieved memory details across participants. In these studies, participants were asked to remember events about historical periods (e.g., World War II; Zaromb et al., 2014) or sports championships (e.g., baseball; Merck et al., 2020). The results showed that many participants remembered the same events occurring during these periods (e.g., when remembering the unfolding of World War II, the participants mentioned the Pearl Harbor attack, Hitler's suicide, German surrender, etc.). Some events (e.g., the Pearl Harbor attack) were mentioned by almost 90 percent of the study sample (Merck et al., 2020; Zaromb et al., 2014). These findings emphasize that individuals separately remembering the occurrence of historical events show similarities in the content of what they remember. In the above-mentioned studies, researchers compared the recall of

memory content across participants by examining the percentage of participants who recalled one detail or happening. This provided an indication of the recall frequency of some aspects of an event in a community. Alternatively, it would be of interest to examine the similarity between the recall details of one participant and the remaining participants of their group (i.e., inter-subjects similarity). This would provide insight into whether memory for specific details about events' unfolding (e.g., the attack happened in the morning, 3000 people died, etc.) are similar across participants and provide a picture of how much the narrative of an event is shared. The main aim of the current study was therefore to introduce a measure of shared memory via inter-subjects similarity matrices. The rationale of this measure relies on the principles of Representational Similarity Analyses (RSA) (Kriegeskorte et al., 2008) that assess neural similarity across subjects for specific contents. Here, the method consists of rating the similarity of narratives for each pair of participants.

In cognitive psychology, memory for public events has also been examined through the study of flashbulb memories. These memories refer to very vivid and long-lasting memories of the circumstances in which one learned about a shocking public event (Luminet & Curci, 2009). They are remembered more clearly and vividly than events from everyday life (Brown & Kulik, 1977). These studies usually focus on negative events that have social importance such as assassinations, political crisis, or national disasters (Luminet & Curci, 2017). Given that they relate to public events that are known by most members of a community and also trigger strong memory for personal context in which the events are learned, flashbulb memories are at the intersection of autobiographical and collective memory (Berntsen, 2018; Conway, 1996; Neisser, 1982; Pillemer, 2009; Zaromb et al., 2014). A few decades ago, Neisser suggested that flashbulb memories were at the junction where one aligns their life with the source of history (Neisser, 1982). The formation of these specific memories depends on multiple factors such as emotional content, social

relevance, personal importance, and rehearsal (Davidson et al., 2006; Kopp et al., 2020; Wolters & Goudsmit, 2005). Emotions are strongly linked with the formation of flashbulb memories (Brown & Kulik, 1977; Finkenauer et al., 1998) as they may act as cement to boost memory for the details regarding the unfolding and the encoding context of a flashbulb memory event. Additionally, Merck et al. (2020) stated that social identity had some impact on the formation of flashbulb and collective memories. Together, these studies suggest that the formation of flashbulb and collective memories are both related to social factors such as the personal importance of the event. Examining individual flashbulb memories characteristics and investigating whether – and to which extent- they relate to the formation of collective memory representations is a secondary objective of the current study.

Age-related changes in memory

It is widely accepted that the ability to accurately remember details of past events that were personally experienced decreases with age (Drag et al., 2009). Specifically, when remembering autobiographical events, older adults recall a lower number of episodic details (Levine et al., 2002; Robin & Moscovitch, 2017) and they report a greater amount of general and semantic – external - elements (Balota et al., 2000; Levine et al., 2002). Regarding age-related differences in the creation of flashbulb memories, past studies have yielded inconsistent findings. Some studies did not report any difference in flashbulb memories' characteristics between young and older adults (Otani et al., 2005). For instance, they showed no age difference in the remembering of the context surrounding the 9/11 terrorists attacks (Davidson et al., 2006; Wolters & Goudsmit, 2005). In contrast, one study reported an age-related decline in the memory of the resignation of Prime Minister Thatcher (Cohen et al., 1994). Interestingly, a recent meta-analysis has revealed that aging was associated with a small to moderate decrease in the amount of flashbulb

memories characteristic features (Kopp et al., 2020). The lack of consistency between above-mentioned studies might be explained by factors related to the nature of the remembered episode that would influence the encoding and the retrieval of flashbulb memories to a different extent in young and older adults: emotional content, social identity, personal relevance, and rehearsal (Davidson et al., 2006; Kopp et al., 2020; Merck et al., 2020; Wolters & Goudsmit, 2005).

Regarding collective memory, little is known about potential age-related differences of shared memory representations and inter-subjects similarity of memory content. One study considering differences between young and older adults examined the collective memory for historical events. This study showed that when asked to retrieve events from long-lasting historical events (e.g., World War II), young and older adults commonly recalled a small set of events but the nature of recalled events differed between young and older adults (Zaromb et al., 2014). Critically, events recalled by older adults were less specific, more extended, and more summarized than those recalled by young adults (Zaromb et al., 2014). This may suggest that older participants relied more on their semantic and schematic knowledge of historical events unfolding when remembering them. A recent study examined age-related differences in across-participants similarity of the content of memory for pictures (Folville et al., 2021). It revealed that the quantity of remembered episodic details across task trials was similar between older participants and that the magnitude of this similarity was comparable to what was observed in young adults (Folville et al., 2021). One caveat with the across-participants similarity measure used in that study is that it compared the quantity rather than the quality of remembered details between participants. In other words, based on that similarity measure, it could be determined whether two participants remembering the same picture both recollected five memory details but it did not examine whether recollected details were – qualitatively- the same.

It is unclear as to whether two older adults who remember the same event will share the same memory details about the unfolding of the event and whether it will be the case to a similar extent in young adults. The second main aim of the study was to examine this question. We conducted a study where young and older Belgian citizens recalled the unfolding of a recent event that happened 7 months before the current study started and that was reported widely in public media (i.e., the collapse of the Morandi Bridge, Italy on August 2018). This public event was chosen because, at the time of the study, it was the only recent public event that stood out in the news because of its unique and attention-catching characteristics. So, it was likely that Belgians would have heard about it and remember the event and key details about it. Several updates were frequently made in Belgian media (paper press, television, etc.) on the day of the disaster and the days following the event. Thus, it constituted a good example of an event to investigate inter-subjects similarity and the age effect on shared memory for a public event.

The details recalled by participants were coded using a pre-defined grid containing the main details about the unfolding of the event (e.g., vehicles fell into the chasm; many people died; the collapse was due to a lack of maintenance, etc.). In addition to age-related differences in the number of details recalled by each participant taken individually, we also assessed whether young and older participants produced similar narratives compared to their counterparts by means of inter-subjects similarity matrices. Finally, we examined the flashbulb characteristics of memories between age groups and we explored the links between flashbulb memories characteristics and inter-subjects similarity.

3. Method

Participants

Between March 13th, 2019 and August 12th, 2019, 375 Belgian citizens answered an online anonymous survey, which was widely distributed via different media: intranet announcement to all university members (students and staff); advertisement to the volunteers of our Center database; and posts on social media (such as Facebook). Some participants were excluded from the analyses because of the following reasons: they didn't remember the event (n = 50); they didn't answer all the questions of the survey (n = 81); or they failed to provide the correct answer to one of the control questions (n = 66). Additionally, 66 participants aged between 31 and 56 years old were not included in the analyses, because the current study only focused on young and older participants. The final sample consisted of 112 participants: 53 young adults (48 women) aged between 18 and 30 years (*M* = 22.58, *SD* = 3.11) and 59 older adults (28 women) aged between 60 and 80 years (*M* = 68.81, *SD* = 5.20). Older adults had attained a higher level of education (from 1 = primary school to 6 = PhD) than young adults (young: *M* = 3.8, *SD* = 0.9; older, *M* = 4.5, *SD* = 0.9, *t*(110) = -3.67, *p* < .001).

Survey

First, participants had to provide demographic information (age, gender, diploma, occupation, and nationality). Next, they were asked whether they remembered the collapse of a bridge in Italy (no further details were provided). If they answered "no", the survey ended. If they responded "yes", further questions were provided. First, they were asked to remember the event with as many details as possible and to write a description of what they remembered about it. There was no space limit for the written report. Second, they were asked to specify how they heard about the bridge collapse: 6 options were listed (radio, television, written press, internet press, online social media, and hearing of the

occurrence of the event from someone) and they could select several answers. Participants were then asked to rate the frequency with which they followed the event in the media on a scale (from 1 "never" to 5 "several times per day") and the number of people with whom they spoke about the bridge collapse on a scale going from 0 to more than 10. Next, participants were invited to answer questions that could characterize the flashbulb dimension of their recollection. They could answer "yes" or "no" to the following items: "Do you remember where you were when you heard about the event?"; "Do you remember at what time of the day you heard about the event?", "Do you remember who you were with or whether you were alone when you heard about the event?"; "Do you remember what you were doing when you heard about the event?"; "Do you remember how you felt or what you thought when you heard about the occurrence of the event?". The number of "yes" answer to these 5 questions was summed. Finally, using a visual analog scale ranging from 0 to 100, participants were asked to assess how emotionally affected they were by the bridge collapse. We added three control questions to the survey. For two of them, participants were instructed to choose a precise response on the Likert scale. The third one was the last question of the survey. Participants were asked to type "orange juice" in a dedicated place. This allowed us to ensure that participants carefully read instructions throughout the completion of the survey. It took approximately 15 minutes to complete the survey.

Text analyses

To analyze the content of participants' memory descriptions, we used a template narrative that described the unfolding of the event (i.e., the bridge collapse), its causes, and consequences. This template narrative was based on television news and social media information gathered before conducting the study. Elements of the narrative were segmented as independent details. Then, the memory description from each participant was compared to the segmented

template narrative (see Figure 1 top for an illustration of narrative coding). Of note, the coding protocol included items mainly related to the facts and details that were not considered by the questions of the survey (e.g., memory about the context of hearing the news was captured by the questions of flashbulb characteristics). Five young and 4 older adults reported one detail that was incorrect or not related to the event (e.g., "there was a thunderstorm" or non-specific information, such as "I don't know if it's correct but I think the bridge was quite high"). As the rates of such intrusions were very low, they were not analyzed.

Description of the event by Participant 1

I was sad when I heard the news (emotional response participant), I remember it happened in August (date). A bridge in Genoa (place) felt. It caused a lot of damage because it was an important communication road axis (communication road axis). I still can see the image of the cars (images) on the bridge after it felt. Vehicles felt from the bridge (vehicles). People were helping (help). It had disastrous consequences for Italian economy (economy) and measures were taken in Belgium (Political Belgian) to prevent the same kind of disaster to happen.

Description of the event by Participant 2

This event took place on August (date), in Genoa (place). One bridge felt and it caused damage because a lot of people used the road and it was communication road axis (communication road axis). I remember that medias gave information about the people who tragically died (death/victims) because of the bridge collapse. I couldn't stop thinking about the poor Italian people (emotional responses about Italian people).

Figure 1

Coding protocol (illustration)

Details event [1]	P1	P2	PX		SIM. P1-P2	SIM. P1-PX	
Date	1	1			1		
Place	1	1			1		
Communication road axis	1	1			1		
Maintain	0	0			0		
Images	1	0			0		
Vehicles	1	0			0		
Death/victims	0	1			0		
Help	1	0			0		
External help	0	0			0		
Economy	1	0			0		
Political - Italian / Belgian	1	0			0		
Emotional responses participants	1	0			0		
Emotional responses about Italian people	0	1			0		
Total individual count	9	5	…	**Total similarity**	3/11= 0.27	…	

Mean similarity P1

Note.
Top: Sample of narratives with coding of details
Bottom, Left: Count of recalled details for each participant taken individually
Bottom, Right: inter-subjects similarity scoring

To assess the number of recalled pieces of information, we computed the total number of details recalled by each participant taken individually (left side of bottom Figure 1). This was done by counting the presence/absence of each detail from the template narrative. Each detail was assigned a score of 0 (not mentioned by the participant) or 1 (mentioned by the participant). All narratives were blindly coded by the first author. The inter-rater reliability measure for the coding was based on the analyses of 20% of the recall data by a second author. Analyses suggest very good reliability between raters with standardized Cronbach's α =. 94.

The measure of inter-subjects similarity was based on the same principles as Representational Similarity Analyses used in fMRI research and each task trial of each subject is used multiple times to compute the similarity between each pair of participants (Kriegeskorte et al., 2008; Nguyen et al., 2019). When used to assess neural similarity across participants (Chen et al., 2017; Oedekoven et al., 2017), commonalities between a participant' neural activation pattern and activation pattern of the remaining participants of their group are computed and the averaged inter-subjects brain similarity measure for each participant is used in analyses for group comparisons.

Following the same idea, inter-subjects similarity of the descriptions was computed as follows: a given participant was compared with each other participant of their age group. Of note, even if each participant's narrative was used multiple times, the variable of interest relied on a similarity score which is unique to each pair of participants. For each comparison, the number of common details recalled by the two participants was computed (right side of bottom Figure 1). This number was then divided by the total number of details that were mentioned at least once by one of the two participants. This ensured that the similarity value between two participants was independent of the absolute number of memory details recalled by the two participants (otherwise, two participants that recalled more details would be more likely to have higher similarity values than two participants recalling few details). In Figure 1, participant 1 and 2 shared 27% of the details that they each remembered. This number was stored in a matrix and the participant of interest was compared with the remaining participants of his/her age group. Then, the scores from each comparison were averaged and the resulting value was taken as the similarity value for that participant.

4. Results

Statistical analyses

The normality assumption was violated for the majority of the dependent variables, therefore we conducted robust statistical analyses (Mair & Wilcox, 2019). Robust statistical methods perform well in terms of Type I error control and statistical power, even when the normality assumption is violated, and thus they increase the likelihood of discovering genuine differences between groups and associations among variables (Wilcox, 2012). Dependent variables were compared between young and older adults using a robust equivalent of the Student t-test (Mair & Wilcox, 2019). Effect sizes for these analyses were estimated using the explanatory measure of effect size ξ. Values of 0.10, 0.30, and 0.50 correspond to small, medium, and large effect sizes, respectively (Mair & Wilcox, 2019). The association between dependent variables was assessed using percentage bend correlations that are robust equivalents of Pearson's correlation coefficient (Mair & Wilcox, 2019). All descriptive statistics refer to the 20% trimmed means (TM) and their 95% confidence intervals (CIs) calculated using the percentile bootstrap method (with 2,000 bootstrap samples; Wilcox, 2012).

Primary results

Recall of the event

First, we conducted a robust Student t test for independent samples to examine potential age-group differences in the amount of remembered details. This analysis did not reveal any group-difference in the number of remembered details, Y_t = -1.27, *p* = .19, *95% CI* [-1.19, 0.24], ξ= 0.20 (young: TM= 4.84; *95% CI* [4.33, 5.42]; older: TM = 5.32; *95% CI* [4.92, 5.81]).

Inter-subjects memory similarity

Then, adopting a classical measure in collective memory studies, we calculated the percentage of young and older participants who recalled each of the most commonly reported details (see Merck et al., 2020 and Zaromb et al., 2014 for a similar approach). Event details recalled by most of young participants (more than 50%) and that could be considered as part of collective memory (Merck et al., 2020) were the fact that people died and the fact that the bridge collapse was later attributed to a lack of maintenance. In older adults, the only detail recalled by more than 50% of older adults was the location of the bridge (see Table 1). Some details (e.g., destroyed dwellings below the bridge and fallen vehicles) were recalled by a greater proportion of older than young adults.

Table 1

The 7 most commonly remembered details about the bridge collapse and the associated percentage for each age-group.

Event detail	% Young adults	% Older adults	Two-tailed % comparison
Death of people	58	48	$p = .28$
Location of the Bridge	43	59	$p = .09$
Bridge maintenance	53	38	$p = .11$
Destroyed dwellings	28	48	***p = .02***
Fallen vehicles	19	41	***p = .01***
Communication axis	25	24	$p = .90$
Images of the bridge collapse	25	26	$p = .90$

Note: Significant differences between groups are marked in bold.

Next, we analyzed whether the inter-subjects similarity in the recall of details, operationalized using our similarity measure, differed between age-groups. Results revealed that inter-subjects similarity values did not differ significantly between groups, Y_t = 1.57, *p* = .12, *95% CI* [-0.05, 0.043], ξ= 0.23 (young: TM = 0.47; *95% CI* [0.45, 0.49]; older: TM = 0.45; *95% CI* [0.44, 0.47]). Young and older adults thus shared 47 and 45 % of their remembered memory details about the bridge collapse with other members of their groups, respectively.

Memory rehearsal

We next examined whether young and older participants differed in their degree of rehearsal of the remembered event. A robust Student t test revealed a significant difference between age-groups in media frequency*, Y_t* = -4.65, *p* < .001, *95% CI* [-2.09, -0.84], ξ= 0.53. This indicated that older adults (*TM* = 3.83; *95% CI* [3.58, 4.00]) reported that they heard about the event in the media more often than young adults (*TM* = 2.36; *95% CI* [1.81, 2.93]) since August 2018. Age-groups differed neither in the number of sources from which they heard about the event*, Y_t* = -0.91, *p* = .34, *95% CI* [-0.73, 0.27], ξ= 0.13 (young: TM = 1.60; *95% CI* [1.30, 1.97]; older: *TM* = 1.83; *95% CI* [1.59, 2.13]), nor in the number of person whom they talked about the event with, Y_t = -0.42, *p* = .66, *95% CI* [-0.95, 0.61], ξ= 0.05 (young: *TM* = 2.90; *95% CI* [2.42, 3.36]; older: *TM* = 3.08; *95% CI* [2.37, 3.83]).

Additional results

Flashbulb characteristics

Then, we compared age-groups for the total of contextual details that participants could remember relative to their hearing of the news, which can be taken as an index of how much memory for the bridge collapse has characteristics of a flashbulb memory. The analysis revealed that the score did

not differ between age-groups, Y_t = -1.48, *p* = .14, *95% CI* [-1.60, 0.23], ξ= 0.20 (young: *TM* = 2.87; *95% CI* [2.21, 3.57]; older: *TM* = 3.57; *95% CI* [2.92, 4.13])[10]. However, older adults (*TM* = 60.13; *95% CI* [52.89, 65.73]) reported higher ratings than young adults (*TM* = 39.48; *95% CI* [30.33, 48.84]) when judging the extent to which they were emotionally affected by the occurrence of the event, Y_t = -3.16, *p* = .002, *95% CI* [-33.08, -8.21], ξ= 0.47.

Relationship between event memory and rehearsal

Last, we examined, in the whole sample, the relationship between the number of sources, the media frequency, the number of persons with whom participants talked about the event, the score reflecting flashbulb characteristics, the extent to which they were emotionally affected by the event on the one hand and the number of remembered details and the inter-subjects similarity values on the other hand.

Percentage bend correlations revealed that the amount of remembered details correlated with the frequency with which participants heard about the event in the medias (see Table 2, Bonferroni's correction applied: significance threshold set at p < .01). No significant correlation was found between the number of remembered details and the number of sources, the number of people with who participants talked, the emotion associated with the flashbulb memory or the flashbulb characteristics.

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[10] Previous studies that investigated age-related changes in the frequency of flashbulb memories examined the percentage of young and older participants for whom the remembering of the context of encoding of the event of interest could be labelled as a flashbulb memory (Cohen et al., 1994; Wolters & Goudsmit, 1995). For instance, Wolters and Goudsmit determined that participants' remembrance could be considered as a flashbulb memory if participants gave a positive response to at least 4 of the 5 questions examining the remembering of the encoding context. Using the same approach in the current study, we found that 47 % and 52 % of the young and older participants' memories could be considered as flashbulb.

Robust correlations revealed that the values of inter-subjects similarity did not correlate with any of the variables (Table 2).

Table 2

Robust correlation coefficients linking flashbulb and memory rehearsal variables with rates of memory recall and values of inter-subjects similarity.

	Recall	Similarity
Media frequency	$p_{pb} = 0.27$, $t = 2.92$, $p = 0.004$	$p_{pb} = -0.11$, $t = -1.22$, $p = 0.22$
Number of sources	$p_{pb} = 0.06$, $t = 0.63$, $p = 0.52$,	$p_{pb} = 0.06$, $t = 0.64$, $p = 0.52$
Number of people who they talked to	$p_{pb} = 0.19$, $t = 2.03$, $p = 0.04$	$p_{pb} = -0.02$, $t = -0.23$, $p = 0.82$
Emotion	$p_{pb} = 0.17$, $t = 1.89$, $p = 0.06$	$p_{pb} = -0.17$, $t = -1.79$, $p = 0.70$
Flashbulb characteristics	$p_{pb} = 0.13$, $t = 1.37$, $p = 0.17$	$p_{pb} = -0.13$, $t = -1.38$, $p = 0.17$

5. Discussion

The current study had two major aims. First, we examined inter-subjects similarity of retrieved details when recollecting a public event, and secondly, we tested whether there are age-related differences in such inter-subjects memory similarity. The main findings are that young and older adults recalled a comparable number of details about the bridge collapse and that both young and older adults recalled event details that were similar across participants of their groups without any age-related differences. However, some details were mentioned more often by older compared to younger participants. Due to the dramatic nature of the public event, we investigated additional factors influencing flashbulb memories creation and related these characteristics to the number of remembered episodic details and inter-subjects similarity values. It revealed that older adults more often reported hearing about the event in the media since its occurrence and that media frequency, but not flashbulb characteristics, correlated with the number of remembered details.

The observation that young and older adults recalled, on average, the same number of details regarding the collapse of the Morandi bridge can seem surprising given the widely reported age-related decline in episodic memory (Drag et al., 2009) and when considering that public events recalled by older adults are less specific compared to those reported by younger adults (Zaromb et al., 2014). However, these results corroborate the findings of a previous study that found no age-related difference in remembering the unfolding of a shocking negative public event (the 9/11 terrorist attacks) (Wolters & Goudsmit, 2005). One way to explain age-invariance in memory in the current study relates to rehearsal. Previous studies showed that the richness of memory encoding of detailed and vivid memories depended on the rehearsal frequency in older adults (Cohen & Faulkner, 1988; Cohen et al., 1994). Besides, previous reports that showed no age difference for recollections of the 9/11 attacks revealed a

greater media exposure relative to the event (Davidson et al., 2006) or a higher rehearsal of the event (Wolters & Goudsmit, 2005) in older compared to younger adults. In this study, older adults followed the news about the target event in the media more often than young adults, and the number of details remembered about the event significantly correlated with the degree of exposure to the media. Therefore, older adults who have rehearsed the event more often than young adults might have had the opportunity to gather ample information about the bridge collapse, leading to being able to recall as many memory details as young adults.

A recent behavioral study revealed that some specific memory details about media events (e.g., the unfolding of a baseball championship) were shared by a large percentage of the study sample. This suggests that individuals can have a common memory for specific details of the past (Merck et al., 2020). Here, using a similar approach to previous studies (Merck et al., 2020; see also Zaromb et al., 2014 and Abel et al., 2019), we showed that some memory details about the bridge collapse were remembered and recalled by the majority (more than 50%) of young participants, suggesting that some details were central and qualified as collective memory for young participants (Merck et al., 2020). By mean of the inter-subjects values of similarity, we extended these observations and we further showed that, on average, 47% of the details remembered by two young participants were the same, which suggests that young adults shared half of the reminisced specific event features with their counterparts. Collective memories (e.g., memory for the bridge collapse) might be constructed in the same hierarchical way as autobiographical memories so that they contain both specific episodic details (e.g., a truck stopped a few meters before the chasm) and general conceptual knowledge (e.g., people died) about past events' unfolding (Conway, 1990). In autobiographical memory, most of the specific details of daily experiences are destined to be forgotten, unless they support our long-term goals, while the general conceptual knowledge related to the event

would remain available. Drawing on this account, the finding of inter-subjects similarity of memory details among young adults might reflect the fact that they have commonly extracted and integrated event details about the bridge collapse into a conceptual representation of the event's unfolding containing the core information about the target event (e.g., the main happening = a bridge collapsed in Genoa in Italy, cause = it appeared that the collapse was caused by a lack of maintenance of the bridge, general consequence = people died). In other words, young participants likely have built a common schematic narrative template of the event (Bartlett, 1932; Wertsch, 2002). These schematic narrative templates refer to knowledge structures supporting the remembering process and that include typically different kinds of information about an event, such as dates, happenings, or characters (Wertsch, 2002; Zaromb et al., 2014).

A main finding of the current study is the fact that young and older participants who remember the same event show similar rates of inter-subjects similarity in the remembered details. Results revealed that inter-subjects values of similarity differed from zero (based on the 95% bootstrap confidence intervals on mean values). Thus, like in young adults, half of the details remembered by two older adults were the same. It has been previously shown that older adults tend to rely much more on their schemas when remembering (Umanath & Marsch, 2014) and that they hold collective schematized memory representations of public events (Zaromb et al., 2014). However, it might be that the content of the schematic narrative template slightly differs between young and older participants. Indeed, the frequency of recall differed between the age-groups for two types of details. While 48% and 41% of older adults respectively recalled the destroyed dwellings and the fall of vehicles, there were only 28% and 19% of young participants who recalled these details. Thus, older adults more frequently recalled elements relative to the dramatic consequences of the accident for human beings (e.g., destroyed dwelling expanded the number of victims beyond the number of people who died from the collapse; the fact that

vehicles fell with the bridge is a shocking detail conveying the notion of individual drama). We can only speculate about the reasons for this age-group difference in the frequency of recall of these details. First, older adults were found to be more emotionally affected by the Morandi bridge collapse than young adults. This might be related to remembering the human consequences of the event more easily. Nevertheless, the correlation between memory recall and emotional reaction did not reach significance in the current study, so caution should be taken when drawing a conclusion. Second, it has been suggested that the perspective of reduced longevity induces a shift towards socioemotional goals in older people (Carstensen, 2006). This appears to promote emotional empathy and prosocial behavior (Beadle et al., 2015). One could therefore hypothesize that the possible consequences of a catastrophe for the lives of other people becomes integrated into older adults' schematic template narrative for public negative events because of this increased emotional empathy.

Finally, we should acknowledge some limitations of the current research. First, we did not include any control – neutral – event in the memory task so that it remains unknown whether the presented pattern of findings extends to non-emotional public events. Future studies should include and compare emotional and neutral events matched in terms of temporal distance between young and older adults (see for instance Kensinger et al., 2005). Second, because the current study was conducted online, no detailed cognitive and/or psychological assessment could be completed with young and older participants. Thus, we cannot rule out the possibility that older participants in this study were particularly high functioning. Replication of the current findings is needed before strong conclusions can be drawn. Third, it should be noted that 13% of the participants who filled-in the survey did not remember at all – or did not heard about- the event, and only half of the participants had a memory experience that could be qualified as a flashbulb memory, which suggests that

the event may not be as important as other events studied within the flashbulb memories literature such as the 9/11 terrorist attacks (Davidson et al., 2006; Luminet et al., 2004; Wolters & Goudsmit, 2005). Factors such as emotional (feelings or appraisal regarding the event) or social (degree of sharing the news in daily-life conversations) importance influence the extent to which the event context of encoding is remembered and can thus be considered as a flashbulb memory (Luminet et al., 2004). In the current study, the low percentage of reported flashbulb memories might be because the remembered event happened in Italy, so it may not be of great personal importance for Belgian citizens. Previous work showed that social identity is an important factor in determining the formation of collective memories and flashbulb memories (Merck et al., 2020). Similarly, it has been suggested that the creation of a flashbulb memory within a community was intrinsically related to whether the occurrence of the event had consequences for that community (Conway et al., 1994; Curci et al., 2001; Hirst & Phelps, 2016). Flashbulb memories may help a community to give meaning to traumatic events that affected them via widespread sharing of these memories (Hirst, Cyr, & Merck, 2020). In addition, the lack of knowledge about the event in 13% of the participants could relate to rehearsal through the media. One should note that this event was covered in Belgium intensively for a few days following its happening, but was not mentioned again in the following weeks. Italian media likely covered the event in a more systematic way and over a longer period, which may have supported the formation of a collective representation of the event in that population to a greater extent than in Belgium. The lack of a relationship between media coverage and inter-subjects memory similarity in the current study may stem from the fact that less attention was paid to the event in the media in the weeks following its occurrence. Future studies should replicate the current findings while using an event that happened in the participants' country (e.g., Brussels terrorist attack for Belgian participants). Indeed, inter-subjects similarity for a

closer and more traumatic event could be higher than in the current study owing to recent evidence showing that social identity is an important factor regarding the formation of collective memories (Merck et al., 2020). An alternative possibility would be to compare directly concerned and indirectly concerned participants about a target event. This investigation would be motivated by previous evidence that examined the occurrence of flashbulb memories in populations that are different in their degree of closeness to the event (personal importance) and revealed important insights about how flashbulb memories arise and are retained across time (Curci et al., 2001; Luminet et al., 2004; Otani et al., 2005).

In summary, the present study provides new evidence that individuals who remember the same event recall details that are similar from one participant to another, and this highlights the collective dimension of remembering. Critically, older adults recalled the same number of details as young adults, and the magnitude of the similarity of these details across participants was comparable to the one observed in young adults. Interestingly, the type of event details remembered by young and older adults seem to be slightly different, but further research should explore possible reasons for this difference. More broadly, future studies should aim at determining how the shared/collective aspect of remembering is affected by emotional and social variables and whether these factors exert a similar influence on young and older adults' collective reminiscence of the past. Understanding the cognitive bases of shared memories of young and older adults may be of interest to feed theoretical models of collective memory with respect to existing accounts on individual autobiographical memory processes.

STUDY 4

Age effects in story recall: Comparing the narrative similarities of a fictional story

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Study 4 examines the age effects on representations in memory for a fictional story. These memories were examined in the context of communication by examining age effects at the speaker and listener levels

Age effects in story recall: Comparing the narrative similarities of a fictional story

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1. Abstract

This study examines the age effects on representations in memory for a fictional story. We compared the narratives of young and older participants about a TV series episode when recalled to a young (condition 1) or older (condition 2) listener. In condition 1, 35 older and 37 young adults recalled the episode to a young adult. In condition 2, 40 older and 37 young participants recalled it to an older adult. Memories were analyzed based on inter-subjects similarity (ISS) analyses and the amount of recalled episodic details. Recalled details were analyzed using a schematic narrative template with three categories (i.e., initial context, events, and resolution). ISS analyses showed that for each of the categories, young adults shared more similar representations of the story among them than older adults. Additionally, participants had more similar representations in memory when recalling the story to an old listener. All participants shared more similar representations of the fictional story for the initial context and the resolution compared to the middle of the story. As expected, young adults recalled more episodic details than older participants. The lexical content analyses showed that regardless of the conditions, young adults used more words related to negative emotions and anger compared to older adults who used more words related to positive emotions. These results highlight the necessity to consider the context and social variables in memory studies, notably in aging, since it seems to influence memories creation and retrieval.

Keywords: audience effect, aging, communication, episodic memory, inter-subjects similarity

2. Introduction

It is now well-established that aging is associated with episodic memory decline (Cansino, 2009; Glisky, 2007). Nowadays, the evaluation of memory in aging has evolved towards a more ecological practice departing from the assessment based on a list of words (Park et al., 1989), but the main variables influencing daily life remembering are still often not considered in most memory research. In everyday life, we use our memory to discuss with others and share memories (Dessalles, 2007; Hirst & Echterhoff, 2012), but we rarely memorize a list of words. This observation led to investigate memory as framed into a social and naturalistic context. Currently, there is a growing interest in the effects of social context on remembering (Adams et al., 2002), especially in the case of aging that is subject to stereotypes (Adam et al., 2013; Fiske et al., 2002; Levy et al., 2003). In the present study, we investigate the effects of the social context on remembering and how these effects are subject to age-related changes.

Communication as a social function of episodic memory

Besides remembering per se, episodic memory has a social function mainly achieved through communication (Bluck, 2003; Mahr & Csibra, 2018). From a sociocognitive perspective (Bietti, 2010), the transmission of information is influenced by the social context (Blank, 2009; Horton & Spieler, 2007). Therefore, communication is characterized by interactive and interpersonal features (Welzer, 2008) and varies depending on the social context (Blanchard-Fields & Chen, 1996; Horton & Spieler, 2007) which includes several variables such as the dynamics between persons engaging in a conversation (Marsh & Tversky, 2004), the characteristics of the listeners such as age (Adams et al., 2002) or gender (Pasupathi & Oldroyd, 2015), and the amount of attention allocated to the speaker (Pasupathi et al., 1998; Pasupathi & Hoyt, 2010; Pasupathi & Oldroyd, 2015). Indeed, the communication accommodation theory suggests that when communicating, individuals make behavioral

changes to adapt to others (Giles & Ogay, 2007; see also research on audience tunning; Echterhoff et al., 2005; or audience effect; Horton & Spieler, 2007).

Moreover, communication processes can be influenced by the different goals of the conversation. It can be used to inform or obtain information (McCann & Higgins, 1988), to develop and maintain social relationships, to create a feeling of closeness (McCann & Higgins, 1988), to influence the listener's mental state (Mahr & Csibra, 2018) and manipulate others (McCann & Higgins, 1988). In this line, researchers compared the recall of past experiences with social (i.e., entertaining goal) or non-social (i.e., to be accurate) goals and found that individuals recall less accurately past experiences in the social context (Dudukovic et al., 2004).

Other studies focusing specifically on the listener effect found that when we believe that the interlocutor does not hold much information, we tend to give more information when recalling a story (Adams et al., 2002) or when explaining a situation (Vandierendonck & Damme, 1988). For example, Adams et al. (2002) asked young and old women to recall a story to a child or the experimenter and found that both young and old women used more elaborative narratives, more repetitions and simplified the story they had to recall to a child compared to the experimenter. Years ago, another study showed that young adults recall more details of a daily event (such as a trip to the doctor) when asked to recall it to a Martian (i.e., non-expert) compared to when recalling it to a human (i.e., expert) (Vandierendonck & Damme, 1988).

Age effects on communication processes

All the studies mentioned above revealed that the social context (and more specifically the listener's characteristics) modulates how people remember and share memories. However, it is unclear how these modulations influence episodic memory in young and older adults.

At the speaker level, age differences can be seen in "how" individuals share information (i.e., form and lexical content). Based on language analysis studies, it seems that older adults use more simplified structures and more fragmented sentences (Kemper & Anagnopoulos, 1989). They also use more extensive discourse, which was associated with social desire (Giles et al., 1992; James et al., 1998).

Additionally, age differences can be seen in "why" individuals share information. Communication goals are influenced by personal values that evolve with aging. In aging, communication maintains a sense of identity (Lubinski & Welland, 1997) and becomes more oriented toward meaningful sharing (Giles & Coupland, 1991; James et al., 1998). This might be explained through the lens of the selective socioemotional theory that suggests that with aging social aims change due to limited time perspective. Older adults focus more on family and friends than new relationships (Carstensen, 1993, 1995; Coudin & Lima, 2011).

Regarding the influence of age at the listener level, it is important to consider that interactions between younger and older adults are modulated by ageism stereotypes (Adam et al., 2013), which can strongly influence how memories are shared. In fact, young adults tend to use a patronizing and simple style called "elderspeak" when discussing with older adults (Kemper et al., 1998; Ryan et al., 1986). This attitude shift is due to the hold of ageism stereotypes such as aging being associated with hearing impairment and cognitive decline (Adam et al., 2013) and older people being warm but less competent (Fiske et al., 2002). Kemper et al. (1998) asked young adults to describe a route on a map so that the listener (an old adult) could trace it on their map. Results indicated that young adults in pairs with older adults simulating dementia symptoms adapt their speech content (i.e., more repetition and longer

speech) compared to when young adults had to share information with an older adult who appeared cognitively healthy.

Overall, these results suggest that age effects on communication are influenced by social and cognitive changes related to aging.

The specific case of aging in (social) episodic memory

According to Mahr & Csibra (2018), episodic memory entails a mechanism allowing the regulation of past event communication to convince the interlocutors that we remember. Therefore, when talking with someone, the quantity of details recalled (i.e., rich and detailed descriptions) is a cue to others and oneself that the memories are well remembered (Bell & Loftus, 1988). As aging is associated with episodic memory decline (Craik, 1994; Glisky, 2007), one expects that such episodic memory decline impacts communication processes.

The episodic memory decline with aging is characterized by a decrease in the number of recalled episodic details (Balota et al., 2000), but older adults recall more external episodic details compared to younger adults (i.e., details not directly related to the episodic event recalled) (Levine et al., 2002). Recent aging studies investigating memory decline have used more ecological materials, such as autobiographical memories (Grilli & Sheldon, 2022; Wank et al., 2020), fictional events (Delarazan et al., 2023), public and historical events such as wars (Zaromb et al., 2014) and natural disaster (Cheriet et al., 2021). They also showed that older adults recalled less accurate details of personally experienced events compared to young adults (Drag & Bieliauskas, 2009). This might be explained by the fact that older adults rely more on the gist than the specific details of these events than young adults (Flores et al., 2017; Grilli & Sheldon, 2022). Regarding historical events, Zaromb et al. (2014) asked young and older adults to recall memories of long-lasting historical events. The results

suggested no difference in the amount of events recalled but the content of the memories was different. Compared to young adults, older adults recalled fewer specific memories and summarized more of the memories. Considering natural disaster events, one study showed no differences between young and older participants for the number of recalled details of such public events (Cheriet et al., 2021). Yet, when analyzed based on a schematic narrative template (Bartlett, 1932), older participants recalled significantly more the consequences of the event compared to younger participants.

Additionally, new investigations examine memories from a similarity perspective. This method assesses to what extent the details recalled are common between participants and therefore the extent to which the representations of an event in memory are similar between participants of the same group defined by age (Cheriet et al., 2021) or social identity (Cheriet et al., 2023). Using this method, a study reported no differences between young and older Belgian adults in the similarity of the memory representations of the bridge collapse in Italy in 2018 (Cheriet et al., 2021). However, the similarity assessment in this study was first based on the overall details shared in each group and did not rely on a narrative template which is known to improve memory recollection (Lang, 1989). Memory schemas are the underlying scripts of stereotypical situations and could influence memories (Bartlett, 1932; Ghosh & Gilboa, 2014). They shape causal and temporal relations between several events (Bartlett, 1932; Radvansky & Zacks, 2017). For example, creating messages in chronological order seems to enhance memory (Lang, 1989).

Although more ecological paradigms and new analyses are increasingly used, the nature of the interactions between participants, and most notably between participants of different ages, is often overlooked. In the current study, based on stereotypes theories and age decline on episodic memory, we were interested in how the speaker and listener's age characteristics might influence

the memories shared with another person. Therefore, young and older adults took part in a memory task where they were asked to watch an episode of a TV series and recall it to either a young or older listener. Taking into account age effects on the complex links between memory and communication processes, we used 3 complementary methods to analyze the data. First, we focused on the decline of episodic memory by assessing the amount of recalled episodic (or internal) and external details (Levine et al., 2002). Then, we focused on shared memories using inter-subjects similarity analyses relying on narrative schemas (Cheriet et al., 2021). Third, focusing on the form (i.e., "how" memories were shared) we analyzed the content of memories via lexical content analyses (e.g., emotional words, personal pronouns...) (Barber & Mather, 2014).

First, we predicted age differences in the number of episodic details recalled: older participants should recall significantly fewer episodic details about the event than younger participants (Glisky, 2007). Since they might rely more on the gist of the story, older participants would recall more external details than younger participants (Levine et al., 2002). Second, we hypothesized age differences in inter-subjects similarity especially for the part of the narrative that relates to the consequences of the event: older people would similarly convey within their group the details of the consequences of the event more than younger adults (Cheriet et al., 2021). We hypothesized the presence of a listener effect so that young and older participants would share more similar representations when they recalled the events to peers of their age than the other listener if there is an own-age bias which consists in favoring within-group over out-group in various cognitive situations (for a review on own-age bias see Wiese et al., 2013). Alternatively, one may expect that all participants adopt a more simple and similarly structured narrative when talking to older compared to young listener because of ageism stereotypes (for a review of stereotypes threat in aging see Lamont et al., 2015). We hypothesized that aging would also

impact the lexical content of memories. Older adults would show a positivity bias in general (Carstensen & DeLiema, 2018).

3. Method

Transparency and Openness

We report how we determined our sample size using G*Power software (Faul et al., 2007), and describe all manipulations and measures that were collected. Deidentified data and materials can be found here: https://osf.io/xmzas/. Data were analyzed using Jamovi, version 2.2 (The Jamovi Project, 2021) and the package GAMLj (Gallucci, 2019) and Walrus (Love et al., 2022). The study design and its analysis were not pre-registered.

Participants

By using G*power software (Faul et al., 2007), using F test for a between-subject design, the a priori estimation is to include in total at least 68 participants (17 participants in each group and condition) to have 90% statistical power to detect an effect size of 0.4 (Cohen's f large effect size), with an alpha of .05 for an interaction effect between groups (young vs old) and the listener's conditions (young vs old). Additionally, to ensure the detection of the principal effects of the group and the conditions, the a priori estimation is at least 34 participants per group to have 95% statistical power to detect an effect size of 0.9 (Cohen's d large effect size), with an alpha of .05. Therefore, we recruited at least 68 young adults and 68 older adults.

In this study, 161 participants aged between 18 to 30 years old (n = 79) and 60 to 75 years old (n = 82) were recruited. Each participant gave their informed consent to participate in the study. The study was conducted by the Declaration of Helsinki. All participants were Belgian and spoke French. The study was conducted from January 2022 to December 2022 in Liege area (Belgium).

To participate, young and old participants should have not suffered from a cognitive, neurological, or psychiatric disease. From this sample, 12 participants were excluded: seven older participants were excluded from the analyses: two due to the use of medication for neurological disease; three had diagnosed cognitive impairment or a score < 23 at the MoCA (Nasreddine et al., 2005); two due to bad audio recording. Five young participants were excluded from the analyses because: one had already watched the series in the past; two due to a lack of standardization during the testing (e.g., noise in the background and help of other people in the room); two due to >16 points at the BDI 13 items corresponding to a severe state of depression (Collet & Cottraux, 1986).

The final sample [11] consisted of 149 participants which included 74 young adults (*M* = 22.2, *SD* = 2.86) and 75 older adults (*M* = 68.1, *SD* = 5.07). Thirty-seven young adults and 35 older adults were included in the young listener condition. The old listener condition included 37 young and 40 older adults. Ethical approval was obtained from the ethics committee of the psychology faculty at Liege University.

Demographic information

Robust ANOVA 2 (groups: young and old participants) x 2 (conditions: young and old listener) were conducted on clinical and demographical variables (see Table 1). No main effect of the group was found for the years of education (*Q* = 0.41, *p* = 0.53) and the anxiety scores (*Q* = 0.43, *p* = 0.51). No main effect of the condition was found for the years of education (*Q* = 0.68, *p* = 0.41) and the anxiety scores (*Q* = 0.07, *p* = 0.79). No significant interactions were found for the years of education (*Q* = 0.75, *p* = 0.39) and the anxiety scores (*Q* = 0.03, *p* = 0.87). A significant effect of the group was found for the score on the depression scale

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[11] Between older adults in condition 1 and 2 no difference was found regarding the score at the MoCA (*t*(41.8) = 1.61, *p* = .12).

(*Q* = 4.59, *p* = .04). Young adults hold higher scores than older adults (see Table 1).

Verbal performance was assessed using fNART (French National Adult Reading Test; Mackinnon &Mulligan, 2005). For the verbal IQ estimation, only a main effect of the group was found, *Q* = 5.38, *p* = .02, suggesting that older participants had higher scores than young adults in both conditions.

Table 1

Mean (standard deviation) for the demographic and clinical variables of the final sample analyzed by groups and conditions.

		N	Age	Years of education	Depression *	Anxiety	fNART verbal performance
Groups	Young	74	22.2 (+/- 2.86)	13.96 (+/- 2.76)	4.38 (+/- 3.10)	9.24 (+/- 2.79)	106 (+/- 8.07)
	Old	75	68.1 (+/- 5.07)	13.96 (+/- 2.31)	3.53 (+/- 2.80)	8.69 (+/- 2.14)	110 (+/- 8)
Conditions	Young listener	72	44.3 (+/- 23)	13.5 (+/- 2.30)	3.64 (+/- 2.53)	8.93 (+/- 2.40)	107 (+/- 9.69)
	Old listener	77	46.2 (+/- 23.9)	13.8 (+/- 2.78)	4.25 (3.32)	9 (+/- 2.59)	109 (+/- 6.93)

Memory task

Encoding task

All participants were invited to carefully watch an episode of a TV series. They were informed that they would have to recall the episode with as many details as possible to "Marie", who has never seen this series. They were told that she would join the participant remotely through an online video call in the second part of the study. They were instructed that after hearing their recall, Marie should be able to pretend that she saw this episode. These instructions aimed at improving encoding since people learn better when they anticipate opportunities to share with others (Lieberman, 2012) but no additional information about Marie was given.

The episode was 2x03 "Stranger on a train" from the "Modern Love" series (Prime Video) in French. It lasted 36 minutes. Briefly, it describes the love story of Paula and Mickael who met for the first time before the two first weeks of the lockdown due to the COVID-19 pandemic on the 20th of March 2020. They ended up falling in love on the train and wished to meet after the two-week lockdown at the same spot. They did not exchange numbers or any way to reach one another. The episode shows their respective lives until the date they had set for their reunion. At that date, the pandemic was getting worse, and several restrictions appeared. Thus, they were not allowed to meet at this spot. Mickael remembered some important information and was able to get near Paula's house. The episode ends here.

Recall task

After a 5-minute retention interval where participants completed one questionnaire (fNART) and demographic information, they were told that unfortunately, Marie could not attend the meeting remotely, but she suggested that the participant audio record the recall of the episode so that she would listen to the story later. They were asked to recall it with as many details as

possible so that after hearing the audio Marie could pretend that she had seen it. Then, participants were told that Marie was either a young adult (condition 1: young listener) or an old lady (condition 2: old listener). In both conditions, they were presented with a picture of Marie according to the age of the listener condition. Participants could then recall the episode without a time limit. A significant effect of the group was found for the word count (i.e., amount of words used at the free recall task) (Q = 6.60, p = .01). Young adults (M = 930, SD = 700) had higher scores than older adults (M = 689, SD = 561).

Questionnaires and additional measures

During the retention interval, participants completed the demographic information questionnaire (e.g., age, years of education, profession, gender) and the fNART (Mackinnon, & Mulligan, 2005) as a measure of crystallized intelligence and verbal abilities in French speakers.

Following the free recall task, participants completed several questionnaires. First, they assessed on a Likert scale from 1 (I do not agree at all) to 7 (I totally agree) the emotional valence of their feeling towards the TV episode through 6 questions; "I was emotionally touched by the story", "I felt sadness", "I felt joy", "I felt anxiety/stress", "I felt fear" and "I appreciated the story". Then, they completed a social cognition assessment through the Interpersonal Reactivity Index (Davis, 1983). They completed the Beck Depression Inventory (BDI 13 items) (Collet & Cottraux, 1986) to ensure that no participant suffer from a depressive disorder. Elderly participants were administered the MoCa (Nasreddine et al., 2005) to ensure that no elderly participant suffered from cognitive impairment. They also completed a short version of the Metamemory In Adulthood which assesses metamemory and internalized stereotypes about memory abilities (Boucheron, 1995). In the old listener condition only, they also completed the Fraboni scale evaluating aging

stereotypes (Boudjemad & Gana, 2009). Then there was a debriefing explaining the purpose of the study and explaining that Marie was a fictional character who was never supposed to join in an online videocall.

Finally, they answered several control questions regarding the study and could answer either yes, no, or I didn't think about it. 1. "Before watching the episode, did you doubt that the person you should recall the episode to would be a young/old adult?" 2. "Before the researcher told you that Marie could not be present, did you think that she would not come to the second part of the interview?" 3. "Throughout the study, did you believe that Marie was a real person?" 4. "Did the fact that you were indicated that Marie would not be present changed how you recalled the episode?" 5. "Before this study, had you ever seen this series? If yes, have you watched this episode?".

All the audio recordings were transcribed manually by the researchers.

Recall analyses

For this study, we analyzed the memories by using three complementary methods to investigate how aging at the speaker and listener levels influences shared memories.

Inter-subjects similarity analyses

The first analysis assesses the similarity of the representations in memory in each group via inter-subjects similarity analyses (Cheriet et al., 2021, 2023 for a more detailed description of the method). The scores of inter-subjects similarity give information about the extent to which representations of memories are similar between one participant compared to every other participant in their group. The first step is to create a grid containing all the principal actions and details of the event. In this case, the grid contained 98

details[12] that were listed chronologically based on the story and separated into three main categories: initial context, events, and resolution. The initial context includes details about the setup including main characters and spatiotemporal information of the beginning of the story (i.e., the initial situation). The events category involves the events following the first interaction between the two main characters (i.e., disturbing elements and adventures). The resolution category starts with the last action where they are supposed to meet again (i.e., the outcome and final situation of the story). For each participant, an element was coded 1 if the item was recalled or 0 if it was not recalled by the participant. Then a score of similarity is computed as the sum of all the common items between two participants divided by the amount of details recalled by at least one of them. After a comparison of each participant with every other participant in the group, a mean score of similarity is computed (see Figure 1).

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[12] 5 independent researchers blind to the hypotheses of this study were asked to list each meaningful action and details of the story. The final items in the grid were selected if at least 3/5 researchers listed the item. The initial context category contained 23 items. The events category contained 54 items. The resolution category contained 21 items.

Figure 1

An example of the coding protocol used for measuring inter-subjects similarity across participants.

	P1	P2	PX		SIM P1-P2	SIM P1-PX
Initial Context						
Train	1	1			1	...
13th March 2020	0	1			0	...
Paula	1	1			1	...
Events						
Mickael and Paula talk	1	1			1	...
Paula is a medievalist student	0	1			0	...
Mickael works in IT	0	1			0	...
Resolution						
Additional restrictions of lockdown	0	1			0	...
						...
Mickael and Paula try to meet	0	1			0	...
Mickael went to her street	0	0			0	
Total recall	3	8		**Total similarity**	3/8 = 0.375	

Note.

Participant 1's recall: "It's the story of two people that met on the train. The woman is called Paula. On the train, Mickael -the man- and Paula discuss with each other.

Participant 2's recall: "On the 13th of March 2020 two people met on the train. Paula is the main character. After a few minutes, she met Mickael. They talked throughout the trip. She is a medievalist student. That means that she studies medieval times. Mickael is different. He works in IT. When they arrived at the destination, they didn't exchange phone numbers but agreed to meet again at the same spot in two weeks. However, after two weeks the lockdown restrictions were extended. Therefore, they can't meet. Mickael and Paula still tried to get to the train station anyway but were stopped by police officers."

Episodic details

The number of episodic details. For each category, the number of details recalled was divided by the number of expected details for each category based on the grid in Figure 1.

Internal and external details. The internal and external scoring dissociates the episodic details retrieved from the semantic elements (Levine et al., 2002) by categorizing each meaningful piece of recalled information as internal or external details depending on whether they are directly associated with the event or not. Internal and external assessment was done using automated scripts (van Genugten & Schacter, 2022).

Episodicity score. The episodicity score of the recall was assessed as internal scores divided by the sum of internal and external scores.

Lexical Content Analysis

The last method is a lexical content analysis using LIWC (Linguistic Inquiry and Word Count) (Pennebaker et al., 2007) to assess the total number of words, the use of emotional words, and self-references.

4. Results

Statistical analyses

The data were normally distributed as confirmed by Akaike's and Bayesian Information Criterion lower for Gamma (AIC = 2857.96; BIC = 2866.162) than for normal distribution (AIC = 2971.21; BIC = 2979.42) obtained by using the package fitdistrplus on R studio (Delignette-Muller & Dutang, 2015). Therefore, we conducted a generalized linear model (GLM) with a Gamma distribution and log link identity (Delignette-Muller & Dutang, 2015). The GLM used 2 (groups: young and old participants) x 2 (conditions: young and old listeners) as between-subject factors x 3 (categories: initial context, events, and resolution) as within-subject factor design, and the dependent variables were similarity scores and amount of episodic details recalled. For internal and external scores, we conducted separate generalized linear models with 2 groups (young and old participants) x 2 conditions (young and old listeners) on the scores. Regarding the lexical content, we conducted a generalized linear model with 2 (groups: young and old participants) x 2 (conditions: young and old listeners) on each of the dependent variables.

The GLM included depression scores and word counts as covariables to control for the observed group differences between younger and older adults. When needed we conducted post-hoc tests based on pairwise comparisons and used Bonferroni correction. The GLM were conducted using Jamovi based on R using the GAMLj module (Gallucci, 2019).

Inter-subjects similarity analyses

Table 2 presents the mean and standard deviation of similarity scores for each similarity category (initial context, events, and resolution) by conditions and groups.

The GLM analyses yielded a significant main effect of the group, X^2 = 19.92, p <.001, with younger participants sharing more similar representations of the episode as compared to older participants. There was also a significant main effect of the conditions, X^2 = 89.49, p < .001, revealing that when recalling the episode to an old adult (old listener condition) participants shared more similar representations compared to when recalling to a young listener.

Results showed a significant main effect of the categories, X^2 = 260, p <.001, suggesting that participants shared less similar representations for the middle of the story (events category) than the context and resolution categories. Pairwise comparisons showed significant differences between the initial context and events categories (z = 12.90, p <.001), and between the events and the resolution categories (z = -14.75, p <.001).

There was also a significant two-way interaction between group and categories, X^2 = 6.56, p = .036. This interaction revealed no significant differences between the young and old participants for the initial context category (z = -1.72, p = 1) and for the events category (z = - 1.22, p = 1). For the resolution category, it revealed significant differences between young and old participants (z = -4.66, p <.001), with higher similarity in young adults' memories than in older adults' memories.

No other interactions were significant, ps > .08. The model did not reveal a significant effect of the depression scores, X^2 = 0.33, p = .57, but revealed a significant effect of the word count, X^2 = 60.84, p <.001, on similarity scores.

Table 2

Mean (standard deviation) for each similarity category by conditions and groups

Conditions	Groups	Initial Context similarity	Events similarity	Resolution similarity
Young listener	Young	0.40 (0.08)	0.29 (0.06)	0.46 (0.12)
	Old	0.36 (0.08)	0.25 (0.08)	0.41 (0.11)
Old listener	Young	0.49 (0.05)	0.33 (0.06)	0.50 (0.10)
	Old	0.45 (0.08)	0.31 (0.06)	0.44 (0.09)

Recall of episodic details

Amount of episodic details

The analyses on the number of episodic details yielded significant main effects of groups, X^2 = 27.57, *p* <.001, categories, X^2 = 141.2, *p* <.001, and conditions, X^2 = 8.71, *p* = .003. Overall, younger participants recalled more details about the episode (*M* = 0.44, *SD* = 0.22) compared to older adults (*M* = 0.33, *SD* = 0.20), and participants recalled more details to a younger listener (*M* = 0.39, *SD* = 0.23) compared to the old listener (*M* = 0.38, *SD* = 0.20). Participants recalled less details for the middle of the story (events category) than the initial context and resolution categories. Post hoc pairwise comparison revealed significant differences between initial context and events categories (*z* = 8.10, *p* <.001), between initial context and resolution (*z* = -3.47, *p* = .002), and between events and resolution (*z* = -11.52, *p* < .001).

No significant interaction effect was found between categories and group (X^2 = 0.66, *p* = .72), or between categories and conditions (X^2 = 1.45, *p* = .48), and conditions and groups (X^2 = 0.38, *p* = .54). No significant interact effect was found between conditions, groups, and categories (X^2 = 0.24, *p* = .88).

The model revealed significant effects of the two covariates, depression scores, X^2 = 13.30, p <.001, and word count, X^2 = 165.11, p <.001.

Details information about mean and standard deviation can be found in Table 3.

Table 3

Mean (standard deviation) for each recall category by conditions and groups

Conditions	Groups	Initial context	Events	Resolution
Young listener	Young	0.46 (0.22)	0.34 (0.20)	0.54 (0.23)
	Old	0.35 (0.20)	0.21 (0.13)	0.43 (0.23)
Old listener	Young	0.47 (0.19)	0.30 (0.15)	0.53 (0.21)
	Old	0.38 (0.17)	0.20 (0.13)	0.41 (0.17)

Internal and external details

For internal details, there was no significant main effect of the group, (X^2 = 3.47, p = .06). No significant effect of the condition (X^2 = 0.10, p = .75) nor interaction (X^2 = 0.05, p = .82) were found.

For external details, the analyses revealed no significant main effect of the group, (X^2 = 0.75, p = .39). No significant effect of the condition (X^2 = 4.29, p = .06) nor interaction (X^2 = 0.49, p = .76) were found.

For the episodicity score, there was no significant main effect of the group, (X^2 = 1.41, p = .24). No significant effect for the condition (X^2 = 2.33, p = .13) nor interaction (X^2 = 2.34, p = .13) were found.

The model indicated a significant effect of the word count for internal details (X^2 = 79.87, p <.001) and external details (X^2 = 69.47, p <.001).

Table 4

Mean (standard deviation) for episodic details categorized as internal, external, and episodic specificity by conditions and groups.

Conditions	Groups	Internal	External	Episodic specificity
Young listener	Young	653 (503)	309 (267)	0.69 (0.06)
	Old	490 (367)	266 (222)	0.65 (0.06)
Old listener	Young	507 (345)	312 (228)	0.64 (0.1)
	Old	361 (254)	214 (168)	0.65 (0.1)

Lexical content analysis

We conducted a generalized linear model with 2 (groups: young and old participants) x 2 (conditions: young and old listeners) as between-subject factors on each of the dependent variables, including depression scores and word counts as covariables. All means and standard deviation can be found in Table 5 by groups and by conditions.

Personal pronoun

There was a main effect of the group for the use of 'I' $(X^2 = 5.83, p = .02)$. This indicated that older adults used the pronoun "I" when recalling the events more than young adults did ($z = 2.38$, $p = .02$). However, no main effect of condition ($X^2 = 2.11$, $p = .15$) and no significant interaction between group and condition ($X^2 = 0.54$, $p = .46$) were found. The generalized linear model suggested a main effect of the word count, $X^2 = 9.67$, $p = .002$.

Negation

The analyses showed a main effect of the group, $X^2 = 5.05$, $p = .02$. Older participants used more negation words (e.g., do not, can not, ...) than young

adults (z = 2.21, p = .03). No significant effect of the conditions (X^2 = 0.01, p = .94) and no significant interaction (X^2 = 0.01, p = .92) were found.

Emotional content

There was only a main effect of the group on the use of negative emotions (X^2 = 13.66, p <.001) revealing that young adults used more negative emotions words when recalling the events than older participants. More specifically, the main effect of the group was seen for the use of anger words (X^2 = 24.15, p < .001) which were more used in the young group than older adults. There was also a main effect of the group (X^2 = 4.77 p = .03) regarding the use of words related to positive emotions. Older participants used more words conveying positive emotions in their recall. A main effect of the conditions was revealed (X^2 = 12.34, p < .001) indicating that participants used more positive emotions when recalling to a young adult (M = 2.38, SD = 0.95) compared to recalling the episode to an old adult (M = 1.87, SD = 0.80).

Table 5

Mean (standard deviation) of main effects by conditions and groups

Conditions	Groups	'I'	Negation	Positive emotions	Negative emotions	Anger
Young listener	Young	2.86 (1.02)	3.13 (0.81)	2.18 (0.84)	1.05 (0.49)	0.57 (0.43)
	Old	3.54 (1.30)	3.50 (1.15)	2.59 (1.03)	0.66 (0.37)	0.24 (0.20)
Old listener	Young	2.81 (0.88)	3.09 (1)	1.75 (0.73)	1 (0.49)	0.55 (0.41)
	Old	3.29 (1.27)	3.46 (1.45)	2.05 (0.92)	0.71 (0.63)	0.25 (0.36)

Additional results

Then we analyzed the questionnaires completed by participants which included cognitive measures and an evaluation of the material. Since the normality assumption was violated for the majority of the variables and did not fit Gaussian, gamma, or fish distribution, we conducted robust statistical analyses (Mair & Wilcox, 2019). Robust ANOVAs were conducted with groups (2: young and old participants) x conditions (2: young and old listeners) between-subject factors on each of the dependent variables. Robust ANOVAs were conducted in Jamovi version 2.2 (The Jamovi Project, 2021) using the Walrus package (Love et al., 2022). All ANOVAs were conducted using a trimmed means method, and the trimmed value was set at .02.

Cognitive measures

Social cognition. The robust ANOVA showed no significant effect of the group (Q= 1.55, p = .22), no significant effect of the condition (Q = 0.06, p = 81), and no significant interaction (Q = 0.40, p = .53) for the interpersonal reactivity index.

Metamemory. There was a significant effect of the group (Q = 8.04, p = .006) revealing that young adults (M = 82.7, SD = 8.33) had higher scores than older adults (M = 77.6, SD = 8.82) which suggests better knowledge and more positive attitudes about their memory abilities in the young group. No main effect of the condition (Q = 0.05, p = .83) or interaction effect (Q = 0.08, p = .78) were found on the scores of the Metamemory in Adulthood questionnaire.

Ageism stereotypes. This score is only available for the old listener condition. The ANOVA[13] showed significant differences between young and older participants, $t(39)$ = 2.73, p = .009, revealing that older adults hold more

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[13] Of note, results at the Fraboni scale evaluating ageism stereotypes did not yield any significant correlations with the similarity scores and the amount of details recalled.

negative stereotypes towards aging (M = 53, SD = 5.81) than young adults (M = 51.4, SD = 6.78) at the Fraboni scale (Boudjemad & Gana, 2009).

TV show evaluation

For the emotional measures related to the series, we conducted robust ANOVAs with 2 (groups: young and old participants) x 2 (conditions: young and old listener) between-subject factors on each main variable.

Emotionally touched. There was a main effect of the group, Q = 8.30, p = .006. Older adults were more emotionally touched by the episode (M = 5.24, SD = 1.47) than young adults (M = 4.57, SD = 1.66). No significant effect of the condition (Q = 1.23, p = .27) or interaction effect between the group and condition (Q = 1.09, p = .3) were found.

Sadness. The analysis showed no main effect of the group, Q = 1.15, p = .29, no significant effect of the condition (Q = 1.82, p = .18) nor interaction effect between the group and condition (Q = 0.46, p = .5).

Joy. There was a main effect of the condition, Q = 4.60, p = .04 indicating that people who recalled to a younger adult felt more joy watching the episode (M = 4.51, SD = 1.61) than when recalling to an older adult (M = 3.86, SD = 1.84). No effect of the group (Q = 0.49, p = .49) or interaction effect between the group and condition (Q = 1.46, p = .23) were found.

Stress/Anxiety. The ANOVA revealed no main effect of the group, Q = 0.18, p = .67, no effect of the condition (Q = 1.41, p = .24) nor interaction effect between the group and condition (Q = 0.44, p = .51).

Fear. There was no main effect of the group (Q = 0.06, p = .82), no effect of the condition (Q = 0.06, p = .82) nor interaction effect between the group and condition (Q = 0.44, p = .21).

Appreciate the story. The analysis showed no main effect of the group (Q = 1.83, p = .18), no effect of the condition (Q = 0.10, p = .75) nor interaction effect between the group and condition (Q = 0.44, p = .51).

Method-related questions

For the answers to the method questions (no (1), I didn't think about it (2), yes (3)) (see method section) we conducted Mann-Whitney tests to compare young and old adults.

Regarding the question "*Before watching the episode, did you doubt that the person you should recall the episode to would be a young/old adult?",* there was no significant difference (U = 2585, p = 0.53) between young (M = 1.92, SD = 0.89) and old adults (M = 1.82, SD = 0.85).

Regarding the presence of the listener assessed by the following question "*Did you think that she would not come to the second part of the interview?*", there was a significant difference between young and old adults, U = 2084, p =. 008. Young adults (M = 2.05, SD = 0.95) believed more often that the listener would not attend the meeting or did not think about it compared to older adults (M = 1.64, SD = 0.86).

Regarding the question, "*Throughout the study, did you believe that Marie was a real person?",* no significant differences were found, U = 2084, p = .05, between young (M = 2.16, SD = 0.81) and old adults (M = 2.45, SD = 0.91).

We also assessed if the fact that the listener did not attend the interview influenced the way they recalled the episode *("Did the fact that you were indicated that Marie would not attend the interview change how you recalled the episode seen?"*). A significant difference between young and old participants was found, U = 2395, p = .04, indicating that the fact that the listener did not attend the interview influenced more how young adults (M = 1.38, SD = 0.75)

recalled the episode than older adults (*M* = 1.15, *SD* = 0.48). Of note, of 149 participants, only 16 participants answered yes to this question.

5. Discussion

In memory studies, it is well-known that aging is associated with episodic memory decline (Balota et al., 2000). However, these studies generally do not include contextual variables that could contribute to better understand such decline. Therefore, with this study, we aimed to assess whether the recall performance could be different depending on the age of the participant (young vs. old) and the age of the listener (young vs. old adult). We analyzed recall data based on three complementary methods: the number of episodic details, the inter-subjects similarity of the recall, and the lexical content analyses. In this study, at the speaker level, age differences were found for the inter-subjects similarity, for words related to negative emotions, and for the amount of episodic details recalled, all in favor of young adults. At the listener level, the representations in memory were more similar when recalling the events to an old listener and the listener's age influenced the number of details recalled.

The communication accommodation theory suggests that interpersonal interactions are influenced by the characteristics of the speaker and the listener, which also include the goals of communication (Dragojevic et al., 2015; Pitts & Harwood, 2015). This theory has been investigated in cognitive psychology but to our knowledge, no study investigated age effects on shared memories and the influence of the listener's age. We will now discuss some key points that could explain age differences at the speaker and listener levels.

At the speaker level, the results of this study revealed that the representations in memory of the episode (beginning, middle, and end) are more similar for young adults compared to older adults, independently of the age of the listener. Also, young adults recalled more episodic details about the event.

In a previous study using the same method on the recall of a public event (e.g., a bridge collapse in Italy), we found no differences in similarity representations in memory nor the amount of episodic details recalled between young and old Belgian adults (Cheriet et al., 2021). Here characteristics of a modern fictional event might have influenced age differences in similarity and the amount of episodic details in favor of young adults. First, it could be related to the content of the story which involves young adults as main characters. In the light of the self-reference effect in memory, young adults could have identified more easily with the story which therefore could have helped them to encode and recall information (Gutchess et al., 2007; Symons & Johnson, 1997). Second, the materials used (a modern love story with young adults) might fit more young adults' prior knowledge (i.e., schemas) (Alba & Hasher, 1983) compared to older adults. It is known that prior knowledge can improve memory (Anderson, 1981). This could explain to some extent why young adults share more similar representations in memory and several details since it is more congruent to their prior knowledge. In aging, even if there is an episodic memory decline, it has been shown that older adults can rely on prior knowledge and that it facilitates memory performance (Reyna & Mills, 2007; Umanath & Marsh, 2014). Therefore, one would expect that inter-subjects similarity would increase in older participants if the story fit better their prior knowledge.

Moreover, regarding the amount of details recalled, the results are congruent with previous evidence of a decrease with aging in the recall of episodic details (Balota et al., 2000). However, opposite to autobiographical memories studies that show age differences for episodic and external details (Levine et al., 2002), we did not find any age effect on internal vs. external details for a fictional event. In this study, the material consisted of a fictive story with a beginning, a middle, and an end; three parts of the episode separated by narrative boundaries. The structure could have helped participants to organize their memories and enhance the amount of details recalled since the structure is already helpful for

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young children (Kleinknecht & Beike, 2004). A recent study on age differences in story recall focused specifically on the use of boundaries (i.e., elements that structure the narratives) and showed no difference between young and old adults who both recalled more information elicited by the events than the boundaries. This suggests that both groups used boundaries to segment the events and encode them in long-term memory (David & Campbell, 2023). Overall, our results suggest that using material relying on a more general schema narrative does not influence episodic memory decline with aging.

Age effects can also be seen at the listener level. Indeed, it appears that young and old participants first hold more similar representations of the episode when they recall it to an older adult compared to recalling it to a young adult, and second share more episodic details with a young listener than an old listener. In this study, older adults hold more negative stereotypes about aging compared to young adults but both groups held aging stereotypes (i.e., scores of each group above the mean score of the Fraboni Scale). For example, specifically in this study, young and old participants might have thought that the older listener was not used to seeing modern fictional series, did not hear well, and had less cognitive abilities (Adam et al., 2013). These activated stereotypes could lead to sharing basic, simple, and key elements of the story (i.e., the gist) understandable by old listeners which in turn leads to more similar representations in both groups when talking to an older adult. Additionally, the goals of communication could be very different with aging, where older adults tend to seek emotional and social meaning in relationships (Carstensen, 1993). Therefore, communication can be used to create a shared reality between two persons (Echterhoff et al., 2008) and can be influenced by ageism (Ory et al., 2003).

The analyses also showed differences in the lexical content. In this study, older participants recalled more words related to positive emotions

compared to young adults. This result could be related to the positivity bias globally found with aging (Mather & Carstensen, 2005). Also here, the results suggested that the opposite bias can be seen with young adults who recalled the story with more use of negative emotions and anger (Reed et al., 2014 for a review). Additionally, older adults felt more emotionally touched by the episode than younger adults. However, even if emotional valence influences memory (Kensinger et al., 2008), both similarity scores and the amount of details were higher in the young group than in the older group, suggesting no benefit due to emotion in older participants' memory.

As previously stated, this study, to the extent of our knowledge, is the first one to investigate age effects on shared memories at a speaker and listener level. However, some limits should be highlighted. First, the results should be replicated with another fictive event. Notably, one should replicate the results by using series that are more familiar to older adults (older series) and more familiar to younger adults (as used in this study) to control for prior knowledge (schemas). Second, in this study, the speaker believed that the listener would be joining online for the recall part. It was then acted that the listener could not make it online and asked the speaker to record the recall. We only showed a picture of the listener. Future studies should adapt interviews with a real listener who attends the meeting (Adam et al., 2002). Of note, some studies did show significant listener effects with an absent and fictive listener (e.g., recall to a Martian, Vandierendonck & Damme, 1988).

In conclusion, this study showed the importance of taking into account the social context in memory to better apprehend how we recall events in daily life. In this study, we showed that aging impacted the similarity of representations in memory for a fictional event. We also showed that the age of the listener can influence this similarity in memory and the quantity of recalled information. Memory investigation should consider variables such as age,

listener's characteristics, emotions, and expectations and also investigate how prior knowledge (schemas) can influence memories' construction.

STUDY 5

A day that America will remember: Flashbulb memory, collective memory, and future thinking for the Capitol riots

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Following the study 3, **study 5** investigates the effects of group identity on flashbulb memories, shared event memories and future thinking.

1. Abstract

This study explores the topics of flashbulb memory, collective identity, future thinking, and shared representations for a public event. We assessed the memories for the Capitol Riots, which happened in Washington DC, on January 6th, 2021. Seventy Belgian and seventy-nine American citizens participated in an online study, in which they freely recalled the unfolding of Capitol Riots and answered questions regarding their memory. Inter-subjects similarity of recalled details was analyzed using a schematic narrative template (i.e., the event, the causes and the consequences). Results revealed that representations of the event, and its causes were more similar among Belgians compared to Americans, whereas Americans' representations of the consequences showed more similarity than Belgians'. Also, as expected, Americans reported more flashbulb memories (FBMs) than Belgians. The analysis underlined the importance of rehearsal through media and communication in FBM formation. This research revealed a novel relation between FBM and future representations. Regardless of national identity, participants who formed an FBM were more likely to think that the event would be remembered in the future, that the government should memorialize the event, and that a similar attack on the Capitol could happen in the future compared to participants who did not form FBM.

Key words: collective memory, flashbulb memories, inter-subjects similarity, social identity, future thinking, cultural memory.

2. Introduction

On January 6th, 2021, an angry mob of rioters entered the Capitol building in Washington, DC. They were objecting the results of the 2020 presidential elections and demanded a reassessment in favor of Donald Trump. The rioters quickly spread across the building, trying to find Vice President Mike Pence and House Speaker Nancy Pelosi. Rioters assaulted officers, occupied the complex, and destroyed property. Lawmakers and the staff were immediately evacuated. Five people died and over a hundred people were injured during the riots.

The news of the Capitol riots spread around the world, so that not just Americans, but many others started to form collective representations of the event. The Capitol riots constituted a historical event that possesses many characteristics favoring the formation of a flashbulb memory. Moreover, details concerning the event itself are likely to be remembered in the future, given its uniqueness and consequentiality. In the present research, we explore the formation of flashbulb memories and collective memories around the Capitol Riots among American and Belgian citizens. We also examine how such memory formation influences future thinking associated with the events with a focus on the following questions: How do these personal and collective representations relate? Will they be associated in some way or remain distinctive representations that do not bear on each other?

From individual to collective memory

Memories of the Capitol Riots, as memories for other important public events, allow us to investigate an individual to collective memory continuum (Figure 1). First, these public event memories could be studied through an individual lens since people individually learn and encode the news about the Capitol Riots. As a result, they can form event memories, which encompass the details and factual information about the event (Finkenauer et al., 1998; Merck,

2020). Moreover, the distinct characteristics of the event could lead to the formation of flashbulb memories (FBMs), that is, memories for the context of reception event (Merck et al., 2020). Thus, people could remember not only the event itself but also the personal circumstances in which they learned about the event (Brown & Kulik, 1977). The reception memories for the Capitol Riots correspond to the most detailed level in Conway's model of autobiographical memories (i.e., where one was, what one was doing at that time, with whom one was...) (Conway, 2005; Tinti et al., 2014).

Additionally, by rehearsing event memories through various means such as media and conversations, people can form shared representations around the event (shared memories). If these shared representations bear on the identity of the community in question, in this case Americans, they can be considered collective memories (Burnell et al., 2023; Hirst & Manier, 2008). Thus, the experience of a public event such as the Capitol riots could initiate the creation of memories at different levels of the continuum between individual and collective memory (Berntsen, 2017; Neisser, 1982) (see Table 1). Memories on this continuum can share common psychological principles (Hirst & al., 2018). For instance, both autobiographical and collective memories are important to build a sense of, respectively, a personal and collective identity (Conway, 2009; Hirst & Stone, 2016; Öner & Gülgöz, 2020). Furthermore, people can form future representations around whether the event should be individually or collectively imagined in the future. These future representations could bear on the more long-term cultural memory of the event (Assmann, 1995).

We will now turn to a more detailed discussion of these different realms of memory and how they might interact with each other.

Figure 1

Memory continuum: from individual to collective memory
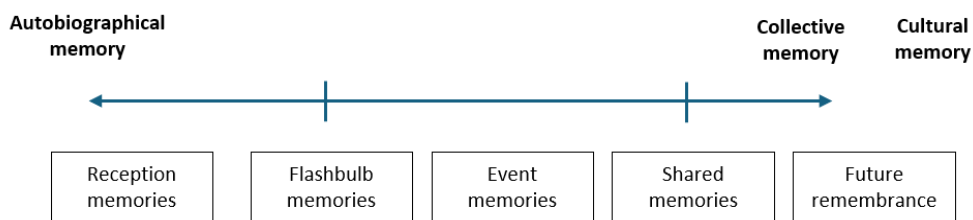
Table 1

Definitions of concepts related to memory representations

Concept	Definitions
Autobiographical memory	*"Memories for the events of one's life" (Conway & Rubin, 1993)*
Reception memories	*Memories for the context of encoding (Merck, 2020)*
Flashbulb memories	*Vivid and long-lasting memories of the personal circumstances in which one heard the news about an event (Brown & Kulik, 1977)*
Event memories	*The facts about the event (Merck, 2020)*
Shared memories	*Memories shared across a community that does not necessarily inform community identity*
Collective memories	*"Widely held memories of community members that bear on the collective identity of the community" (Hirst & Manier, 2008, p. 184)*
Future remembrance	*The degree to which people think the event would and should be remembered and memorialized in the future*
Communicative memory	*Memories that are based on and transmitted through everyday communications (Assmann & Czaplicka, 1995; Muller et al., 2018)*
Cultural memory	*Long-term and stable memories that are maintained through cultural formations and that inform cultural identity (Assmann, 1995)*

Flashbulb memory

Flashbulb memories (FBMs) are vivid and long-lasting memories of the personal circumstances in which one heard the news about an event, such as when, where, and what one was doing when one heard the news, what might be referred to as the *reception event* (Brown & Kulik, 1977).

In earlier work, Brown & Kulik (1977) suggested that FBMs rely on a separate memory system distinct from autobiographical memory. According to subsequent research, however, FBMs exhibit similar characteristics as everyday autobiographical memories, especially in terms of their consistency and the rate of forgetting (Hirst & Phelps, 2016, for a review). What differentiates FBMs is probably not the memory system involved but characteristics of the FBM other than accuracy and rate of forgetting. Several are worth emphasizing. First, as indicated, they are more confidently held and more vivid over the long-term than most autobiographical memories (Talarico & Rubin, 2003, 2007). In addition, they are more likely to be associated with members of the affected community, e.g., French citizens are more likely to form memories of learning of the death of French President Mitterrand than are French-speaking Belgians (Curci et al., 2001). In this regard, the degree of identification with that community is also important. Memories of the reception event that team-specific baseball fans formed were more likely to have the characteristics associated with FBMs, that is, vividness and confidence, than were the reception memories of generic baseball fans (Merck et al., 2020). Whether one can refer to a reception memory without these characteristics as a FBM is a matter of definition. What is clear, however, is that one can have a reception memory with the characteristics of FBM without being a member of an affected community (Cheriet et al., 2021), but community membership and social identification make these characteristics more likely to emerge.

Finally, FBMs are widely held within the affected community. It is not simply that FBMs of the death of Mitterrand are more likely to be formed by French citizens than French-speaking Belgians, but it is also the case that most French citizens form such an FBM. Because FBMs are associated with the affected community and are widely held within the affected community, they can serve as a marker of membership within the community (Hirst et al., 2020). A French citizen who does not have a FBM of Mitterrand's death would be considered to only weakly identify with France (Cyr et al., in prep; Merck & Hirst, 2022).

Several factors are often viewed as initiating conditions or maintenance factors for the formation and retention of FBMs. At the time of encoding, emotions such as surprise, consequentiality and, as noted, social identity seem to influence the creation of FBMs (Curci & Conway, 2013; Kopp et al., 2020; Finkenauer et al., 1998; Hirst & Phelps, 2016; Tinti et al., 2009; Stone et al., 2019; Wolters & Goudsmit, 2005). Rehearsal, on the other hand, fosters FBMs after encoding (Curci & Conway, 2013; Hirst & Phelps, 2016).

Emotion has been extensively studied in the FBM literature. It enhances the memory for the context of shocking events (Finkenauer et al., 1998). Most studied FBMs involve negative events associated with strong emotional content, such as assassination of presidents (Pillemer, 1984) or natural disasters (Luminet & Curci, 2017). However, positive events can also trigger FBMs (Bohn & Berntsen, 2007; see Stone & Jay, 2017). One specific emotion often associated with the occurrence of FBMs is the surprise felt when hearing the news.

Brown and Kulik (1977) had, early on, described consequentiality as a critical component in FBM formation. At first, discussions on consequentiality focused on the personal impact of a public event through the lens of appraisal theories (Lazarus & Smith, 1988). Based on these theories, one should assess an event as personally important to develop a strong emotion, and as a result

form FBM (Conway et al., 1994; Lazarus & smith, 1988; Tinti et al., 2014). Several studies, however, showed that low personal impact of a public event does not necessarily prevent the formation of FBM (Curci & Luminet, 2006; Kvavilashvili et al., 2003). Consequentiality also refers to the consequences of a public event for one's community. In this way, it can bear on social identity. Consequentiality can thus operate both at the personal and the collective level (Hirst & Phelps, 2016; Tinti et al., 2009; see Rice et al., 2017 for a review on the taxonomy of consequentiality).

Rehearsal has been studied as a post-encoding variable, which can also entail an individual and a collective focus (Conway et al., 1994; Tinti et al., 2014). At the collective level, people can be exposed repeatedly to the facts about the event (event memories) through media. People can also rehearse both event and reception memories through communication with others. Some studies focused on these two types of (more collective) rehearsal: media frequency and verbal communication (Cordonnier & Luminet, 2021; Curci et al., 2015; Gandolphe & El Haj, 2017). At the individual level, one can also rehearse event and reception memories by recalling personal details associated with hearing the news and event details through rumination (Curci et al., 2001; Luminet et al., 2004; Tinti et al., 2009; Tinti et al., 2014). There are, then, three major means of rehearsal: media exposure, communication, and rumination. Rehearsal either generates FBMs directly (Conway et al., 1994) or its effect on FBM is considered as being mediated by event memory (Tinti et al., 2009).

The emotional-integrative model suggests two routes for FBM formation (Finkenauer et al., 1998, for a review see Luminet, 2017). The direct route is through activation of novelty and surprise. The indirect route begins with the evaluation of event importance leading to emotional response, which in turn increases rehearsal and finally FBM formation. The choice of the indirect or direct path seems to depend, to some extent, on social identity activation

(Cordonnier & Luminet, 2021; Luminet & Curci, 2009). Social identity is defined as "those aspects of an individual's self-image that derives from the social categories to which they perceive themselves belonging" (Tajfel & Turner, 1979, p.40). In psychology, social identity is typically measured via group membership, whether, for instance, it is based on religion (Tinti et al., 2009) or nationality (Berntsen, 2009; Curci & Luminet, 2006). For example, Luminet and Curci (2009) compared FBMs of the 9/11 attacks for American and non-American participants. Results showed that regarding this model, the direct path was significant only for the American participants, whereas the non-direct path was significant only for the other group. In the present study, then, surprise might play a more important role in FBM formation for Americans, whereas rehearsal might play a more important role for Belgians. Other studies also showed more subtle links between social identity and FBM. For example, Coordonnier & Luminet (2021) showed that social identification to Brussels and Europe (for Belgian participants) correlated with measures of FBM formed for the Brussels bombings in 2016, whereas it was not the case for identification to Belgium.

Collective memory and shared representations

How about the memory for the public event itself? Our interest here is whether the FBM-eliciting events, which are by definition public, become shared across the public and hence potentially become incorporated into the collective memory of the affected community. A growing number of studies have investigated the cognitive mechanisms underlying the formation and retention of collective memories (see Manier & Hirst, 2008; Hirst et al., 2018; Hirst & Merck, 2022 for reviews). Some studies investigated collective memories for historical events, such as WWII, that happened before the birth of participants (e.g., Zaromb et al., 2014). Other studies investigated lived collective memories, which encompass memories formed around public events that happen during one's lifetime (Choi et al., 2021; Hirst & Meksin, 2008; Liu & al., 2021), such as

terrorist attacks (Hirst et al., 2009), governmental terrorism (Muller et al., 2016) or, at a more mundane level, sports events such as baseball game (Merck et al., 2020) or football games (Kopietz & Echterhoff, 2014; Tinti et al., 2014; see Manier & Hirst, 2008 for a discussion of lived collective memories).

We treat collective memories here as individual memories shared across a community that bear on member's social identity (Hirst & Manier, 2008). According to this definition, a critical step in the formation of a collective memory is for individual memories to become shared across the community. The relation between social identity and collective memory is interactive: the formation of collective memory may affect social identity, but social identity can in turn shape the creation of collective memories. For example, Merck et al. (2020) examined collective representations of championship sporting events among sports fans and found that fans of a particular team recalled more details about events associated with that team and formed more shared memories compared with sports fans in general.

There are a variety of reasons to expect that people are more likely to form shared memories of an FBM-eliciting event if they are members of the affected community. For instance, inasmuch as FBMs are associated with members in the affected community and news coverage may be more likely in the affected community than in unaffected communities, there might be greater opportunity for rehearsal across the affected community for details about the event itself (see Hirst et al., 2009, 2015). Along the same lines, those in the affected community may be more likely to talk to others about the event. This may occur because the event may be more emotionally evocative to them or more consequential for their community, both of which should lead to more conversational sharing (Rimé, 2009). The affected community could thus share similar emotions (collective emotions) in response to the event (Goldenberg et al., 2020). Collective emotions are usually triggered through social identity

(Tajfel, 1982). Finally, people have greater mnemonic access to memories of events that affect their community rather than a community to which they do not belong, suggesting that they may be more likely to form memories of events important to their community (Sahdra & Ross, 2007).

On the other hand, the formation of FBM seems to involve different mechanisms than the formation of collective memories. The extent of media coverage is not always an important variable for the formation of FBMs, but it is for formation of memories for the event itself (e.g., Hirst et al., 2009, 2015). Moreover, the international nature of much of media coverage, especially when the event involved the United States, makes it likely that those outside the affected community may be as exposed –or at least substantially exposed– to the relevant news as those in the US. Finally, given the hegemonic place of the US in the world, events such as the Capitol Riots may be viewed as consequential and emotionally evocative for both Americans and non-Americans. Whether or not FBMs of the Capitol insurrection will be associated with the formation of shared memories is an empirical question worth exploring.

A variety of methods have been used to measure the level of convergence in people's representations of public events. One method for quantifying convergence in memories is to compute how many individuals in a group report a given detail about the event (Merck et al., 2020; Zaromb et al., 2014). Additionally, one can measure similarity in collective memory representations by computing how many details contained in the memory of one participant are also present in the memories of other participants from the same group (Cheriet et al., 2021). This method is called *inter-subjects similarity analysis*. Compared to frequency of recall of specific details, this method has the advantage of considering the narrative as a whole and to identify commonalities in the retelling of the unfolding of events. It, thus, allows researchers to identify distinct items in a narrative that corresponds to the

elements in a narrative template (i.e., abstract forms of narrative representations used to narrate events (Wertsch, 2008)) such as causes, details about unfolding events, and consequences. In the present research, we will explore similarities in narratives across participants. To our knowledge, the influence of social identity on collective memory representations has not been studied using such a similarity measure. We aim to see if similarity levels change as a matter of identity. Tracking these convergences in memory and exploring its relation to identity is important because, as noted, the critical step in forming collective memories is the formation of shared representations (Hirst & Manier, 2008).

From memory to collective future thinking

Collective future thinking refers to "the act of imagining an event that has yet to transpire on behalf of, or by, a group" (Szpunar & Szpunar, 2016, p. 378; Merck et al. 2016; for a review of the extant psychological literature, see Topçu & Hirst, 2022). The extant research reveals two major findings. Firstly, as in episodic mental time travel (Schacter & Addis, 2007) there is a strong correspondence between collective memory and collective future thinking in terms of the specificity, phenomenal characteristics, content, and valence of events (Öner & Gülgöz, 2020; Topçu & Hirst, 2020). Moreover, when people use certain schematic narrative templates to remember the collective past, they are likely to rely on them when imagining the collective future (Topçu, 2021). These findings indicate that people's representations of the collective past can inform their representations of the collective future. The second finding reveals a valence-based dissociation between personal and collective future thinking: people exhibit a positivity bias when imagining the personal future while they exhibit a negativity bias when imagining the collective future (Deng et al., 2022; Shrikanth et al., 2018).

In the aforementioned studies, participants are usually asked to remember and imagine collective events. Studies to date have not asked about whether people expect to remember specific public events in the future. Can people agree on whether a specific public event will be remembered in the near or the far future? Do they think that the memory of the event would be transmitted to future generations and would be crystallized in cultural formations like history books? Do they believe that the government should make an effort to memorialize the event? These questions are important because they tap into the formation of cultural memories (Assmann & Czaplicka, 1995) by measuring people's prospections for the future remembrance of a public event. In Assmann's conceptualization, communicative memory relies on everyday communications and its temporal horizon is very limited, whereas cultural memory refers to more stable and long-term memories that inform cultural identity. Communicative memory transforms into cultural memory when memories are crystallized in cultural formations that reflect the community's self-image (Assmann & Czaplicka, 1995). In the present research, we are interested in whether people think Capitol Riots would transform into collective memory in the future with a focus on the effects of social identity and memory characteristics.

As we were with collective memories, we are also interested in the relation between flashbulb memory formation and collective future thinking involving the Capitol Riots. As noted above, flashbulb memories can serve as markers of membership within the affected community, with the stronger one identifies with the affected community, the more likely the formation of an FBM (Hirst et al., 2020). Because of these characteristics, someone with an FBM may not only expect that the event itself will be remembered over the long term, but also that the emotionally charged event associated with the FBM should be memorialized. So, the question is: Does the existence of FBMs influence people's projections of future remembrance? Will its presence also influence

people's projections for similar future attacks? These explorations will constitute a first step to study the intersection of personal and cultural memory through the examination of future thinking.

Present research

In the present study of FBMs, shared memories, and future prospections concerning the Capitol insurrection, we will contrast the representations of Americans with those of Belgians. We chose these two nations because of our concern about community membership and social identification. The affected community, at least in a narrow sense, was clearly the United States, since the insurrection was an assault on the government of the United States. Although Belgium has many connections to the United States, it can reasonably be viewed as an "unaffected community". Employing samples from these two communities will allow us to assess the main concerns of the present paper.

Our main prediction for FBM formation is that Americans will provide more reception details than Belgians, thereby suggesting that Americans are more likely to form FBMs of the Capitol insurrection than are Belgians. Based on the extant FBM literature, we also expect Americans to be more confident in the accuracy of their reception memories, to be more emotionally touched by the events, to rehearse the event more through media and communications, and to view the event to be more consequential compared to Belgians. We will also explore the relation between reception memories and these associated variables such as confidence, emotionality, rehearsal, etc.

Collective memory for the event will be assessed via inter-subjects similarity analyses, which measures the degree of sharedness in memory. We will examine whether Americans have more similar memory with other Americans compared to the similarity Belgians have with other Belgians. We make this prediction based on the claim that the proximity of the place where

the event took place, along with the sense of national identity, favors a more coherent collective representation (Merck et al., 2020). Memories will be analyzed using a narrative structure distinguishing event details, causes and consequences in order to identify what aspect of narratives shows potential differences as a function of nationality (Cheriet et al., 2021). As for the shared memories association with FBMs, we will explore the relation between inter-subjects similarity and FBM formation and memory characteristics.

As for future representations, we include three main constructs: future remembrance, governmental effort, and future attack. We are interested in participants' evaluations for the degree to which the event will be remembered in the future, the degree to which the government should make efforts to memorialize the event, and the possibility of a similar attack in the future. We will investigate whether national identity, FBM formation, memory characteristics, and collective memory have any effect on people's ratings of future remembrance, governmental effort, and future attack.

STUDY 5

3. Method

Participants

A priori power analyses using G*Power 3.1 (Faul et al., 2007) based on a t test for independent groups (to test the group differences on collective memory measures) for a medium effect size d = 0.5, with alpha = 0.05 and a power = 0.80 recommended a minimum of 64 participants per group.

One hundred and five American (US) and 83 Belgian (BE) citizens answered an online survey anonymously from May 14 to June 21, 2021. The survey took approximately 15 to 20 minutes to complete. Both American and Belgian participants were remunerated 2.50$ using the Prolific database. Belgian participants were also recruited through social media due to the small number of French-speaking Belgian citizens in the Prolific database [14]. Participants took part in the study on average 134 days after the event occurred (SD = 9.76). Americans completed the survey in English, whereas Belgian participants completed the same survey translated in French.

Several participants were excluded from the analyses because of the following reasons: they did not remember the event (American n = 1, Belgian n = 8); they did not answer all the questions of the survey (American n =1; Belgian n = 1); they failed to provide the correct answer to one of the control questions (Belgian n = 1). Additionally, 24 American and 4 Belgian participants were excluded from the analyses because they reported to be under medication for a diagnosed psychiatric disorder or neurological disease (such as bipolarity, depression, anxiety disorder...). The final sample consisted of 79 American adults (30 women) aged between 20 and 40 years (M = 28.90, SD = 5.86) and 70

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[14] Analyses revealed no significant differences between Belgian participants recruited through Prolific and social network for memory scores. Also, no significant differences were found for age, education and gender between Belgian subgroups.

Belgian adults (32 women) aged between 20 and 40 years (*M* = 26.1, *SD* = 4.34). Americans were older than Belgian participants, *t*(147) = -3.278, *p* = .001, 95% CI [-4.49, -1.11], *d* = -0.54. Belgian participants attained a higher educational level (from 1 = primary school to 6 = PhD) than American adults (M_{US} = 3.84; M_{BE} = 4.17) (*W* = 3367.5, *p* = .015)[15].

Regarding political identification, 53% of American participants described themselves as Democrat, 8% as Republican, 30% as Independent, and 10% as "other". 60% of Belgian participants indicated that they would be Democrat if they were Americans, 7% Republicans, 20% Independent, 7% did not want to answer, and 6% answered "other". In terms of their voting behavior in the 2020 presidential elections, 65% of Americans indicated that they voted for J. Biden, 18% that they did not vote, 8% that they voted for D. Trump, 4% that they voted for another candidate, and 4% did not wish to answer. Belgians reported that they would have voted for J. Biden mostly (73%), followed by no vote (18%), D. Trump (8%), and no wish to answer (4%).

Materials

The representations for the Capitol riots in Washington that happened on the 6th of January 2021 are investigated in the survey, which consisted of three sections. The first section included questions on the memory of the event and FBMs. The second section consisted of questions addressing future representations about the event. In the final section, participants answered questions on political identity and demographics.

Before starting the survey, participants were asked whether they remembered the Capitol riots in Washington DC, USA (no further details were provided). If they answered "no", they had to click on an exit button and the

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[15] Correlational analyses revealed that these variables did not correlate with the variables of interest.

survey ended. If they answered "yes", they moved on to the other questions. All participants viewed the questions in the order they are presented below. The methodology was inspired by several studies on FBMs which led us to assess event memory and several factors related to FBM formation (Finkenauer et al., 1998). Such as surprise (see Brown & Kulik, 1977; Luminet & Curci, 2017), consequentiality (Brown & Kulik, 1977; Curci et al., 2001; Tinti et al., 2009), emotions and rehearsal (Brown & Kulik, 1977; Curci et al., 2001; Tinti et al., 2009).

Event Memory

Participants were asked to remember the event with as many details as possible and to write a description of what they remembered about the Capitol riots. There was no space limit. We also did not specify any time range for the event, so participants could mention the build-up and aftermath of the event. After that, they were asked to indicate how confident they were with the accuracy of their response on a 7-point scale ("not confident at all" to "very confident").

Flashbulb memory

Participants answered 5 questions that address reception memories (Brown & Kulik, 1977; Davidson et al., 2006; Wolters & Goudsmit, 2005). They could answer "yes" or "no" to each of the following questions: "Do you remember where you were when you heard about the event?" (place); "Do you remember at what time of the day you heard about the event?" (time), "Do you remember who you were with or whether you were alone when you heard about the event?" (presence of other); "Do you remember what you were doing when you heard about the event?" (ongoing activities); "Do you remember how you felt or what you thought when you heard about the occurrence of the event?" (own affect and thoughts). For each of these questions, they were also asked to make a confidence judgment as explained previously.

Associated variables

Rehearsal. To measure the degree to which they were exposed to the news relating the event they were asked 3 questions. First, they specified how they heard about the Capitol riots. The list contained 6 options: radio, television, written press, internet press, heard by someone else, social networks. They were asked to specify the social networks. This question was exploratory and is not included in the analysis. Second, they rated how often they followed the event on media on a visual analog scale (VAS, 0 to 100) from "never" to "very often" (media frequency). Finally, they indicated approximately how many people they talked to about the event (number of persons they talked to). No time range was specified.

Emotion. The third page of the questionnaire concerned the intensity of *emotions* felt about the Capitol Riots. On a VAS scale of 0 to 100 that goes from "not at all" to "very much", they judged how emotionally touched they were by the event[16]. Using the same scale, participants also indicated how surprised they were by the events.

Consequentiality. Participants answered the following questions on *consequentiality* using a VAS scale (0 – 100) going from "not at all" to "extremely": "How important are the Capitol riots in Washington DC to you" (*personal importance*), "How do the Capitol riots in Washington DC affect your life" (*personal impact*), "How much do you feel concerned about the Capitol riots in Washington DC" (*concern*), "The extent to which the Capitol riots in Washington DC impact the society" (*societal impact*).

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[16] We also asked participants questions about their level of anger, anxiety/fear, guilt, interest, pride, and boredom. These questions were included for exploratory purposes and therefore are not analyzed. In the memory section we also included a measure for identification with the US for exploratory purposes. Its analysis did not yield any noteworthy results and therefore it is not included in the paper.

These four questions were entered into a principal component factor analysis, separately for American and Belgian participants. Details of theses analyses are reported in the supplemental material (see Supplemental Table 1). For both samples, the analysis yielded a single factor that included all four items. Cronbach's alpha in both the US (α = .85) and Belgium (α = .76) samples exceeded .70. We computed a composite score for consequentiality by getting an average of participants' responses to these questions.

Future Representations

The second part of the survey addressed projections for the future. For all questions, participants used a VAS scale (0 – 100) from "definitely not" to "definitely yes" to respond.

Future Remembrance. The first set of questions addressed "future remembrance", and involved participants' expectations of how widely the Capitol Riots will be remembered in the future: "Do you think the Capitol riots would be widely remembered in the future?" "Do you think the Capitol riots would be widely remembered in 1 year, in 10 years, in 25 years, in 50 years, and in 100 years?" "Do you think the Capitol riots would enter US history books as an important national event?" "Do you think future generations will remember the Capitol riots?" "Do you think the Capitol riots would have a long-lasting effect on American politics?"

To create a composite score for "future remembrance" we conducted principal component factor analyses with all nine questions measuring future remembrance with orthogonal rotation (Varimax), separately for the American and the Belgian sample. In both samples all nine items for "future remembrance" loaded on the same factor. Details of these analyses are reported in the supplemental material. We created a composite variable for future remembrance by taking the average of the scores for the nine items (α = .93 in both samples).

Governmental Effort. Participants answered the following question to address the degree to which they think the government should memorialize this event: "Do you think the government should make efforts to remember this event?". This question was adapted for Belgian participants as the following: "Do you think the American government should make efforts to remember this event?".

Future Attack. Finally, participants indicated the likelihood of a similar attack in the future by answering the question: "Do you think there could be a similar attack on the Capitol in the future".[17]

Political Identity and Demographics

Following the section on future projections, participants answered questions about their political identity. American participants answered the following questions. "Generally speaking, do you usually think yourself as a Republican, a Democrat, an Independent, or something else?". Responses included: Republican, Democrat, Independent, I prefer not to answer, Something else (please specify). We also asked them for whom they voted for the 2020 elections and if they voted through mails or at the office.[18] These items were adapted for Belgian citizens: "If you were American, would you think yourself as Republican, Democrat, Independent, I prefer not to answer, Something else (please specify). For whom they would have voted in 2020 (Trump, Biden, other), how they would have voted (offices, mail ...). Participants also indicated the extent to which they approved the attack on the Capitol on a

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[17] Two more questions were asked in this section about whether the Capitol Riots and its aftermath represent what America stands for. The analysis of these two questions is included in the supplemental material. There was also an exploratory open-ended question that asked participants to describe the details of how a similar incident in the future would unfold.

[18] There was also a question that measured political identity on a scale form very conservative to very liberal. Since this data was only collected for American participants, we did not include it in the paper.

VAS scale of 0 to 100. Finally, participants provided demographic information (age, gender, education, occupation, State/city, origin/ethnicity, and medical/psychological history).

Text analysis and inter-subjects similarity measure

We will now describe how we computed the degree of convergence in participants' responses for the event memory question. The instructions to the participant mentioned only the Capitol Riots, without specifying any time landmarks. Memories provided by participants clearly extended beyond the moment rioters were on the site of the Capitol and included some causes and previous events such as the mob gathering in Washington, DC after Trump's speech as well as some events that happened a few days after the incident. This corresponds to classical narrative templates involving causes, event unfolding, and consequences (i.e., abstract forms of narrative representations used to narrate events). Therefore, we analyze inter-subjects similarity using this narrative template that encompass details involving the build-up, the event, and the aftermath of the Capitol Riots (Werstch, 2008). These narrative templates are considered as cultural tools for remembering the collective past and therefore they can be culturally dependent and bear specificities as a function of nationality or other group memberships (Rimé et al., 2015; Wertsch, 2008), such as age (Cheriet et al., 2021).

The texts participants provided in response to the event memory in question were analyzed through a method used in a previous study (Cheriet et al., 2021) which allowed us to compute inter-subjects similarity values. First, we created a grid which contained several details related to the unfolding of the event. Based on this grid, the description about the event written by each participant was analyzed: Each piece of information was segmented and compared to each item in the grid (see Table 2). If the participant mentioned an item, it was scored as 1, and if it was not mentioned by the participant, it was

scored 0 in the grid. Table 1 illustrates the scoring grid for two narratives as examples.

All narratives were coded by the first author. The inter-rater reliability measure was based on the coding of 20% of the data by another author (AF). Inter-rater reliability across both groups was very good with standardized Cronbach's α =.84 (US α =.95, BE α =. 99).

Of note, only 2 Belgian participants and 2 American participants reported one item of information that was classified as false memories (e.g., "they attacked the White House"). Since the rate of false memories was very low and similar in both groups, this category was not analyzed. Finally, the length of the descriptions was measured using the Linguistic Inquiry and Word Count (LIWC) (Pennebaker et al., 2007) and there was no significant difference for the word count between groups, $t(147) = 0.86$, $p = .29$, 95% CI [-10.13, 25.76], $d = .14$.

After the coding of each text, we computed inter-subjects similarity values (Cheriet et al., 2021). In each group (Americans & Belgians), each participant's narrative was compared to the narrative of every other participant from the group. For each pair of participants, we computed the number of common details recalled by the two participants, divided by the total number of details mentioned by at least one participant of the pair. For example, in Table 2, participants 1 and 2 share 36% of details in their memories in total. For the current analyses, we computed a similarity value for each narrative category: event, causes, and consequences. Then, the similarity scores obtained for each participant by comparing him or her to the others were averaged to provide summary similarity values for each participant, which was then used in the statistical analyses.

Data are available on https://osf.io/un7dt/.

Table 2

An example of the coding protocol used for measuring inter-subjects similarity across participants

Major Details	P 1	P 2	P X		SIM. P1–P2	SIM P1-PX
	Similarity Analyses					
<u>Events</u>						
Date	1	0			0	...
Capitol	1	1			1	...
Riots/attack	1	1			1	...
Place / City	1	0			0	...
<u>Causes</u>						
Votes/elections	1	0			0	...
Pro-Trump attackers	1	1			1	...
Trump's message	1	0			0	...
<u>Consequences</u>						
Death	1	0			0	...
Injured	1	1			1	...
Trump trial	0	0			0	...
Trump actions	1	0			0	...
Politicians resigned	0	1			0	...
			...	Total similarity	4/11 = 0.36	

Note.
Participant 1's recall: "It was in January; pro-Trump attacked the Capitol in Washington. This started because Trump had a meeting before and was saying that they cheated when counting the votes. People died during this attack and several other persons were injured. Even if Trump supposedly asked them after a few hours to stop, it was too late."
Participant 2's recall: "Pro-Trump attacked the Capitol. Some people got severely hurt and politicians were so afraid that they finally resigned."

4. Results

Statistical analyses

We conducted robust statistical analyses since the normality assumption was violated for almost all the variables (Mair & Wilcox, 2019). Dependent variables were compared between American and Belgian participants (groups) using a robust statistic test equivalent to the Student t test (Wilcox, 2012). For robust Student t test, the effect sizes were calculated using ξ. Small, medium, and large effect sizes correspond respectively to the values of .10, .30, and .50 (Mair & Wilcox, 2019). We also computed robust statistic test equivalent to ANOVA for the inter-subjects similarity analyses. Note that no effect size is available for the equivalent of ANOVA in robust statistics. Associations between reception memory and inter-subjects similarity measures on the one hand and variables such as emotion intensity, rehearsal, consequentiality and future thinking measures on the other hand were assessed with correlations. Pearson's correlations were replaced with their equivalent in robust statistical analyses using percentage bend correlations (Mair & Wilcox, 2019).

As indicated in the participants section, the distribution to political parties was very imbalanced (only 8% of Americans and 7% of Belgians were Republican while 53% of Americans and 60% of Belgians were Democrat). Therefore, we did not include political identification as a co-factor in our analyses. We do, however, report comparisons for political identity categories in supplemental material Table 4. We used approval for the Capitol Riots as an additional measure of political views and entered it into correlational analyses with all variables of interest. There was only one significant correlation for governmental effort in the Belgian sample (p_{pb} = -0.31, p = .008).

Flashbulb Memory

Memory formation

Reception memories associated with the formation of FBMs related to the news of the Capitol Riots were indexed by the total number of yes responses to the five questions regarding major features of reception memories in FBMs. A robust Student t test revealed a significant difference between groups, $Yt = 4.24$, $p < .001$, 95% CI [0.75, 2.01], $\xi = .52$. Americans reported significantly more reception features ($M = 4.06$, $SD = 1.25$) than Belgian citizens ($M = 3$, $SD = 1.47$). We also created a categorical variable for the existence of FBMs. Those who responded with yes to at least three out of five reception memory questions were categorized as having formed an FBM for the Capitol Riots. According to this categorization, 87% of Americans and 64% of Belgians formed FBMs. As expected, American participants ($M = 6.44$, $SD = 0.73$) were also more confident in their responses to the reception memory questions than Belgian participants ($M = 5.97$, $SD = 0.90$) ($Yt = 3.78$, $p < .001$, 95% CI [0.25, 0.77], $\xi = .42$), indicating that their reception memories were more characteristically FBM than Belgians'.

Associated variables

Rehearsal. Americans ($M = 73.89$, $SD = 23.33$) followed significantly more the news than Belgian citizens ($M = 52.25$, $SD = 26.87$) ($Yt = 5.32$, $p < .001$, CI [15.52, 33.34], $\xi = .58$) and they talked to more people about the events ($M = 7.46$, $SD = 6.75$) compared to Belgians ($M = 5.30$, $SD = 5.79$), $Yt = 3.26$, $p < .001$, 95% CI [0.13, 0.53], $\xi = .34$.

Emotionality. Robust Student t tests revealed that Americans were significantly more emotionally touched ($M = 59.23$, $SD = 29.77$) than Belgian citizens ($M = 41.90$, $SD = 29.59$), $Yt = 3.19$, $p = .004$, CI [8.22, 34.41], $\xi = .39$.

For the surprise felt about the event, the analysis showed no significant differences between groups (US, BE), Yt = 1.23, p = .20, 95% CI [-2.40 – 11.50], ξ = .15, (M_{US} = 69.09, SD_{US} = 27.73; M_{BE} = 65.7, SD_{BE} = 24.48).

Consequentiality. Americans (M = 58.28, SD = 22.15) thought that the event was more consequential compared to Belgians (M = 38.53, SD = 18.81), Yt = 6.16, p < .001, 95% CI [14.74, 28.96], ξ = .63.

Overall, these results indicate that American participants attended the media more, were more emotionally touched, and viewed the event as more consequential than Belgian participants.

FBM and associated variables. How does reception memories relate to memory features (media frequency, number of people talked to, emotionality, and consequentiality)? To address this question, we correlated FBM scores with these variables separately for each group. In the US sample, FBM scores correlated with media frequency (p_{pb} = 0.46, p <.001), the number of people that they talked to (p_{pb} = 0.33, p = .003), and emotionality (p_{pb} = 0.28, p = .01). In the Belgian sample, FBM only correlated with media frequency (p_{pb} = 0.30, p = .01) and the number of people they talked to (p_{pb} = 0.29, p = .02).

Collective memory

Confidence in event memory

Robust Student t test showed that Americans (M = 6.30; SD = 1.24) were significantly more confident in their recall than Belgians (M = 5.67, SD = 1.14), Yt = 4.187, p < .001, 95% CI [0.40, 1.19], ξ = .44. We next correlated confidence in event memory with FBM score and there was a significant relation in the US sample (p_{pb} = 0.33, p = .003) but not in the Belgian sample (p_{pb} = 0.14, p = .23). This result indicates that an increase in Americans' confidence in their event memory was associated with an increase in the number of reception details they remembered.

Inter-subjects similarity

We conducted a 3 (category: event, causes and consequences) x 2 (group: Americans and Belgians) robust ANOVA on the similarity values, with categories as within-subjects measure and group as a between-subjects measure (Figure 2). There was a main effect of group, $F(1, 86) = 9.245$, $p = .003$, revealing that inter-subjects similarity was in general higher in Belgian ($M = 0.28$, $SD = 0.11$) than American ($M = 0.22$, $SD = 0.08$) participants, $Yt = 3.70$, $p < .001$, 95% CI [-0.09, -0.03], $\xi = .39$. Results also showed a significant main effect of the categories, $F(2, 83) = 221.02$, $p < .001$. Post hoc Tukey tests showed that participants had significantly more similar representations about the event ($M = .30$, $SD = .13$) and the causes ($M = .32$, $SD = .20$) rather than the consequences ($M = .07$, $SD = .08$), ps <.001.

These main effects were informed by an interaction between the category and group, $F(2, 83) = 14.964$, $p < .001$. To explore this interaction, we conducted robust Student t tests to assess the difference between American and Belgian participants for the inter-subjects similarity for each category. We found significant differences in inter-subjects similarity between Americans and Belgians for all categories. Compared to American participants, the inter-subjects similarity in memory representations was higher in Belgian participants for the event category ($M_{US} = .28$, $SD_{US} = .11$, max_{US} [19] $= .44$; $M_{BE} = .33$, $SD_{BE} = .14$, $max_{BE} = .5$), $Yt = -3.049$, $p = .003$, 95% CI [-.10, .02], $\xi = .36$, and for the causes ($M_{US} = .27$, $SD_{US} = .18$, $max_{US} = .44$; $M_{BE} = .38$, $SD_{BE} = .19$, $max_{BE} = .54$), $Yt = -3.30$, $p = .002$, 95% CI [-.21, .05], $\xi = .37$. In contrast, Americans ($M = .09$, $SD = .05$, $max_{BE} = .22$) recalled significantly more similar details about the consequences of the event than Belgians ($M = .04$, $SD = .05$, $max = .14$), $Yt = -2.92$, $p = .002$, 95% CI [.02, .09], $\xi = .42$ (Figure 2).

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[19] For each group and each category the minimum scores were equal to 0.

Figure 2

Inter-subjects similarity values as a function of recall categories and group
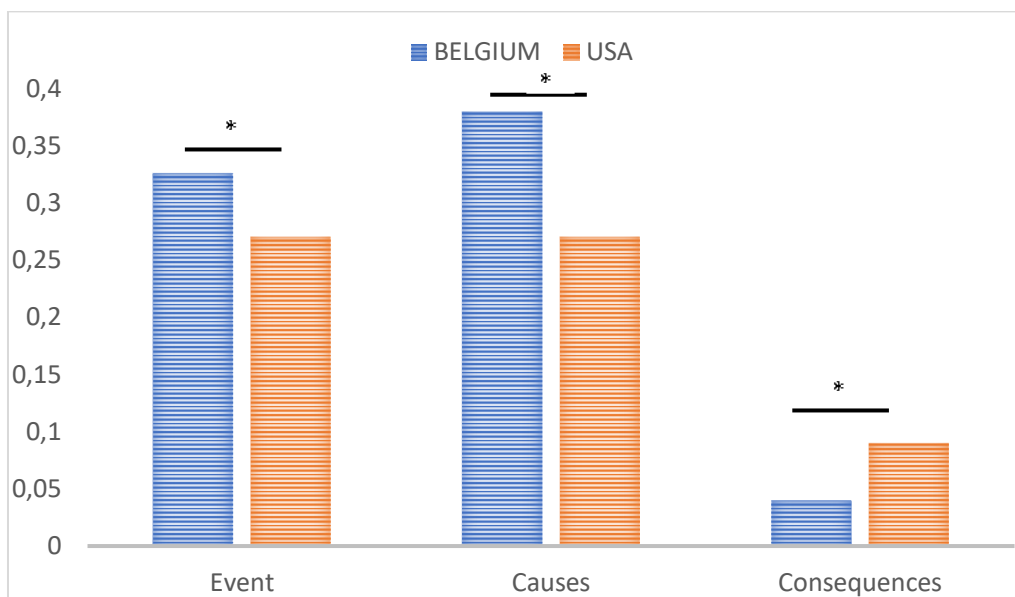
Next, we correlated inter-subjects similarities with confidence in event memory, FBM score, and event features (media frequency, number of people talked to, emotionality, surprise, and consequentiality) separately for Americans and Belgians. In the US sample, inter-subjects similarities for consequences correlated with media frequency (p_{pb} = .30, p = .007) and the number of people they talked to (p_{pb} = .23, p = .04). In the Belgian sample, the only significant correlation was between the inter-subjects similarities for event and consequentiality (composite score), (p_{pb} = .24, p = .049).

Future Representations

For all future variables we conducted a 2 (FBM: Yes vs. No) x 2 (Group: US vs. BE) between-subjects ANOVA. In these analyses, we used the categorical variable for FBM, which indicates whether participants were able to remember three or more reception details or not. To explore the relation between memory constructs and future representations we correlated each future variable with

FBM score and memory features (confidence in event memory & FBM, media frequency, number of people talked to, emotionality, and consequentiality), separately for US and Belgian samples (Table 3). We also correlated future variables with inter-subjects similarity measures. These analyses are presented separately for future remembrance, governmental effort, and future attack.

Future remembrance

The 2 x 2 ANOVA only yielded a main effect for FBM (F (1, 17) = 24.40, $p <$ .001). Robust Student t-test revealed that people who formed reception memories that are indicative of the formation of FBM thought that the Capitol Riots will be remembered more in the future (M = 65.03, SD = 21.22) than those who did not form a FBM (M = 42.29, SD = 17.74), Yt = - 6.83, p <.001, 95% CI [-32.2, -17.5], ξ = .75.

The correlational analyses of future remembrance with FBM and memory characteristics indicated that in the US sample, future remembrance correlated with confidence in event memory, FBM score, confidence in FBM, media frequency, number of people talked to, emotionality, surprise, and consequentiality. In the Belgian sample, on the other hand, future remembrance only correlated with FBM score and surprise (Table 3). These results indicate that the formation of FBM and the feeling of surprise is related to the belief that the events will be remembered more by society in the future, regardless of national group. Additionally, in the US sample, the more people are confident in their event memory and FBM, the more they think that the event is emotional and consequential, and the more they rehearse the event through media and communication the more they believe that it will be remembered in the future.

The correlational analyses with inter-subjects similarity measures did not reveal significant effects, see Table 5 Supplemental (Event: p_{pb} = -.07, p = .39; Causes: p_{pb} = -.05, p = .96; Consequences: p_{pb} = .14, p = .09)

Governmental effort

The 2 x 2 ANOVA yielded only a main effect for FBM (F (1, 22) = 12.14, p = .002). People with an FBM for the event (M = 71.21, SD = 29.47) thought that the government should make an effort to remember this event in the future more than those who did not form an FBM (M = 53.43, SD = 30.13), Yt = 3.46, p = .002, 95% CI [-36, -9.29], ξ = .44.

The correlational analyses with FBM and memory characteristics indicated that governmental effort correlated with media frequency, emotionality, and consequentiality in both samples. In the US sample there was an additional correlation with surprise (see Table 3). These results indicate that the more Americans and Belgians attended to media, felt emotionally touched, and thought that the event was consequential, the more they thought the government should memorialize the Capitol Riots.

The correlational analyses with inter-subjects similarity measures did not reveal significant effects see Table 5 in supplemental.

Future attack

Again, the 2 x 2 ANOVA only revealed a significant effect for FBM. The expectation of a similar attack in the future was higher for people who formed an FBM (M = 67.99, SD = 25.01) than those who did not (M = 55.09, SD = 29.83), Yt = 2.41, p = .02, 95% CI [-24.8, -2.04], ξ = .35.

The correlational analyses with FBM and memory characteristics revealed a significant relation with confidence in event memory, media frequency, and consequentiality in the US sample and with confidence in event memory, FBM score, number of people talked to, and emotionality in the Belgian sample (Table 3). This result indicates that the more Americans were confident in their event memory, followed the event via media, and thought the event was

consequential, the more they expected a similar attack to happen in the future. For Belgians, on the other hand, confidence in event memory, the formation of FBMs, rehearsal through communication, and emotionality were associated with a belief that similar event could happen in the future. The divergence between the BE and US samples in terms of variables that correlate with future attack is noteworthy.

The correlational analyses with inter-subjects similarity measures only revealed a significant correlation between future attack and similarity for consequences (p_{pb} = .22, p = .008) in the US sample see Table 5 in supplemental.

Table 3. Robust Correlations between Future Variables and FBM, Media Frequency, Emotionality, and Consequentiality

	Future Remembrance		Governmental Effort		Future Attack	
	US	BE	US	BE	US	BE
Confidence in event memory	.39**	.18	.09	.12	.26*	.25*
FBM score	.42**	.29*	.20	.14	.18	.26*
Confidence in FBM	.29**	-.06	.07	.02	.18	-.14
Media frequency	.41**	.15	.49**	.25*	.49**	.17
Nr. of people talked to	.27**	-.03	-.009	.002	.06	.31**
Emotionality	.49**	.21	.46**	.34**	.16	.38**
Surprise	.35**	.26*	.19	-.02	.06	-.18
Consequentiality	.38**	.17	.56**	.52**	.34**	.13

Note. * < .05, ** < .01.

5. Discussion

The Capitol riots that happened in Washington DC on January 6th, 2021 constitutes a distinctive case to study the individual to collective memory continuum. In the present research, we aimed to explore different realms of memory through the examination of reception memories in the context of FBM, shared memories in the context of collective memory, and future representations in the context of cultural memory. In these explorations, we focused on the comparison of American and Belgian participants to examine the effect of physical and psychological proximity to the event. Our analyses revealed novel patterns. We will first discuss the implications of these findings for FBM and collective memory, and then we will move on to the discussion of future thinking.

Flashbulb memory

As expected, American citizens formed more reception memories about the Capitol riots than Belgian citizens (Curci et al., 2001; Luminet & Curci, 2017). Not only did American participants report more features typical of FBMs than Belgian participants, but they were also more confident in their memory for the circumstances in which they learned about the event. According to Echterhoff and Hirst (2006), such high confidence when one is close to a shocking public event (either physically or psychologically) could be generated by normative beliefs related to a "duty to remember". A large proportion of American participants reported that they remembered three or more contextual elements relative to their hearing of the news about the riots (87%), whereas presence of FBMs was less frequent among Belgians (64%). These results are consistent with previous findings showing an influence of social identity on FBM (Brown & Kulik, 1977; Cordonnier & Luminet, 2021).

Research on FBM have considered variables that promote their creation (see Luminet & Curci, 2017 for a review). Here, groups differed on all examined

variables, except the surprise felt when hearing the news. To be more specific, Americans attended the media more, they communicated with more people about the event, they were more emotionally touched by the events, and they viewed the events to be more consequential compared to Belgian participants. In this study, we considered individual emotions. Future work might assess the association between collective emotions and FBMs. The lack of difference in surprise is not in line with some studies (Christianson, 1989) but it is in line with others. A study investigating FBMs of a nuclear accident in Japan, for instance, showed no difference for the surprise among participants who formed FBMs and those who did not (Otani et al., 2005).

Here, Belgians and Americans were equally highly surprised by the occurrence of the event, which might be due to the unprecedented nature of the event in US history. Surprise also did not correlate with the creation of flashbulb memories in either group. In the US sample, FBMs did correlate with media frequency, the number of people talked to, emotionality attached to the events, and confidence in event memory. In the Belgian sample, FBM correlated with media frequency and number of people talked to. These results suggest that the formation of flashbulb memories for the Capitol Riots did not rely exclusively on a direct path through the activation of surprise, but rather on an indirect path through media attendance, communication, emotionality, and event memory confidence in the US sample, and through media attendance and communication in the Belgian sample (Finkenauer et al., 1998).

Collective Memory

The collective representations formed about the Capitol riots was examined via inter-subjects similarity measures of representations in memory of the event across the cause, event and consequences categories of the schematic narrative structure. Previous work revealed that being a member of a community closely interested in a topic would favor memory for events about

this topic (Merck et al., 2020). Therefore, we predicted that Americans should share more similar memory representations of the riots that happened in their country compared to Belgians. The findings did not fully support this prediction. Overall, the reverse pattern is observed with more similarity in memories among Belgians than among Americans. However, the group by category interaction suggested a more subtle pattern of results. Americans indeed had more similar collective representations than Belgians but only concerning the details relative to the consequences of the riots (e.g., several people died, rioters were arrested...), whereas Belgians had more similar representations for the causes and the unfolding of the events.

The degree of similarity between Americans' representations for the consequences of the event correlated with the frequency of media exposure and the number of persons they talked to. The link with media frequency could suggest a role of cultural artefacts in the collective representations of the aftermath of the riots. Indeed, media in the USA covered this event days and even weeks after it happened, thus elaborating a lot on the consequences of the event. Media coverage in Belgium, however, was intense during the first day of the riots and decreased rapidly afterwards, which could explain the relative dissimilarity of their representations for the consequences of the event.

In contrast, the memories Belgians reported about the event were more similar for details about the causes (e.g. Trump's message, Trump's meeting, Pro-Trump individuals attacked) and the event specifics (e.g., people entered the building, offices were vandalized, rioters were angry...). Conversely, Americans were more dissimilar to each other in terms of the details they recalled for the causes and the unfolding of the event. This finding might be explained by how media presented the news in Belgium as opposed to the USA. The coverage of the event in Europe leaned towards a more Democratic angle and thus portrayed former president D. Trump in a more negative way (Sintes-

Olivella et al., 2021), suggesting that the riots were largely related to his contestation of the election results. In contrast, the coverage in US media outlets reflected the polarized public opinion on the events. Although some media outlets emphasized Trump's role in inciting the events, others downplayed his involvement.

The type of information provided by the media may also have influenced the type of details regarding the event that individuals were informed of. A more varied way of presenting the events in the USA would contrast with a more uniform discourse in Belgian media. In other words, Americans had more opportunity for diversity in their representations of the riots compared to Belgians, thus leading to more dissimilar collective representations for the causes and the event unfolding. Also, one should note that Belgians claimed more often than Americans that this event reflected what America stands for (see Supplementary Table 3). So, a stereotypical vision of America could have influenced the representations of the event in memory. Indeed, it is well known that collective memories are biased by stereotypes. Generally, one recalls more positive memories for one's ingroup (i.e., the group to which one identifies), whereas one recalls more negative memories for the outgroup (Baumeister & Hasting, 1997; Shahdra & Ross, 2007; Winiewski & Bulska, 2019). Altogether these interpretations echo with the notion that collective memories for public events are strongly shaped by cultural artefacts such as television and press documentaries (Assmann & Czaplicka, 1995).

It is also important to note that the data for the present study was collected only four months after the event, which might not have been enough for shared memories to emerge. In Assmann's (1995) conceptualization, representations first exist at the communicative memory stage, which is characterized by "thematic instability and disorganization" (p. 126). Cultural formations are needed to transform communicative memories into more stable

and organized representations in cultural memory, and such transformation takes time. In future studies, one can explore whether the level of inter-subjects similarities increase as a function of time through longitudinal designs.

Interestingly, we did not find a relation between FBM formation and collective memory formation, at least in terms of the present measurements. As we noted, the dynamics underlying these two types of memories are complex. Media coverage, conversational interactions, and social identity played a role in both the formation of FBMs and collective memories, suggesting that there should be an association. However, these seeming similarities may mask telling differences. As noted, media coverage is not always an important variable for the formation of FBMs (e.g., Hirst et al., 2009, 2015). Moreover, as we just outlined, the news coverage is substantially different, making the way it might shape FBM formation distinctive. Clearly, more research needs to be done about the relation between the two.

Future representations

The present research also involves a novel exploration of future representations in the context of FBM and collective memory. There were three constructs that addressed future representations: future remembrance, governmental effort, and future attack. The first two constructs were included in the study to address the more long-term representations of the event, which would let us investigate whether and how people think the Capitol Riots would become part of cultural memory (Assmann & Czaplicka, 1995). With the "future attack" construct we wanted to measure the degree to which people think a similar attack on the Capitol is probable. In examining these constructs, we focused on the differences between Americans and Belgians, and the differences between participants who formed and did not form an FBM. The latter point is especially important because, so far, research that examines collective future thinking, either focused exclusively on the collective domain

(Topcu & Hirst, 2020; Öner & Gülgöz, 2020) or on the differences between the personal and collective domains (Shrikanth et al., 2018; Deng et al., 2022), without exploring the relation between these two domains.

Findings revealed an association between the formation of FBMs and future representations. Participants who formed an FBM for the Capitol Riots believed that the event will be remembered more in the future, that the government should make more efforts to remember the event in the future, and that there could be a similar attack on the Capitol in the future. We should note that national identity did not interact with these patterns, and more importantly there were no overall differences between Americans and Belgians.

What can account for the relation between FBM and future thinking? Flashbulb memories involve a link between personal and collective memory as they consist of personal memories about the circumstances in which an individual learned of a public event (Brown & Kulik, 1977). When people form flashbulb memories of a collective event, they create a more personalized link between their own experiences and the collective event itself (Hirst & Meksin, 2008). This increased personal relevance might explain why people who form FBMs are more likely to think that the event will be remembered more in the future and that the government should engage in more effort to memorialize the event. Similarly, an increased personal relevance might also lead to an increased belief that there could be a similar attack in the future.

A more indirect explanation could be that the same factors that affect the formation of FBM might also influence people's future representations. We tested this possibility through a series of correlational analyses between future representations and memory features. Here, we will focus on the correlations that are common for both FBM and future representations. In the US sample, future remembrance correlated with media frequency, number of people talked to, emotionality, and confidence in event memory. The same variables were also

associated with FBM formation, which indicates that these shared factors might underlie the relation between FBM and future remembrance. In the Belgian sample, there were no common variables that correlated with both FBM score and future remembrance. This might indicate that the relation between FBM and future remembrance is more direct in the case of a non-US sample.

Governmental effort, on the other hand, correlated with media attendance and emotionality in both the US and Belgian samples, which were also related to FBM formation. This result indicates that similar processes might be at work in these groups when it comes to the relation between FBM formation and governmental effort: the more they attend to media and feel emotionally touched the more they think that the government should memorialize the event. Finally in the case of future attack, the common factors that correlated with both FBM and future attack were confidence in event memory and media frequency in the US sample; and number of people talked to in the Belgian sample.

In these discussions, rehearsal, especially through media attendance, emerges as an important factor to consider when exploring FBM formation and future representations, and the relation between the two. The present study contributes to the research on collective future thinking by revealing a possible connection between flashbulb memories and future representations involving a collective event, which can shed light on the interplay between personal and collective memory. Additional studies with more fine-grained analysis are, of course, needed to explore the dynamics of the relation between FBM and future representations. Future studies can, for instance, focus on more group-based variables such as collective emotions (Goldenberg et al., 2020; Páez et al., 2015), collective angst (Wohl et al., 2012), and identity fusion (Swann Jr. & Buhrmester, 2015) and explore how they might interact with FBM and collective future thinking.

Limitations and Conclusion

We would like to acknowledge some limitations of this study. First, regarding the evaluation of FBMs, references to FBMs in the current study involved only the number of reception memories as we did not assess consistency over time, accuracy or the vividness of representations which are key characteristics of FBMs. In the present research, our focus was on group differences and the relation between memory realms. Future studies on FBMs should use a multi-component approach, which includes longitudinal designs that explore consistency, accuracy, and vividness (see Luminet, 2022). Such an approach could shed light on how these factors might influence the relation between FBM, collective memory, and future thinking. Additionally, the questions assessing FBMs are based on classical questions assessing FBMs (Brown & Kulik, 1977; Davidson et al., 2006; Wolters & Goudsmit, 2005). However, future studies could rely on more recent literature and assess additional canonical categories.

Second, we did not measure the presence and nature of cultural stereotypes. We suggested that stereotypes could have biased the creation of collective memories, but we could not formally confirm this hypothesis. Third, the media coverage in Belgium and in the US were different. Whereas it only lasted a few days in Belgium, media in the US covered the event weeks and months after its happening. To control for the differences in media coverage, a study could investigate collective memories right after the incidence happens (Cordonnier & Luminet, 2021). Additionally, one should note that the sample used in this study mostly consisted of liberals/democrats, which might make it difficult to explore differences in memory and future representations between different political groups. We also did not observe the changes between inter-subjects similarity for collective representations over time. As discussed before, it would be interesting to investigate how collective memories evolve in time. We

could hypothesize that, with time, memories of a public event will become more schematized and less specific, as in the case of autobiographical memories (Conway, 2009).

In summary, the current study indicated that nationality affects the creation of flashbulb memories for a surprising public event as well as the similarity of memory representations among citizens of a country. Whereas findings are consistent with past research in showing that people tend to form more flashbulb memories for events that happened in their country and concerned them, results were unexpected for collective representations. Although hypothetical, results indicate that the influence of nationality on the similarity of memories might be driven by media attendance, which could also provide an explanation for the differences in future representations. Finally, the present research unravels novel patterns for the relation between FBM and future representations, which can inform the discussions on the intersection of personal and cultural memory.

6. Supplemental material

Principal axis factor analyses for consequentiality variables

The four items measuring consequentiality were entered into a principal axis factor analysis, separately for American and Belgian participants. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analyses in both samples (KMO_{US} = .80; KMO_{BE} = .71) and the KMO values for each item exceeded .64. Correlations between items were sufficiently large for the principal axis factor analyses for both samples (For the US, $\chi^2(6)$ = 125.95, p < .001; for BE, $\chi^2(6)$ = 71.38, p < .001). The analyses yielded a single factor that had eigenvalues that exceeded Kaiser's criterion of 1 and explained 69% and 58% of the variation for the US and BE (Table 1 presents the factor loadings for each item).

Table 1. *Summary of exploratory factor analysis results for the consequentiality questions separately for the US and BE*

	Factor Loadings	
Item	US	BE
How important are the Capitol riots in Washington DC to you? (personal importance)	**.78**	**.68**
How do the Capitol riots in Washington DC affect your life? (personal impact)	**.73**	**.50**
How much do you feel concerned about the Capitol riots in Washington DC? (concern)	**.76**	**.90**
The extent to which the Capitol riots in Washington DC impact the society? (societal impact)	**.79**	**.57**
Eigenvalues	2.75	2.32
% of variance	68.8%	57.9%

Note. Factor loadings over .30 are in bold

Principal axis factor analyses for future thinking variables

We conducted principal axis factor analyses with all 11 questions for future representations with orthogonal rotation (Varimax), separately for the American and the Belgian sample. For both samples the Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analyses (KMO_{US} = .83; KMO_{BE} = .80) and all KMO values for individual items were larger than .68 except the future attack question for BE sample (.23). For both samples, correlations between items were sufficiently large for the principal axis factor analyses (For the US, $\chi^2(55)$ = 704.02, p < .001; for BE, $\chi^2(55)$ = 706.62, p < .001). For the US two factors and for

BE three factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 67% and 76% of variation for the US and BE (Table 4 includes the factor loadings after rotation). Since in both samples the first factor explained the majority of the variance (55% for both samples), we decided to use the first factor to compute an aggregate score for "future remembrance". For the US sample, all nine items that measure "future remembrance" had factor loadings above the critical value of .3 after rotation (Field, 2013). In the BE sample only the item "Do you think the Capitol riots would be widely remembered in 1 year" had a factor loading below .3 after rotation (Table 2).

Table 2. *Summary of exploratory factor analysis results for the future thinking questions separately for the US and BE*

	Rotated Factor Loadings				
	Factor 1		Factor 2		Factor 3
Item	US	BE	US	BE	BE
Do you think the Capitol Riots would be widely remembered in the future?	**.60**	**.51**	**.44**	**.35**	**.61**
Do you think the Capitol Riots would be widely remembered in 1 year?	**.63**	.20	.01	**.86**	.17
Do you think the Capitol Riots would be widely remembered in 10 years?	**.97**	**.59**	.18	**.75**	.05
Do you think the Capitol Riots would be widely remembered in 25 years?	**.83**	**.81**	**.44**	**.49**	.08
Do you think the Capitol Riots would be widely remembered in 50 years?	**.61**	**.95**	**.56**	.29	-.01
Do you think the Capitol Riots would be widely remembered in 100 years?	**.60**	**.86**	**.63**	.17	.06
Do you think the Capitol Riots would enter US history books as an important national event?	**.59**	**.46**	**.49**	**.42**	**.49**
Do you think future generations will remember the Capitol Riots?	**.52**	**.73**	**.57**	.15	**.50**
Do you think the Capitol Riots would have a long-lasting effect on American politics?	**.40**	**.38**	**.60**	.14	**.49**
Do you think the government should make efforts to remember this event?	.17	.10	**.57**	**.36**	**.60**
Do you think there could be a similar attack on the Capitol in the future?	-.02	-.04	**.35**	-.03	.14
Eigenvalues	6.07	6.02	1.25	1.30	1.02
% of variance	55.21	54.72	11.38	11.83	9.23

Note. Factor loadings over .30 are in bold

FUTURE	t	p	CI	Effect size	Mean USA	Mean BE
Do you think the Capitol Riots would be **widely remembered** in the future?	3.613	**<.001**	7.92 – 27.05	0.47	79.089	61.275
in 1 year	3.157	**.002**	3.75 -16.54	0.37	88.506	77.203
in 10 Years	3.337	**.002**	6.62 – 23.78	0.44	75.418	60.652
in 25 years	3.495	**.001**	9.36 -32.23	0.43	65.316	46.145
in 50 years	3.303	**.003**	9.23 – 35.36	0.41	54.430	34.797
in 100 years	3.264	**.001**	9.39 – 34.70	0.39	45.797	28.071
Do you think the Capitol Riots would enter US **history books** as an important national event?	1.510	.131	-2.63 – 19.09	0.18	68.494	63.754
Do you think **future generations** will remember the Capitol Riots?	2.997	**.002**	6.25 -28.16	0.36	64.165	49.377
Do you think the Capitol Riots would have a **long-lasting effect on American politics**?	3.882	**<.001**	11.13 -31.73	0.44	60.329	41.314
Do you think the **government should make efforts to remember** this event?	1.339	.168	-3.98 – 20.49	0.16	69.430	64.174
Do you think the Capitol Riots reflect **what America stands for**?	-5.600	**<.001**	-51.33 – (-24.33)	0.60	32.177	60.420
Do you think the **aftermath of the riots -the responses** from various groups in the society- reflect what America stands for?	-2.413	**.011**	-24.42 – (-3.41)	0.30	47.532	61.186
Do you think there could be a **similar attack on the Capitol in the future**?	1.226	.20	-2.72 – 13.59	0.16	66.810	62.871
Future attack confidence judgment	2.754	**.006**	0.18 – 1.05	0.34	5.810	5.214
How confident are you with your future projection?	2.887	**.004**	0.21 – 1.09	0.36	70.5	58.5

Table 3. Additional analyses on future part of the questionnaire

Table 4. Robust ANOVAs of *the comparison of three political groups for collective memory measures, and future representations*

	F	*P*	*Mean Democrat*	*Mean Republican*	*Mean Independent*
Event Similarity	6.31	**.009***	0.302	0.399	0.266
Causes Similarity	0.08	.93	0.330	0.317	0.313
Consequences Similarity	0.87	.44	0.07	0.05	0.08
FBM scores	0.79	.47	3.68	3.91	3.27
Consequentiality	2.22	.14	53.1	44.3	42.6
Emotionality	3.70	.05	57.1	48	40.32
Future Remembrance	2.20	.15	64.1	60.4	53.3
Future government	3.31	0.07	73	49.5	59.6
Future attack	0.51	0.61	66.2	56.8	61.6

Note. We should note, however, that the existence or nonexistence of significant effects regarding political identification should be interpreted with caution since our sample consisted of people who overwhelmingly identified as Democrats as opposed to Republicans. Regarding, event similarity, post hoc tests revealed that Republicans (M = 57.06, SD = 28.50) share more similar representations of the events than Independents (M = 40.32, SD = 31.60), $\hat{\Psi}$ = *-0.13 p* = .01, *95% CI* [-0.22, -0.03], and democrats $\hat{\Psi}$ = *-0.10, p* = .02, *95% CI* [-0.18, -0.009].

Table 5. Robust Correlations between Future variables and inter-subjects similarity categories

	Future Remembrance			Governmental Effort			Future Attack		
	US	**BE**	**BOTH**	**US**	**BE**	**BOTH**	**US**	**BE**	**BOTH**
Event	-.11	.11	-.07	-.32	.04	-.15	.05	-.01	-.03
Causes	.04	.18	-.05	-.02	.03	-.03	.003	.01	-.04
Consequences	-.04	.09	.14	.11	-.06	.09	**.25***	.02	.22*

p < .05

GENERAL DISCUSSION

1. Summary of the thesis

This thesis investigated collective memory from a sociocognitive perspective by examining both the temporal (past and future) and the information type (personal and collective) dimensions. We adopted an integrated approach to investigate collective memory by drawing on knowledge about autobiographical memory, with the assumption that similar psychological processes underlie collective memory (see Abel & Berntsen, 2021; Hirst et al., 2018 for a similar approach). With Studies 1 and 2, we proposed research anchored in the cognitive structure of collective memory (aim 1), by extending the Self Memory System model of autobiographical memory to understand the cognitive structure of collective memory (see Figure 1). Then, Studies 1, 3, 4 and 5 focused on the effects of personal importance, aging, and social identity as variables influencing the creation of collective memories (aim 2).

In this section, a summary of each study is presented, highlighting the main results that will be discussed in the following sections. Table 1 provides a summary of the studies, and the sections discussing these results.

Study 1 examined the influence of the passage of time and personal importance on lived collective memories. Participants recalled their memories of the COVID-19 pandemic and a political event at two-time points (in 2021 and 2022). In 2021, participants imagined a future pandemic and a future political event to assess to what extent the collective future relies on the collective past. Results were influenced by the proximity to the event as participants recalled more personal and collective information related to the pandemic than to the political event, but there was a greater difference between pandemic and political events for personal information, compared to collective information. Results proved that the passage of time influenced the type of information retrieved about lived collective memories, as more personal and collective information was recalled in 2021 than in 2022. For the political event, the

number of information decreased with time, but the decrease was similar for personal and collective information, with the latter always dominating. In contrast, for the pandemic, in the first interview, participants recalled more personal than collective information; with time, both decreased, but more so for the personal information, which was recalled to the same extent as collective information in the second interview. Moreover, participants' narratives were overall shorter in 2022 than in 2021, but the sentences they contained were proportionally richer in detail. This effect of the passage of time was observed for the pandemic but not for the political memories. This might reflect a reorganization of the memories of the pandemic in the sense of denser but still rich representations of the events. Additional findings revealed the absence of age effects on episodic details recalled but we found age-related differences in the formation of flashbulb memories about the lockdown announcement.

Regarding future thinking, there were three main results. We found more episodic richness when imagining a future pandemic than a future political event, more collective than personal thoughts about future events, and themes related to a future pandemic were similar to the ones recalled about the past pandemic.

Study 2 examined whether the COVID-19 pandemic influenced autobiographical memory organization. Building on the Living-In-History effect, we hypothesized that participants who were more impacted by the pandemic would refer more to this collective event when recalling personal memories. The results showed that the COVID-19 pandemic did not induce a Living-in-History effect, as young Belgian adults rarely relied on this collective event to date past experiences, whatever the impact of the pandemic had on their lives.

The following studies aimed to examine social variables influencing the creation of memory, focusing on age and social identity effects. Classically, the examination was based on the amount of memories recalled. More originally, we

provide a new perspective in memory examination through the inter-subjects similarity analyses based on a schematic narrative template including three blocks of information (e.g., the context, the causes, and the consequences).

Study 3 assessed the extent to which individuals can share similar memory representations of a public event and the potential age-related differences in memory similarity. Younger and older Belgian adults recalled their memories of the deadly bridge collapse that happened in Italy a few months earlier. Results showed no age-related differences in the number of details remembered. We also found that both young and older adults recalled event details that were similar across participants of their group without any age-related differences. However, older participants mentioned the consequences of the incident more frequently than younger participants. These findings suggest that individuals who remember the same event can share common memory details and that across-participants memory similarity for a public event remains spared in normal aging. We did not find age differences in the creation of flashbulb memories for the bridge collapse.

Following Study 3 examining age effects on lived collective memories, **Study 4** assessed the influence of age effects on memories for a fictional story. Moreover, to test the influence of the current context through the audience effect, we compared the narratives of young and older participants about a TV series episode when recalled to a younger or older listener. Recalled details were analyzed using a schematic narrative template with three blocks of information (the context, the events, and the resolution). Results showed that for each block, young adults shared more similar representations of the story among them than older adults. Additionally, participants had more similar representations in memory when recalling the story to an old listener. All participants shared more similar representations of the fictional story for the initial context and the resolution compared to the middle of the story. As

expected, young adults recalled more episodic details than older participants. The lexical content analyses showed that regardless of the conditions, young adults used more words related to negative emotions and anger compared to older adults who used more words related to positive emotions. These results highlight the necessity to consider the context and social variables in memory studies, notably in aging, since it seems to influence memory creation and retrieval.

Study 5, the last study, explored flashbulb memory, collective identity, future thinking, and lived collective memories of a public event. Belgians and Americans recalled the unfolding of the Capitol riots (Washington DC, January 2021). Consistent with the previous studies, inter-subjects similarity of recalled details was analyzed using a schematic narrative template (the event, the causes, and the consequences). Results revealed that Belgians had more similar representations of the event and its causes compared to Americans, whereas Americans' representations of the consequences were more similar than Belgians'. As expected, Americans reported more flashbulb memories than Belgians. The analyses underlined the importance of rehearsal through media and communication in flashbulb memory formation. This research revealed a new relationship between flashbulb memories and future thinking. Regardless of national identity, participants who formed flashbulb memories were more likely to think that the event would be remembered in the future, that the government should memorize the event, and that a similar attack on the Capitol could happen in the future compared to participants who did not form flashbulb memories.

Overall, the studies conducted in this thesis allow a better understanding of the cognitive architecture of collective memory and its constructive nature, especially through the results of Studies 1 and 2. Concerning the second aim of this thesis, we highlight in section 3 how aging, personal importance, and social identity influence collective memory, by confronting the results from all studies. After discussing our results, we emphasize some limitations of the current work and mention important variables to consider in future examinations of collective memory, as emotions and media influence collective memories (section 3). Then, we encompass these elements in one model that brings a new perspective to investigate collective memory (section 4). In the end, because we rely on autobiographical memory, we propose a general discussion on how autobiographical and collective memory are similar but still distinct types of memory (section 5).

Table 1

Summary of the effects studied regarding the two aims, temporal dimensions, and section in the discussion.

Studies	Short title	Effects studied	Aims	Temporal dimension	Measures	Discussion
1	COVID-19 pandemic	Time	1 – Cognitive structure: episodic details level & collective knowledge	Past and future	1. Episodicity 2. Information type: personal vs collective 3. Themes 4. Flashbulb memories	Section 2 – The cognitive architecture (and construction processes)
1	COVID-19 pandemic	Personal importance	2 – Variables influencing collective memory	Past	1. Episodicity 2. Information type: personal vs collective	Section 3 – Variables influencing collective memory
2	COVID-19 Transition	Collective transition	1 – Cognitive structure: collective knowledge	Past	1. Dating of memories	Section 2 – The cognitive architecture
3	Bridge collapse	Aging on lived collective events	2 - Variables influencing collective memory	Past	1. Amount of details recalled 2. Inter-subjects similarity 3. Flashbulb memories	Section 3 – Variables influencing collective memory

4	Fictional - Modern Love	Aging & communication	2 - Variables influencing collective memory	Past	1. Amount of details recalled 2. Inter-subjects similarity	Section 3 – Variables influencing collective memory
5	Capitol riots	Social identity	2 - Variables influencing collective memory	Past and future	1. Inter-subjects similarity 2. Flashbulb memories	Section 3 – Variables influencing collective memory

2. The cognitive architecture of collective memory

Results from Studies 1 and 2 gave some insight into the episodic details and higher-order knowledge levels of the cognitive architecture of collective memory, as illustrated in Figure 1. We primarily focus on the influence of the passage of time on lived collective memories, revealing the constructive processes that underlie collective memory. Results provided by our first study also link the past and the future, which allows the discussion of collective future thinking (section 2.3).

Figure 1

Collective memory cognitive architecture model
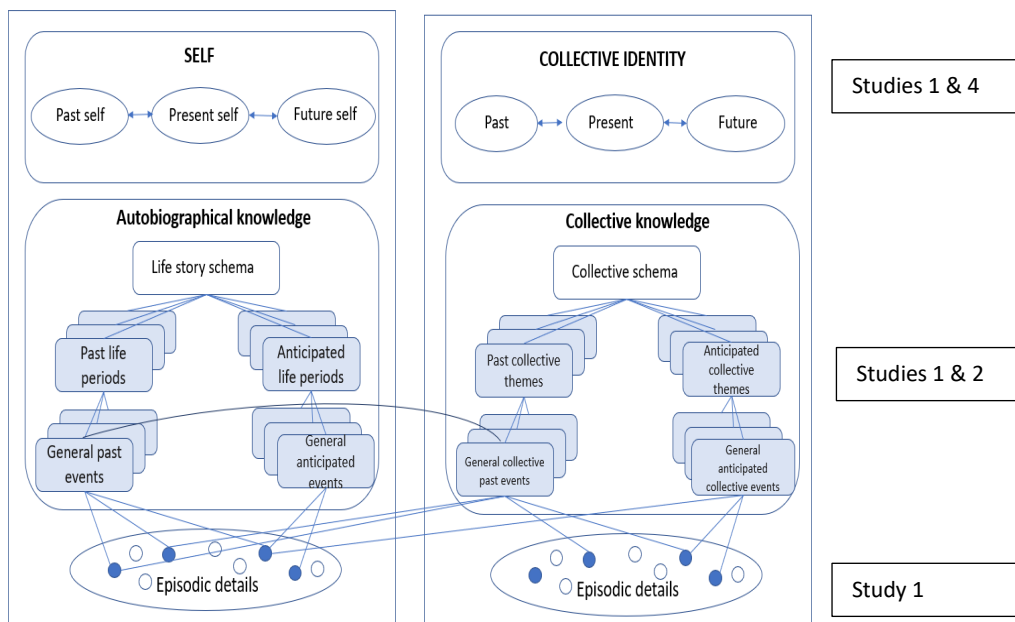
2.1 The episodic details level

In Study 1, we found that lived collective memories were associated with a general loss of episodic and semantic details in the narratives with the passage of time. This loss was more important for the pandemic memories than the political memories. While we found a general loss of details, our results also suggest that, overall, narratives were proportionally richer in detail. In other words, as participants' narratives in 2022 were shorter, participants needed fewer sentences to describe events related to the pandemic during the year 2020 and could provide all details with fewer words. This was only true for the pandemic but not for the political memories. Our results suggest a reorganization of the memories of the pandemic in the sense of a denser but still rich representation of the events. Moreover, the lexical content analyses conducted on the narratives about the pandemic in 2020 also bear on that interpretation, as we found more references to COVID-19 in 2022 than in 2021.

Building on episodic memory studies, our results align to some extent with the well-known progressive loss of episodic details associated with a memory (Tulving, 1972). More particularly, the remembering–imagining system reveals that fewer episodic details are recalled and with more general representation of older memories compared to recent memories (Conway et al., 2016), as they rely on high-level schema due to increased temporal distance from the past (Trope & Liberman, 2010). Contrary to personal memories, in the context of collective memory studies little is known about the specificity of memories. Up to this day, to the best of our knowledge, there are no studies that examined the episodicity of personal and collective information retrieved about the same public event. The closest analysis to ours is from a study revealing that personal memories tend to be more specific, in the sense of referring to unique events that occurred within 24 hours, than public event memories (Abel & Bernsten, 2021). Therefore, Study 1 provides some original insights into the

specificity of lived collective memories. However, we also acknowledge that further analyses of Study 1 will provide information about the episodicity of personal and collective memories related to lived collective events. Indeed, we reported only the degree of details of the narrative as a whole.

More work needs to be conducted to test the hypothetical cognitive model of collective memory and the constructive processes underlying that structure. For instance, future research should focus on the influence of cues in the activation of representation in memory of collective events, such as studies in autobiographical memory (Robin & Moscovitch, 2014). This could shed light on how collective memories are reconstructed by building on episodic details and higher-order knowledge levels (Conway et al., 2019). Additionally, we propose that examining the episodic details level should be done on lived collective memories, and not distant collective memories, as it allows us to examine memories from their initial creation and first moments of consolidation, as opposed to distant collective memories. Finally, the novelty effect known to enhance episodic memory (Fenker et al., 2008; Tulving & Kroll, 1995) might provide some insights into the differences we observed between the pandemic and the political events. Contrary to the political events that are expected (e.g., every four years for the Presidential elections), the COVID-19 pandemic appeared as a unique and novel event. We suggest that future studies should also consider that dimension.

2.2 The collective knowledge level

2.2.1 General memories

In our first study, we found that the passage of time influenced the type of information retrieved about lived collective memories, as more personal and collective information was recalled in 2021 than in 2022. However, the decrease in personal and collective information was also influenced by the personal importance of the event (examined through the event type). In 2021, memories of the pandemic were recalled with more personal than collective information. With time both decreased but more so for the personal information, which was recalled to the same extent as collective information in the second interview. Regarding political memories, the number of information decreased with time, but the decrease was similar for personal and collective information, with the latter dominating in 2021 and 2022. The influence of the passage of time on lived collective memories (personal and collective information) is consistent with general theories in episodic memory such as the decay theory that suggests that memories naturally fade over time, leading to a progressive global decrease in the amount of recalled information (for a review, see Hardt et al., 2013; Sadeh et al., 2014).

Up to this day, the distinction between personal and collective information related to collective events has been made through the distinction between lived and distant collective memories. Results have shown that lived collective memories are recalled with more personal memories associated with the events compared to distant collective memories (Merck, 2020; Muller et al., 2018). By examining both personal and collective information related to a lived public event in 2021 and 2022, our findings provide a new perspective on the construction of lived collective memories. More precisely, we found that with time memories of the pandemic evolved towards a more collective representation, whereas memories of politics were always recalled from a

collective perspective. Therefore, it seems that lived collective memories are influenced by the self, but more importantly tend to be remembered in a collective perspective, fitting the nature of these events (collective event).

Overall, we found differences in terms of episodic details, and personal/collective information between the pandemic memories and the political memories. The Self-Memory system posits that memories and episodic details are usually forgotten unless they are important for personal goals and values (Conway & Pleydell-Pearce, 2000; Loveday & Conway, 2011). This highlights the influence of the self on autobiographical memory. The influence of the self, through personal importance, is discussed in more detail in section 3.

2.2.2 Collective transitions

Study 2 was built on the Living-in-History effect suggesting that collective events with sufficient effect on daily lives can influence memory organization by constituting temporal landmarks that may be useful for recalling past personal memories (Bohn & Habermas, 2016; Gu et al., 2017; Zebian & Brown, 2014). These transitional events separate different lifetime periods (Bohn & Habermas, 2016; Brown, 2021, 2023). In our second study, we examined the extent to which the COVID-19 pandemic could be used as a temporal landmark when recalling personal memories, which would provide evidence that the COVID-19 pandemic constitutes a transitional event. At the time when Study 2 was conducted, we hypothesized that the COVID-19 pandemic had strongly affected our lives as we were still affected to some extent by the pandemic. Thus, these events could be used as temporal landmarks that help to organize autobiographical memory. However, Study 2 failed to provide sufficient evidence that the COVID-19 pandemic acts as a collective transitional event (Brown, 2021), contrary to a recent study revealing that the COVID-19 pandemic served as a temporal landmark for personal memories related -or not- to the

pandemic (Ekinci & Brown, 2024). However, our study focused on participants aged between 18 to 40 years, while Ekinci & Brown (2024) focused on two groups of first-year university students, who graduated high school during the pandemic, which is also known to be an important personal event (Thomsen, 2009), making them more likely to use the pandemic as a temporal landmark. Moreover, that study asked participants to recall memories of personal events for periods that happened between September 2019 and December 2020 or from January 2020 to April 2021, depending on their groups, while in our study the period from which participants could retrieve memories was 5 years. The difference in time windows and age of participants between studies could explain to some extent the different results.

While our study did not confirm the hypothesis of the pandemic influencing the organization of personal memory, it opened valuable perspectives. Notably, it highlighted the importance of considering the period when examining collective events as transitional events, as seen with the inconsistent findings on collective memory transitions in the case of the pandemic. Some results revealed that older adults are more likely to choose personal events as transitional events, due to a longer lifespan perspective (Bluck et al., 2016; Luchetti & Sutin, 2018). Based on that we assume that the time perspective influences the use of collective events as transitional events. Therefore, examining this effect from a longitudinal perspective (at different time points) would help to understand the creation of collective transitions. Initially, we hypothesized that young adults might need more time to situate collective events as transitional events in a broader context - a lifespan perspective-. Yet recent results are not congruent with this hypothesis, as they revealed that young Americans referred to the COVID-19 pandemic as a transitional event, but it seems to be explicable if the collective event happened around personal events such as graduation (Ekinci & Brown, 2024). Additionally, our results stress that future research should explore how collective transitions influence

not only autobiographical memory organization but also collective memory organization. More precisely, how would groups refer to a collective event in the story of their group? For instance, could the death of George Floyd in the USA constitute a transitional event in the long period of racism against black Americans? (e.g., My community, Afro-American, lived with highly racist behaviors in daily life until there was the death of George Floyd which led to the rebirth of the Black Lives Matter movement). We propose that examining how collective transitions influence collective memory organization would provide more evidence at the collective knowledge level.

2.2.3 General and underlying schemas

In this thesis, we did not investigate the existence of collective schemas/scripts known to act as expected events that help to organize memory from a lifespan perspective (Berntsen & Rubin, 2004; Shanahan & Busseri, 2016) (see Figure 1 autobiographical knowledge component). However, we examined the use of schemas using schematic narrative templates, which are considered to act as prior knowledge that helps to organize how memories are recalled (Bartlett, 1932; Wertsch, 2002). We examined memories as narratives built on three blocks of information: the context, the causes, and the consequences (Studies 3 and 5), or the context, the events, and the resolution (Study 4).

By using this method, we found subtle effects on memory. In Study 3, our results revealed that older adults recalled more the consequences of a real public event than younger adults. Similarly, this method allowed us to find in Study 4, that younger adults share more similar representations for each block of information compared to older adults. Additionally, using that narrative template gave us insight into the presence of a serial position curve in collective memory in terms of similarity and not the number of details recalled. Indeed, results from our Study 4 showed that participants had more similar memories

about the beginning (the context) and the end (the resolution) of the story than the middle (the events) (Abel & Berntsen, 2021). Accordingly, we also found subtle effects of social identity on lived collective memories. In Study 5, we observed that Americans recalled the consequences of the Capitol riots more similarly than Belgians, and Belgians recalled more similarly the context and the causes compared to Americans.

While the specific effects of aging and social identity are discussed in section 3, we highlight here the originality of a micro-level examination. These specific findings would not have been possible if the memories were examined through the classical method of investigation based on the sum of details recalled (Sekeres et al., 2016). To some extent, the classical method of investigation neglects that the narrative schemas, acting as prior general knowledge, play a crucial role in memory organization, which can influence the recall of past experiences (Bartlett, 1932; Wertsch, 2002, 2008). In our studies, examining memories as information built on narrative schemas allowed us to combine an examination at a general level (total of details recalled) and a deeper level (details recalled by building blocks).

2.3 Collective future thinking

In Study 1, we examined collective future thinking by asking participants to imagine a future pandemic in ten years and the future EU dissolution in ten years. Results revealed three findings: more episodicity when imagining a future pandemic than a future political event (1), more collective than personal thoughts about future events (2), and the themes related to a future pandemic were similar to the ones recalled about the past pandemic (3).

The higher episodicity for the future pandemic compared to the future political event corresponds to the fact that future thoughts about a pandemic were more episodic than thoughts about the future EU dissolution. This result is

important as it brings evidence that participants might have used information about specific events to simulate what could happen in the future if a pandemic occurred again in 10 years. Moreover, our results highlighted that thoughts about a future pandemic were influenced by past experiences, which were characterized by direct reference to the past through topics reflecting the desire to "learn from the past", and more generally by imagining themes that were similar to the one recalled about the past pandemic, such as daily life impacts, hospital and medical management, and politics. This finding is consistent with other studies revealing similarities between themes recalled and imagined at the collective level (Michaelian & Sutton, 2017; Öner et al., 2023; Öner & Gulgoz, 2020; Topçu & Hirst, 2020). Overall, our results indicate that future thoughts draw from memories, tapping into both episodic and semantic collective memory, which is consistent with theories highlighting links between the past and the future such as the remembering-imagining system and the constructive episodic simulation theory (Conway et al., 2016; Conway et al., 2019; Hirst & Manier, 2008; Schacter & Addis, 2007). Surprisingly, some topics imagined in 2021 about a future pandemic were topics recalled for the memories of the pandemic in 2022 and not when they recalled it in 2021, such as the importance of political relationships with other countries. While we found evidence of how the collective future relies on the collective past, this specific result highlights the reconstructive and adaptative nature of collective memory (Mahr & Csibra, 2018).

More precisely, regarding the adaptative nature of collective memory, topics reflected the desire to learn from the past for better adaptation. This directly refers to the directive function of memory (Bluck et al., 2005; Burnell et al., 2023; Heux et al., 2022). Moreover, this is consistent with the notion that shared memories are used to help societies to avoid making the same mistakes (Gensburger & Lefranc, 2020). Heux et al. (2022) discuss this function as the political function of collective memory. They argue that the collective past of

violent events such as war can be promoted for peace and tolerance at a societal level, but the same memories can be used to trigger hate and intolerance. Here we share the same interpretation of the function, but contrary to the current theories that drive their interpretation in a political context, we argue that it is a societal function beyond the political context.

Furthermore, people's predictions about future public events were more group-based than individual, which is characterized by more collective information than personal information for future events. This is important considering that during the task participants were not asked specifically to imagine collective events related to these future public events. Our results highlight more concerns about the community's actions than individual actions. Building on the tendency to imagine future public events with a collective view, we propose that future research should focus on the influence of collective identity both in the examination of collective memories and the examination of collective future thoughts. In our model, we hypothesize that collective identity influences collective memory (see Figure 1). However, based on the results of Study 5, it seems that it is not the collective identity (nationality) that influences collective future thinking, but there rather might be an underlying link involving variables enhancing the creation of flashbulb memory and collective future thinking. More precisely, in Study 5, participants who formed flashbulb memories for the Capitol riots believed that the event would be remembered more in the future, that the government should make more efforts to remember the event in the future, and that there could be a similar attack on the Capitol in the future. National identity did not interact with these patterns, and more importantly, there were no overall differences between Americans and Belgians. The influence of social identity is discussed in more detail in section 3.

2.4 Influence of the current context on collective memory

Memory, known for its dynamic nature especially in reconstructing past social and political events, can be heavily influenced by the social context, governed by cultural and social norms (Bartlett, 1932; Bietti, 2010; Halbwachs, 1950; Roediger & Abel, 2015). Collective memory studies usually examine public events. These events encompass societal and emotional influences that vary with time. Therefore, the current societal context during memory recall may differ from the context in which events were initially experienced. Yet, surprisingly, the influence of the social context on the construction of memories and future thoughts is often overlooked.

2.4.1 Influence of the societal context on collective memory

In this thesis, we discuss the influence of the current context at a societal level through the results of Studies 1 and 2. In Study 1, participants were asked to recall the COVID-19 pandemic that happened in 2020 at two time points. It would be reckless to not consider how the Belgian social context has evolved during the year 2020 with several lockdowns, one of which continued during the year 2021 (first interview), while no other lockdowns were imposed in 2022 (second interview). In fact, around mid-2021, restrictions related to the pandemic were mostly abandoned by the Belgian government. More importantly, the news of the vaccines was already out, and the first vaccines were administrated, which alleviated the anxiety associated with the pandemic giving some hope to people (Metzler et al., 2023; Monselise et al., 2021). For sure, remembering the pandemic in an anxious context is different from remembering the pandemic when the consequences of the event are reduced, such as in Study 1 two years after the event. At the individual level, the influence of the current situation on memory retrieval is well documented, as evidenced for instance by studies priming emotions in laboratory settings (Hansen &

Shantz, 1995; Kensinger & Schacter, 2008). At the collective level, research provides robust evidence that the current societal context significantly influences the creation of shared memories (Cole et al., 2023; Lanciano et al., 2024; Niziurski & Schaper, 2023; Öner et al., 2023). For instance, the strength of governmental measures during the pandemic impacted memories of that period (Öner et al., 2023). In a recent study, Öner and colleagues (2023) found that participants residing in countries where the severity of governmental measures was high during the pandemic recalled more events about politics and infections, whereas participants from countries with low severity of governmental measures reported more events related to travel, culture, lockdown and health. Moreover, people from countries with high severity governmental rules reported up to 9 times less events related to death compared to participants from low and medium severity. To some extent, that might have influenced the type of words used to recall the event in Study 1, as we found more words related to anxiety in memories of the pandemic in 2021 compared to 2022.

In the same logic, imagining a future pandemic similar to the one we lived one year before in a context that still encompasses the consequences of such events, is different from imagining a future pandemic years after it happened. Similarly, for instance, imagining a future war in the context of a current war is different than imagining a future war while our country is at peace, and never went under extreme conflicts (Tabaszewska, 2023).

2.4.2 Influence of social interactions on memory

Study 4 provides evidence of the influence of the social context on memory. Because all the previous studies relied on individual interviews, without considering the interview characteristics, we conducted a new study to first control the rehearsal variables through the unique view of a TV series episode. Then, building on the communication accommodation theory, we aimed to test and control the audience effect by recalling memories either to a young adult or an older adult (Giles & Ogay, 2007; Horton & Spieler, 2007). The originality of the study is to consider age effects on memory similarity rather than only the amount of details recalled as a traditional assessment. Our results indicated that participants had more similar representations in memory when recalling the story to an old listener compared to a younger listener (Adams et al., 2002). These results seem to suggest that all individuals (younger and older adults) align their memories of the fictional event to share a similar story to an older adult, which might be explained by the influence of ageism stereotypes activated in the social context (Adam et al., 2013). In other words, the social context, activating ageism stereotypes such as older adults having bad memory, might have modulated the similarity of the memory they would like to share with older adults (Adam et al., 2013). This similarity might reflect the selection of key story elements by all participants.

In this thesis, we did not thoroughly examine social interaction's influence on collective memory. From a functional approach to memory, it is important to highlight that sharing memories in communities helps to create or strengthen relationships within the group, or with other groups (Burnell et al., 2023). Additionally, storytelling through narratives helps to create and transmit collective memories (Bruner, 1990). From a cognitive perspective, this recall also reinforces this information in individual memory (Roediger et al., 2009). Participants in Studies 3 and 5 were asked to report how many times they

discussed the events with other people. In Study 3, we found that the more participants talked with other people about the bridge collapse, the more they recalled details about that public event. On the other hand, it did not influence the creation of similar representations in memory. In Study 5, we found that the more people talked about the Capitol riots the more likely they were to form flashbulb memories related to that event, independently of their nationality. Contrary to Study 3, we found that the number of people Americans talked with influenced the similarity of representation of the consequences of the Capitol riots. More precisely, the more Americans discussed these events with others, the more similar were their representations of the consequences. While we provide some evidence of the social context and interaction influence on collective memory, it is worth noting that several other processes are in play like shared attention, social contagion, conversations, shared reality, subjective state, and expertise (Heux et al., 2022; Roediger & Abel, 2015).

3. Variables influencing collective memory construction

Through several studies, we aimed to unravel the influence of aging, personal importance, and social identity in shaping collective memories. The following section discusses previous results and offers nuanced interpretations of the age effects on collective memory. The exploration of personal importance is discussed drawing on the outcomes of Study 1, underscoring the imperative for a more cautious examination of this variable. Crucially, the role of social identity is presented as a linchpin in our understanding of collective memory dynamics. While the realm of emotions and media remain globally uncharted territories within this thesis, we suggest that some results could be interpreted by considering their influence on collective memory. This strategic inclusion enhances the comprehensiveness of our research and reflects our commitment to a holistic exploration of the multifaceted nature of collective memory (see

Figure 2). We believe this comprehensive approach contributes to the robustness of our findings, encouraging readers to appreciate the depth and intricacy of collective memory.

3.1 Age effects on collective memory

Studies 3 and 4 aimed to examine age effects on collective memory. Age effects are discussed in terms of episodic details, and more originally by employing the inter-subjects similarity method we created. The discussion extends to novel perspectives on age effects concerning future thinking and flashbulb memories.

3.1.1 Aging: the amount of information, similarity, and narratives

Despite the well-known episodic memory decline with aging revealing that older adults recall less episodic details and more the gist of the memory compared to younger adults (Balota et al., 2000; Brainerd & Reyna, 2002; Levine et al., 2002; Piolino et al., 2002), our studies revealed that age differences in episodic details and the amount of information in memory varied as a function of the nature of the event to remember. In Study 3, there were no significant differences between younger and older adults in terms of the amount of details recalled about the bridge collapse in Italy. Conversely, findings from Study 4 aligned with the typical pattern, as younger adults recalled more episodic details for a fictional story (i.e., the video of a TV series episode) than older adults (Balota et al., 2000). Moreover, we provide another perspective to apprehend age effects on memory through the examination of inter-subjects similarity. As a reminder, the method shows the extent to which representations in memory are similar within a group, compared to another group. Our results from Study 3 indicated that aging does not influence the similarity of the representations in memory for a public event. We found that older adults recalled as similarly the memories of the bridge collapse in Italy, as younger adults. Contrary to results

from Study 3, in Study 4 we demonstrated that young adults share more similar representations of a fictional story than older adults.

Overall, we hypothesize that the differences in event nature (real or fictional), the recall timeframes that were different between studies (5 minutes or months after the events), and the length of memories recalled (one year of pandemic, or 1 hour of a TV show) may contribute to the differences in episodic memory decline.

As seen previously, a specific investigation of memory based on narrative schemas is important as it can reveal specific effects that might not be seen through the classical method of investigation. In line with the notion that memories are constructed coherently, based on narrative schemas, results from Study 3 revealed that older adults emphasized the consequences of the bridge collapse more than younger adults, while the total of information recalled did not provide evidence of age effects on memory. This result is crucial as it highlights how recalling memories can be influenced by socio-emotional effects in aging. More precisely, the socio-emotional theory of aging considers that older adults, perceiving a shorter time horizon, reappraised a situation with a more positive and social perspective (Carstensen, 2021), which seems to enhance emotional empathy and prosocial behaviors (Beadle et al., 2015). Therefore, we can assume that because of this enhanced emotional empathy, older adults recalled more the consequences of catastrophic public events that impacted other people's lives. Additionally, we also found that older adults used more positive words when recalling the fictional event in Study 4 compared to younger adults, revealing a more positive interpretation of the TV episode. This is also consistent in our additional results from Study 1 where older adults mentioned more positive emotions than younger adults, but younger adults

mentioned more anger than older adults about their memories of the pandemic and the political event of 2020[20].

While our results focus on the content of memories, it is worth noting that there also exist phenomenological differences with aging, as the sense of reexperiencing events diminishes in older adults compared to younger adults (Comblain et al., 2005; Rubin & Berntsen, 2009), whereas the vividness of memories is rated higher for older adults compared to younger adults (Folville et al., 2020). To the best of our knowledge, this aspect of age-related differences has not been explored in the context of collective memory and should be assessed in future studies (see Topçu & Hirst, 2020 for the examination of collective memory phenomenology).

3.1.2 Aging and flashbulb memories

Age effects on flashbulb memories were examined in Studies 3 and 5. In Study 3, we did not find evidence of age differences in flashbulb memory creation for the bridge collapse in Italy. This means that younger Belgians did not remember more than older Belgians, for instance, what they were doing, where they were, and what they were thinking about when they learned the news about the bridge collapse that happened in Italy. However, in Study 1[21], additional

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Age effects analyses were computed based on three age groups (young, middle-aged, and older adults).

[20] Main effects of age were found for the emotion category for positive emotions (Q = 15.32, p =.001), anger (Q = 21.32, p =.001), and anxiety (Q = 11.84, p = .004). Post hoc tests revealed that older adults (M = 2.27, SE = 0.05) mentioned significantly more positive emotions compared to young adults (M =1.98, SE = 0.05), psihat = 0.29, p <.001, $95\% CI$ [0.12, 0.46]. Post hoc tests found that younger adults used more anger-related words (M = 0.40; SE = 0.03) than older adults (M = 0.24; SE = 0.02), psi-hat = -0.16, p <.001, $95\% CI$ -0.24, -0.07].

[21] Results show a significant effect of the groups on the formation of reception memories (RC) and flashbulb memories for the lockdown (FBMs)(Q = 6.68, p =.04). Robust post hoc tests revealed that older adults formed significantly less flashbulb memories than younger adults (psi-hat = -0.26, p = .02, 95% CI [-0.52, 0.005]). No significant differences were found between middle-aged and older adults (psi-hat = 0.13, p = .41, 95% CI [-0.25, 0.52]), or between middle-aged and younger adults (psi-hat = -0.13, p = .30, 95% CI [-0.42, 0.17]).

results revealed that younger Belgian adults formed more flashbulb memories about the lockdown announcement than their older counterparts. In other words, this means that younger adults remembered more than older adults, where they were, what they were doing, with whom they were, and what they thought when they heard the news about the lockdown. Considering flashbulb memory creation as a potential marker for future historical events (Luminet & Spijkermans, 2017), we propose a link between the time perspective (shorter for older adults) and flashbulb memories. Building on an adaptative comprehension of this phenomenon we suggest that young adults, with a longer lifespan in front of them and therefore more likely to see an event become historical, are more inclined to form flashbulb memories.

3.1.3 Aging and future thinking

Based on the influence of time horizon on memory with aging, a pertinent question arises: How does the limited future time perspective influence the creation of personal and collective future thoughts about public events? Interestingly, additional analyses conducted in Study 1 [22] did not find age differences in the content of future thinking (episodic details and proportion of collective information). However, our findings from this study align with a nuanced age-related pattern in emotional expression about future events, where young adults expressed more negative emotions (anger) and more positive emotions than older adults[23]. This divergence resonates with existing studies revealing inconsistent findings about age effects on future thoughts. In

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[22] Results did reveal a significant effect of age groups for internal details (Q = 2.91, p = .24), external details (Q = .85, p =.09), episodicity (Q = 0.39, p= .83). Regarding the proportion of collective information, no significant of age groups was found (Q = 3.86, p =.15)

[23] Main effects of age were found for positive emotions (Q = 6.97, p = .03), and negative emotions (Q = 6.63, p = .04). Post hoc test revealed that younger adults referred significantly more than older adults to positive emotions (*psi-hat* = -0.40, p = .04), and negative emotions (*psi-hat* = -0.25, p = .03).

line with our results, one study found that the narrative of neutral future events encompassed more anxiety-related words in narratives from younger adults compared to older adults (Steinbicker et al., 2018). Another study found that aging influences the emotional valence of memories, but not future thoughts (Oner & Watson, 2022). This divergence in emotional expression for imagined events could be explained using different methods and analyses and needs further exploration as there is a limited exploration of future thinking in aging.

In summary, the combined results and hypotheses offer a fresh perspective on age-related decline in memory. It underscores the importance of adopting a multi-analytical approach (considering episodic details, type of information, and the similarity of memories), accounting for event nature (real or fictional), and acknowledging the influence of psycho-social variables. This holistic approach might reveal the impact of a more social and positive reappraisal of memories and future thinking at a collective level, in the aging process, as still little investigation is available on age effects and collective memory.

3.2 The personal importance effect of collective memory

This thesis explored personal importance in Study 1 at two levels, investigating the impact of two collective events with varying societal implications for Belgians: the pandemic and a political (American) event (collective level), and examining the influence of the pandemic on daily life, psychological well-being, and so on (individual level). As seen in section 2, the findings revealed that the personal importance at the collective level shaped the type of information recalled (personal/collective) as we found more personal and collective information recalled for the pandemic than the political events. Additionally, it influenced the episodicity of memories over time, as memories of the pandemic were richer in episodic details, which was not the case for

political memories. On the other hand, the impact at the individual level was associated with memory content through the words used in recalling memories in 2021, as we found correlations between daily life impacts and COVID-19 contact with the use of words related to negative emotions and anxiety, while the psychological impact related to the COVID-19 virus and the COVID-19 contact correlated with words related to anger.

Although initially labeled as "personal importance", we acknowledge that this term may not fully capture the variability in the influence of public events on collective memory. For instance, in Study 3, we examined the emotional impact of the bridge collapse in Italy. Focusing solely on the event's occurrence in Italy overlooked certain aspects of personal importance. Indeed, some Belgians might have been personally impacted by the events happening in Italy because they had family and friends there or were used to traveling in that country. This led us to explore the influence of social identity on collective memory in Study 5, revealing the impact of nationality and geographical distance on lived collective memories and flashbulb memories. Both studies highlight how the concept of "personal importance" can include different dimensions at individual and collective levels. Therefore, this concept should be examined carefully, by encompassing the impacts of the collective event at both personal and collective levels. This new approach has been adopted by recent research examining the global and personal importance of collective events during the COVID-19 pandemic (Cole et al., 2023). This dual perspective allows for a comprehensive understanding, acknowledging the complexity of influences on memory.

Considering the impacts of collective events, we emphasize the importance of two distances: psychological and physical. Physical distance, referring to the fact that events were lived or heard about, leads to different memory patterns (Gold, 1992; Pezdek, 2003). In this thesis the physical distance

was examined through the type of event (pandemic vs political memories) in Study 1, and through the nationality in Study 5 (which is discussed specifically in section 3.3). In Study 1, Belgian participants mainly chose to recall an American political event (the presidential campaign in 2020). Therefore, the political event has a greater physical distance than the pandemic in 2020 for Belgian citizens. We found greater episodicity for the pandemic than the political memories. We also found more personal and collective information recalled about the pandemic than political memories. Moreover, we found specific differences in the type of words people used to talk about the pandemic memories compared to political memories, with the recall of the pandemic being associated with more use of first singular and plural pronouns, references to family and friends, positive emotions and anxiety, cognitive processes, and finally, as expected, for references to the COVID-19 pandemic. All these findings are consistent with previous results highlighting that direct involvement results in more memories, rather than not being involved and hearing about it from the media (Er, 2003; Larsen & Plunkett, 1977; Neisser et al., 1996; Pezdek, 2003). For example, New Yorkers remember more accurate details about the events related to the 9/11 attacks compared to participants from the East Coast and Hawaii (Pezdek, 2003).

  This distance to the event can also be viewed as a continuum, allowing for a nuanced understanding rather than a dichotomous perspective. The distance continuum accounts for various psycho-social processes that influence proximity. For instance, Neisser (1996) found that participants who knew family members who experienced a public event remembered it better than participants who had no connection to it. Therefore, while psychological distance often aligns with physical distance, it is crucial to acknowledge that in our interconnected world, psychological proximity can override the influence of physical proximity (Hoskins, 2011). In Study 1, we found that the impact at the individual level was associated with memory content through the words used in

recalling memories in 2021, as we found correlations between daily life impacts and the use of words related to negative emotions and anxiety, while the psychological impact related to the COVID-19 virus correlated with words related to anger. Additionally, links between memory and the collective importance have been made by Tekcan et al. (2017) in a study that showed that memories retrieved during the reminiscence bump period encompass more public events that are important for the collective memory of the group. In tandem with the extensive research on flashbulb memories, the examination of collective memory must include an exploration of the concept of consequentiality (see Rice et al., 2017 for a review). In Study 5, we found a link between consequentiality and similarity of memory of the context in Belgians. As demonstrated in Study 5, we advocate for consistently examining the consequences of collective events at both individual and collective levels. This approach ensures a comprehensive understanding of how the perceived importance and impact of the events influence memory processes, which can also be associated with the group identity to some extent.

3.3 Identity effects on collective memory

This thesis sheds light on the influence of collective identity on collective memory, revealing a significant impact of national identity in shaping lived collective memories. This link is built on two main findings from Study 5. First, we found that nationality influenced the similarity in recalling the consequences of the event, with Americans exhibiting greater inter-subjects similarity in recalling the consequences of the Capitol riots compared to Belgians and Belgians reporting more similar memories regarding the causes and events compared to Americans. Then, our results, consistent with other studies, found more flashbulb memories reported by Americans than by Belgians (see Berntsen, 2017). Additionally, our results from Study 1 highlight that collective events and memories might influence personal identity. This is evidenced by

results from the centrality of event scales completed after recalling or imagining a pandemic or a political event, by which participants reported a significant integration of pandemic events into their identity, whereas it was not the case for the political event.

In other words, expanding on studies demonstrating how social identity influences vivid memories of the context of learning about public events (Luminet & Curci, 2017), our results suggest that collective identity plays a pivotal role in shaping collective memory, akin to how personal identity (the self) influences individual memories (Conway, 2005). This association can be extended to how collective memory influences group representation across time (the past, the present, and the future) (Liu & Hilton, 2005). Simultaneously, collective memories contribute to a sense of continuity in the community and sustain the group identity (Heux et al., 2022; Reese & Whitehouse, 2021).

Related to collective identity and the future, in the case of the COVID-19 pandemic, some researchers hypothesized that the COVID-19 pandemic might not be remembered in the future as a historical event since it does not bear on the collective identity (Hirst, 2020). In Study 1, we found that two years after the events Belgians recalled fewer memories about the pandemic than one year after the event, but still recalled personal and collective memories about the pandemic (more than for the political event). More precisely, two years after the events Belgians still recall memories of the pandemic in detail and reconstruct a more collective representation of these events. Additionally, most participants formed flashbulb memories of the lockdown announcement. As some research suggests, the creation of flashbulb memory could be a marker of future historical events (Luminet & Spijkerman, 2017). Our study provides evidence that the COVID-19 pandemic might constitute a historical event and bear on the group's identity, confronting Hirst's hypothesis. Yet, we do not exclude that a longer longitudinal approach (e.g., in ten years) might bear on Hirst's hypothesis.

In summary, this thesis suggests a link between collective memory and collective identity, and collective memory and personal identity.

3.4 Emotions in collective memory

Due to the emotional characteristics (negative) associated with public events examined in this thesis, participants were asked to assess how they felt about the event they were asked to recall. Several emotions were examined such as surprise (strongly associated with flashbulb memory formation), joy, pride, and so on. Therefore, emotions were examined at the individual level. We did not find correlations between emotions and the similarity of lived collective memories of the bridge collapse in Italy (Study 3) nor between emotions and the similarity of representations of the Capitol riots (Study 5). However, we found a correlation between emotions and collective future thinking for both Belgians and Americans (Study 5). We also explored emotions through the lexical content and found age differences in Studies 1 and 3, as previously discussed. Exploring the influence of emotions on collective memory is a crucial variable, necessitating consideration of several dimensions. Firstly, emotions can be examined at the memory level, evaluating the positive and negative valence of memories. Secondly, the examination of emotions can be done at the individual level by examining individual-focused or group-based emotions, considering the collective emotional experience of a group (Sullivan, 2015).

3.4.1 Emotion valence of memories and future thoughts

The influence of constructive processes on memory is also evident through emotional biases at personal and collective levels, impacting both memories and future thinking (D'Argembeau et al., 2011; Shrikanth & Szpunar, 2021; Topçu & Hirst, 2020). Recently, Adler & Pansky (2020) reviewed the positivity bias in memory, a well-known phenomenon revealing that individuals

typically have a more positive perception of the past for personal memories, remembering more good than bad experiences. This positivity bias in memory extends to future personal thoughts -called optimism bias-, which are imagined more positively than negatively (D'Argembeau et al., 2011). At the collective level, collective memories recalled are usually more negative than positive events, while studies on the collective future still yield inconsistent findings (Migueles Seco & Aizpurua Sanz, 2024; Niziurski & Schaper, 2023; Shrikanth & Szpunar, 2021; Topcu & Hirst, 2020). Of note, this negativity bias in collective memories is not surprising considering that generally, public events that we most often talk about are negative in valence (Soroka & McAdams, 2015). Regarding the emotional bias in collective future thinking, researchers suggest the influence of other variables such as agency, and culture to understand the inconsistent findings (Liu & Szpunar, 2023; Topçu & Hirst, 2020). This new perspective pinpoints the need to develop a multi-dimensional analysis of collective memory.

3.4.2 Individual vs group-based emotions

The emotion enhancement memory effect refers to the influence of emotion enhancing memory processes (Kensinger & Ford, 2020). In Studies 3 and 5, our results did not reveal a link between the emotions felt about a public event and the similarity of representations in memory for the bridge collapse in Italy and the Capitol riots. While we examined emotions at an individual level in our studies, we believe that there is a necessity to examine both individual and group-based emotions in the context of collective memories. While much exploration of emotions' impact on collective memory has focused on flashbulb memories (see Luminet & Curci, 2017 for a review), there remains a gap in understanding how individually and collectively felt emotions influence the creation of collective memories.

At the collective level, emotions can be triggered by one's identification with a group. Group-based emotions are individual emotions such as anger, guilt, shame, and pride associated with ingroup behaviors (Doosje et al., 1998; Figueiredo et al., 2016). For instance, studies show that the more one identifies with ones' group, the less one feels guilty about the wrongdoing of the group (Doosje et al., 1998). Social psychologists have been interested in examining how social identity influences group-based emotions, whereas cognitive psychologists examine collective emotions through individual emotions in a group (Goldenberg et al., 2020). The combination of both perspectives could provide a comprehensive understanding of the intricate interplay between emotions, identity, and collective memory processes.

3.5 Cultural artifacts: media

In this thesis, the COVID-19 pandemic, the presidential American election, the Black Lives Matter movement, the Morandi bridge collapse in Italy, and the Capitol riots in the USA were all public events shared worldwide by the media. Studies 1, 3, and 5 examined media frequency. Findings from Study 3 revealed that the media frequency correlated with the amount of details recalled. In Study 5, we found that the more Americans watched the media, the more similar their representations about the consequences of the Capitol riots were. We also found that media frequency was associated with the formation of flashbulb memories about the Capitol riots in both Belgian and American groups. Overall, it underlines the significant influence of media on collective memory and autobiographical memory.

Public events, whether historical or recent, are often framed and discussed through cultural artifacts, with media playing a pivotal role in shaping collective memory. Mass media serves as a powerful tool in creating shared realities across groups, societies, and nations (Neiger, 2007). In contemporary

society, mass media, distinguished by its visual and dynamic aspects, has become a primary means through which individuals make sense of the past (Kitch, 2006). The constant richness of visual and dynamic elements in mass media influences significantly the construction of collective memories (Matei & Ball-Rokeach, 2005).

While we already discussed media influence on lived collective memories, Study 5 also provided evidence on links between media frequency and collective future thinking. Indeed, the more participants checked the media for news about the Capitol riots the more they thought that that event will be remembered in the future, that the government should make an effort to remember the event in the future, that there will be a similar attack in the future. Therefore, it seems that the media's impact extends to temporality, engaging with both the past and the future (Gülüm, 2024). This duality is reflected in the reverse temporal process (Gibson & Jones, 2012), and prospective memory (Tenenboim – Weinblatt, 2013), as it allows us to envisage future events building on past and present events (Gülüm, 2024).

Rehearsal, a fundamental cognitive process, plays a crucial role in the formation of collective memories. In cognitive psychology, media is studied as a variable that enhances memorization through rehearsal, particularly in flashbulb memory studies (Hirst & Meksin, 2017). Furthermore, interaction on social media platforms has been shown to influence memory (see Marsh & Rajaram, 2019). Media consumption influences collective memory through social digital remembering, modulating the formation of collective memory (Barnier & Sutton, 2008; Erll, 2011; Greeley et al., 2022; Hirst & Echterhoff, 2012; Öner et al., 2023; Wertsch & Roediger, 2008). For instance, research demonstrated that only 6% of the news headlines were remembered by participants when they were asked to recall them the same evening (Neuman, 1976). The ability to remember news has been related to motivation and the

ability to process single news items (Eveland, 2001), highlighting links with the self.

New media, according to Wang (2008), has the potential to influence the narratives held by groups about the present and the past, thereby impacting collective identity. How these narratives are shared through media is also subject to the influence of nations and cultures (Hagström & Gustafsson, 2019). Wertsch (2021) recently discussed how different governments lead to different collective memories. Additionally, media can be a source of misinformation and fake news (Lim et al., 2024), underlying the importance of culture in collective memory (Rajaram, 2022; Wang, 2021). For instance, it is well known that American news TV channels are politically oriented which is seen through the narratives relating a TV news (Cassino, 2016; Dunaway & Graber, 2022). Understanding the intricate interplay between media, culture, and memory is essential to understanding how collective memories are constructed, shared, and perpetuated in contemporary societies.

4. Future perspectives

Collective memory gained interest in psychology over the past two decades, with teams all over the world focusing on understanding cognitive processes, cognitive architecture, and functions associated with collective memory. Integrating cognition and ecological perspectives has resulted in a comprehensive approach to memory. In this section, various ideas related to the theoretical framework and methods are presented and linked to a new model presented in Figure 2.

Figure 2

Key variables to consider in the investigation of collective memory
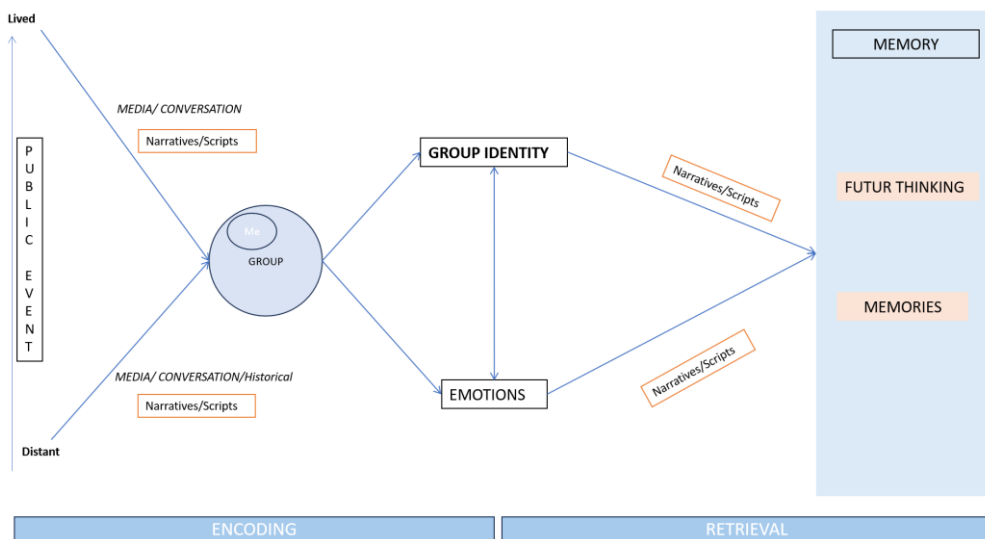
Definitions. A general remark is linked to the necessity to use consistent definitions for the same concepts – avoiding umbrella terms- addressing the potential interchangeability of terms like event memories, shared memories, and collective memories (Roediger, 2021). The distinction between collective identity and social identity, often used interchangeably, requires attention as well.

Memory processes. Regarding memory processes, we emphasize the need to examine how people encode events. As proposed in the model (see Figure 2), a specific examination of variables influencing encoding and post-encoding steps of memorization is needed, as it has been done for flashbulb memory creation (see Luminet & Curci, 2017). We suggest focusing on media as influencing both encoding and retrieval processes in memory. This could help to understand why some memories of public events make it to long-term memory, while others do not.

Nature of collective events. Future research should distinguish lived and distant collective memory, as it underlines a crucial distinction between communicative memory and cultural memory (Assman & Czaplicka, 1995). Within lived collective memories, a distinction needs to be made between public events that people personally experienced or heard about. Studies also need to consider that the physical proximity to the event does not encompass personal importance, as a geographically distant collective event can still be considered important or have an impact on one's life. Examining the nature of events is also essential as differences between memories of fictional events such as TV series or real collective events were found in Studies 3 and 4. Overall, these distinctions are also associated with the memory processes including differences in rehearsal and maintenance.

Emotions. Emotions in collective memory must be examined more cautiously. Usually, studies examine the emotions felt at an individual level about a collective event and compute a mean score through the participants as seen in Study 5. Collective emotions are examined as the sum of individual emotions. We propose that the next studies examine how both individual and group-based emotions influence several memory indicators of collective memory. For instance, emotions examined as individual "I feel sad about the Capitol riots." might influence memories and future thoughts differently than

group-based emotions. For instance, results from the following assessment "As an American, I feel sad about the Capitol riots" or "As Americans, we feel sad about the Capitol riots" could lead to different collective memory representations. Additionally, a multi-level method must be applied when examining emotions in memory studies, examining several aspects of emotions such as vividness and arousal (Luminet, 2022).

Group identification. Group identification is an essential variable in collective memory, as seen in the model in Figure 1. Whether it is the group identification with one's family, sports club, political group, or religious group, it must be examined beyond the categorical/dichotomic features (e.g., belonging or not to a group). For instance, studying sports fan groups should go beyond labeling them as fans or non-fans. Group identification is influenced by the social context and timeline (past, present, and future), which should be considered as a variable that varies in degree and depending on the social context (Hirst & Merck, 2020; Merck, 2020; Merck et al., 2020). As seen previously, it influences collective memory (Merck, 2020).

In this model, we hypothesize a strong influence of group identification, mediated by individual and collective emotions, on various facets of collective memory, encompassing content, phenomenology, and temporal dimensions (past and future). This hypothesis serves as a foundational framework for exploring the intricate dynamics of collective memory formation and retention.

Collective memory representations. The examination of collective memory should focus on the temporal dimension, examining both the past and the future. Moreover, future studies should focus on the emotional valence bias of the collective future thinking that yields inconsistent findings. Finally, in this thesis, we focused on the content of narratives using several methods of analysis, overlooking the phenomenology of mental representations. Therefore, a combination of both examinations of the content and the phenomenology in

collective memory might provide additional results (Abel & Berntsen, 2021; Topçu & Hirst, 2020).

As a concrete perspective, my future work will examine how bearing on different national identities (such as the French-Algerian population) influences collective memory (past and future thinking). Group identification will not be based on their nationality as they bear on both citizenships. However, participants will be asked to evaluate the degree to which they identify to Algeria (on a scale from 0 to 100), and to France (on a scale from 0 to 100). This allows for a more precise examination of group identification that varies in degree. Regarding the memory task, to examine both past and future collective thinking, participants will recall memories of the Algerian War and discuss how they imagine a future relationship between France and Algeria. For both the past and the future, participants will be asked to assess the emotions associated with their memories and future thoughts at the individual and collective levels. For instance, "As an Algerian, I feel sad about the War (collective level)" or "I feel sad about the war."

Regarding media influence on collective memory, one future study will examine how different American media that are politically oriented influence the similarity of memories about the same event. Two groups of participants (democrats and republicans) will hear the news from two different media (democrats and republicans oriented). This method allows us to investigate the influence of media values consistent -or not- with individual values, on memories of public events.

In summary, a strong call is made through this discussion for research to examine collective memory from a meta-perspective. Additionally, because of its complexity, collective memory needs to be examined through several dimensions, as presented in Figure 2. This model includes the nature of the collective event by distinguishing between lived and distant collective

memories, real and fictional events, and lived or heard-about events. It also distinguishes between encoding and retrieval memory processes. It focuses on the examination of collective memory temporal dimension (past and future), examining their content and phenomenology. On the left side of the figure, it highlights the links between the self -within a group- and the collective identity in every variable of interest (emotions, group identification, and memory). In brief, as stated previously, collective memory should be examined from a multi-level, multi-component, and multi-method perspective.

5. Autobiographical memory and collective memory: similar but not the same?

This research on collective memory relies on the knowledge of autobiographical memory, presenting several similarities. Thus, it can be easily argued that these types of memory are one unique type of memory (Abel & Berntsen, 2021; Burnell et al., 2023). If they share the same psychological processes, the same cognitive structure, and the same functions, then how are they different types of memory? Several scholars emphasize the necessity to be cautious when drawing on autobiographical memory to understand collective memory (Burnell et al., 2023; Hirst & Manier, 2008; Wertsch, 2002). In this section, we argue that the two types of memory are different by discussing the nature of the events, their formation and maintenance in memory, the cognitive structure and characteristics, their functions, and age effects.

The nature of the memory retrieved is different. Per definition, personal memories are memories of directly experienced events, while collective memory includes memories of public events that we lived or heard about. Therefore, while we experience some collective events, it is not always the case, contrary to personal events. Moreover, collective memories are not just the sum of individual memories. They are the alignment of an individual's memories

across the group, that can bear on the group identity. Personal memories do not need to be shared with others to influence one's identity, contrary to collective memories. While personal memories need to be aligned with one's values and goals, collective memories must align with both personal and the group's goals and values, which depend on social identity and different group levels (family, friends, society, work...). This leads to an important influence of the self component in both types of memory.

Collective memory as autobiographical memory is influenced by rehearsal, which helps to consolidate memory (Roediger et al., 2009). Contrary to personal memories that are rehearsed only mentally and through communication processes, collective memories can also be rehearsed by media consumption, adding constant visual information that is less available for personal memories (e.g., a few photographs about a personal event).

While we found evidence that they might share a similar structure, still more work needs to be done to examine precise processes underlying collective memory. Therefore, the overall cognitive structure might be the same, but memory characteristics can be different, as studies show differences in terms of content and phenomenology. For instance, Abel & Berntsen (2021) found that public events memories were assessed as more negative, less specific, less vivid, and with less feeling of reliving the event than personal memories.

Both memory types serve the same functions but at different levels. At a collective level, memories have broader implications, such as in politics (Heux et al., 2022). Abel & Berntsen (2021) found that public events memories arose less deliberately and spontaneously than personal memories, which could influence the frequency of use of collective memories to fulfill each function (Burnell et al., 2023). Up to this day, we have evidence that personal memories fulfill more the self function and the directive function than collective memories

(Abel & Berntsen, 2021; Conway, 2005; Conway et al., 2019) and that collective memories fulfill the social function (Abel & Berntsen, 2021).

Additionally, aging seems to influence personal and collective memories differently. Memories of public events seem to not be influenced negatively by healthy aging.

In summary, despite apparent similarities, autobiographical and collective memory exhibit nuanced differences across various dimensions, emphasizing the importance of a comprehensive understanding of their individual and interconnected roles.

In this thesis, we explored the world of collective memory through 5 studies. To explore collective memory, we proposed a sociocognitive approach integrating knowledge from autobiographical memory studies.

Lived collective memories were examined as being on a spectrum from episodic details, personal/collective information, and themes, but also in terms of similarity. Overall, we found that lived collective memories were influenced by the passage of time, the collective identity, aging, the importance and impacts of collective events, emotions, and media. We also underlined the influence of the current context, through communications processes.

This thesis brings new perspectives on the cognitive approach of collective memory, by examining personal and collective memories about the same public event, by examining the collective past and future, and by integrating a new view of age effects on collective memory.

While we provide a new perspective to examine memories, in terms of similarities, still not enough is known about collective memory from a cognitive perspective. We advocate for a multi-dimensional examination of collective memory integrated into a sociocognitive perspective.

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