An encounter with personal possessions in everyday life, such as souvenirs, jewellery, or digital photos, may bring the past back to mind. Sometimes this is a brief and fleeting memory, other times it brings back vivid memories and emotional responses. Through three qualitative studies, this PhD research investigated personal possessions as cues: The responses personal possessions evoke (called cued responses), how the item-memories relationship evolves, and what characteristics of possessions facilitate cued remembering. An understanding of this process could facilitate the design of personal possessions or systems for cuing memories, for example in the field of human-computer interaction. The findings in this thesis showed the dynamic nature of the item-memories relationship, and the ways in which cuing can be facilitated or hampered.

Personal Possessions as Cues for Autobiographical Remembering

Annemarie Zijlema

PhD
2018

TU/e
&
UTS

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Doctoral thesis by Annemarie Francien Zijlema

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&

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Personal Possessions as Cues for Autobiographical Remembering

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven, op gezag van de rector magnificus prof.dr.ir. F.P.T. Baaijens, voor een commissie aangewezen door het College voor Promoties, in het openbaar te verdedigen op dinsdag 16 oktober 2018 om 11:00 uur

door

Annemarie Francien Zijlema

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Het onderzoek of ontwerp dat in dit proefschrift wordt beschreven is uitgevoerd in overeenstemming met de TU/e Gedragscode Wetenschapsbeoefening.

CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Annemarie Francien Zijlema, declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Engineering and Information Technology at the University of Technology Sydney and the Department of Industrial Design at the Eindhoven University of Technology. This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This thesis is the result of a research candidature conducted jointly with the Eindhoven University of Technology and the University of Technology Sydney as part of a collaborative doctoral degree. This thesis has not been submitted for qualifications at any other academic institution.

Supervision has been shared between two universities. Supervision at the University of Technology Sydney (where most time was spent) involved prof.dr. E.A.W.H. van den Hoven MTD as the principal supervisor, with prof.dr. J.H. Eggen acting as co-supervisor. Supervision and examination at the Eindhoven University of Technology was outlined on the previous page.

Signature:

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Annemarie F. Zijlema

Sunday 9 September 2018

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SUMMARY

Personal Possessions as Cues for Autobiographical Remembering

An encounter with personal possessions in everyday life, such as souvenirs, jewellery, or digital photos, may bring the past back to mind. Sometimes this is a quick and fleeting memory, other times it brings back vivid memories and emotional responses. The research presented in this thesis investigates personal possessions as cues: The cued responses personal possessions evoke, how the item-memories relationship evolves, and what characteristics of items facilitate cued remembering. The phenomenon of the activation of memories is what we call 'cuing' and the memories of personal experiences of one's individual life 'autobiographical memories' (Conway & Pleydell-Pearce 2000).

Academia and industry have been developing products aiming to cue personal memories in everyday life. In the last few decades, the interest in design for remembering in the field of human-computer interaction has increased, with many new technologies facilitating remembering and storytelling (Van den Hoven 2014; Van den Hoven, Sas & Whittaker 2012). Especially the ease and growth of capturing media digitally, for example with cameras and mobile phones, inspired the development of new products and research prototypes to facilitate remembering. This motivated us to investigate the process of cued remembering by personal possessions, and how the item-memories relationship comes into existence to enable cued remembering. A better understanding of cued remembering may improve designs for remembering.

Through three qualitative studies, this PhD research aimed to provide insight into the aspects influencing the item-memories relationship and the process of cued remembering, for physical as well as digital items. We found that different uses of personal items could influence their potential to cue memories, and also tensions in the relationship with possessions affected their potential to cue. We found that possessions could cue different types of responses and that these items had particular characteristics. From a longitudinal study, we found several reasons why cued responses by personal possessions changed over time. Based on interviews with repair professionals and object owners, we gained insights into the role of possessions' traces and ageing on cued remembering. At the end of this thesis, we reflect on and discuss how the gained knowledge can facilitate design for remembering with design considerations for designers.

DEFINITION OF KEY TERMS

The research we present in this thesis is multidisciplinary, and the terminology used can have different meanings in different disciplines. Below we define the key terms as used in this thesis.

MEMORY SYSTEMS

Memory: The term memory is sometimes used as the system of cognitive processes that enable remembering, and other times as 'a memory' (as an entity). For the latter, see the definition of 'memories'. Memory as a system is defined as 'the means by which we retain and draw on our past experiences to use this information in the present' (Sternberg & Sternberg 2011, p. 534). This includes memory for how to do things (driving a car), learning facts, remembering faces etc. In this thesis we focus on autobiographical memory.

Autobiographical memory: A memory system that facilitates the construction of autobiographical memories and consists of autobiographical knowledge structures of our lifetime, episodic memory and a working self (Conway & Loveday 2015; Conway & Pleydell-Pearce 2000 and more explanation can be found in Chapter 2 (Section 2.2)).

CONTENT OF REMEMBERING

Memories: Mental representations of past experiences resulting from remembering. When used in this thesis, we mean episodic memories (see episodic memories in this list).

Autobiographical memories: Autobiographical memories are significant long-term memories of events that occurred in a person's life and relate to themselves (Conway & Pleydell-Pearce 2000). They define who we are and how we think about ourselves, and they affect our future goals and plans (more explanation can be found in Chapter 2 (Section 2.2)).

Episodic memories: Episodic memories are memories of personal events defined by a specific time frame (a moment, or some days) and place, often coming to mind in visual form. Examples are refuelling the car the other day, this morning's breakfast, your first date with your current partner, or climbing the Eiffel tower. Often episodic memories can be accessed only shortly after they occurred (e.g. a few days), unless they become integrated with autobiographical memory (Conway 2009 and more explanation can be found in Chapter 2 (Section 2.2.2); Conway, Loveday & Cole 2016).

Semantic knowledge: General world knowledge, not defined by a time period and often not personal (Tulving 1972). It is often contrasted with episodic memory.

CUED REMEMBERING

Perception: Perception is to become aware of something (a stimulus in the environment) through the senses, and recognising and comprehending what is sensed (Sternberg & Sternberg 2011).

Remembering: The act of mentally travelling back in time and constructing memories from memory. Remembering can be activated by internal or external cues.

Cuing: Cuing is the process initiated by a cue that activates a mental response, for example, a memory, an emotion, or a thought.

Cued response: A cued response is a mental representation such as a memory, an emotion, or a thought, activated by a cue and is the outcome of the process of cuing (more explanation and examples can be found in Chapters 1 and 4).

Remembering experience: Involves the experience of remembering and may also include the experience of the activity that was involved when a memory was cued, such as interacting with a device that contains memory cues (Van den Hoven 2014).

CONCEPTUAL STAGES IN MEMORY

Encoding: A mental process in which an experience is transformed into constructs that can be stored in memory and retrieved later (Brown & Craik 2000).

Storage: Refers to how encoded information is retained in memory.

Retrieval: A mental process of accessing memories, knowledge, emotions, and other previously encoded information in human memory. In the autobiographical memory system model we have adopted in this thesis (the Self-Memory System), this process of accessing knowledge and memories is activated by internal cues that 'constantly cause patterns of activation, some of which may stabilize into memories' (Conway & Loveday 2015, p. 575).

TRIGGERS FOR REMEMBERING AND ITS CONTEXT

Cue: A cue is a stimulus that activates a mental response (e.g. a memory). Cues can be internal (e.g. autobiographical knowledge, a thought, or a memory) and external (e.g. a thing, person, circumstance, or a feature of one of these) (Berntsen 2009). In this thesis we focus on personal possessions and their features as cues.

Object: In this thesis, we sometimes use the term object to refer to a physical personal possession, as opposed to digital possessions such as digital photos.

Personal possession: A personal possession is a digital or physical object. They may be household possessions, digital objects, cherished objects, mementos, souvenirs, and heirlooms. Personal possessions and their perceived features can act as cues. We use this term synonymously with the term 'personal item' in this thesis.

Personal item: We use this term interchangeably with the term 'personal possession' (see personal possession).

Traces: In this thesis, the word traces refers to material traces on personal possessions, such as scratches, fading colour, or patches. In psychology, the term 'memory traces' refers to the encoded information a past experience has left in the mind, which can be retrieved when remembering.

Product attachment: Product attachment is the emotional bond a person experiences with a personal possession. Memories associated with the possession can be a determinant for product attachment, besides other known factors such as utility and appearance (Mugge, Schifferstein & Schoormans 2010) (more explanation can be found in Chapter 2 (Section 2.4)).

Home: By home, we mean the dwelling a person is living in and which contains at least a part of that person's personal possessions.

Personal environment: The personal environment, as opposed to a public space, is a space that is to some extent under the person's direct control and may contain personal possessions. For example a person's home, their car, or their desk space at work.

1 INTRODUCTION

Abstract

This chapter provides an introduction into the research presented in this thesis about cued autobiographical remembering in the personal environment. Personal possessions, such as souvenirs, photos and decorative objects, may act as cues for remembering past events. This process of cued remembering by personal possessions is investigated in this thesis, and this introduction chapter explains what this topic entailed and how it was studied. The purpose of the research was to gain knowledge about the relationship between personal possessions and memories. Among other benefits, this knowledge could help the design of products specifically to help people remember personal events and experiences in their lives. This knowledge was gained by conducting qualitative research from an interaction design perspective, adopting knowledge from other areas, such as memory research from the area of cognitive psychology. We carried out three studies covering four main topics: people's behaviour with personal possessions that could act as memory cues, the outcomes of cuing by personal possessions (which we call *cued responses*), the fluctuation of cued responses by personal possessions over time, and the type of possessions and features that can act as cues. We conclude the chapter with a thesis outline.

1.1 Cued remembering with personal possessions

In our day-to-day life it is likely that we come across personal possessions that cue memories from our past. Imagine for example a living room with furniture, a book case, decorative objects, paintings and photos on the wall. When the owner of all these possessions looks around, what could come to mind? A series of books in the book case from her studies may remind her of her time as a student. A framed photo on the wall of a mountain landscape might bring back memories of a kayak trip in New Zealand, and that chest of drawers might remind her of her late grandmother and how as a child she used to play with the drawers when the chest was still in her grandmother's house. This process, whereby a memory comes to mind when a personal possession is encountered, is an example of what we call 'cued autobiographical remembering'.

While memory cues can come in a variety of forms, such as people, locations or thoughts, our focus in this thesis is on personal possessions as memory cues. Personal possessions can comprise a wide range of modalities that can facilitate memory cuing. Memories can be cued by visual features such as a photo, by auditory features such as a song, olfactory features such as a perfume, and even tactile features, such as the weight of heavy blankets reminding you of sleepovers as a child at your grandparents. Personal possessions can thus be associated with memories, which we will call the 'item-memories' relationship.

The mental representation that is cued by a personal possession, such as a memory, is what we call a 'cued response' in this thesis. This is what spontaneously comes to mind when the owner of the possession encounters the item. This may be a different response compared to the response when the owner is asked about the possession by someone, or is explicitly asked what he/she knows about the possession. We differentiate in this thesis between cued responses and the remembered events that are associated with a personal possession. The latter describes a situation where the owner actively retrieves memories that the participant has associated with the item, contextualises the events and accommodates the story to the listeners. The explanation of the item's background and memories can be seen as the narrative (Fivush & Merrill 2016) or 'storytelling' (talking to others who were not present at the original event) rather than 'reminiscing talk' (talking to people who were present at the original event), as defined in the area of domestic photography (Frohlich et al. 2002). Descriptions of remembered events are for example, what the remembered event was about, their experience and feelings, who was there and what happened before and after. Cued responses in this thesis are descriptions given by participants of what came to mind when she/he perceived the item, as much as they could express this. While the cued response can match with the remembered event description, it is not always the case. For example, the response cued by a miniature Eiffel tower may be the moment standing on top of the tower, while the associated remembered events may involve the reason for the trip to Paris, the

people, and how the person got there. In other cases, the cued response and the associated remembered events may be the same.

In this thesis, we are especially interested in the cuing of autobiographical memory. Autobiographical memory involves our personal past experiences, enriched with thoughts, emotions, motivations and explanations of why events happened (Conway, Singer & Tagini 2004; Fivush 2011). Together they form a life story, including past experiences and future goals.

Autobiographical remembering plays an important role in the daily functioning of human beings, its major roles being social bonding, shaping our identity and guiding future behaviour (Bluck & Alea 2002). Personal possessions can facilitate remembering and they have been found to serve similar functions as the functions of autobiographical remembering. For example, possessions can facilitate social narratives and sharing experiences, be quick reminders of past experiences, or lead to private immersion in memories, as in reminiscing (Whittaker et al. 2012). In addition, the presence of memorabilia in the home has been found to correlate positively with better mood (Sherman 1991), and both remembering and personal possessions are associated with improved wellbeing (Rathbone et al. 2015; Sherman 1991).

1.2 Designing for the purpose of remembering

Products have been developed in both industry and academia aimed at cuing personal memories in everyday life. For example, people buy souvenirs to be reminded of joyful past experiences. In the last few decades, the interest in design-for-remembering in the fields of human-computer interaction (HCI) and interaction design has increased, with many new technologies facilitating the use of personal media, such as photos (Van den Hoven 2014; Van den Hoven, Sas & Whittaker 2012). Capturing digital media by using digital cameras and mobile phones, has inspired the development of new products and explorative designs to facilitate remembering. For example, researchers developed small objects with RFID tags called ‘sonic gems’ that can capture and play audio recordings from our daily life that are precious to us (Oleksik & Brown 2008), or developed a personal tangible data souvenir (a postcard representing their visit) from a museum visit (Petrelli et al. 2017). In the commercial world we can find other initiatives that can facilitate remembering. One commercial example is the digital photo frame, which can display digital photos in a slideshow; another is the ‘On this day’ function on Facebook, which displays status updates from the same day one or more years ago (Konrad 2017). Designing for remembering has existed for centuries, and in the last decades, made a shift to digital devices. How does the underlying process of cuing memories work? Little is known about cued remembering by personal possessions, such as people’s behaviour with the item, or a possession’s features

that facilitate cued remembering, or about the variety of thoughts/memories that come to mind every time people encounter their possessions, even over a long time. A better understanding of 'cuing memories' may improve designs for remembering. For this purpose, we investigate cued autobiographical remembering with personal possessions.

1.3 A model of cued autobiographical remembering

In this section, we illustrate our perspective on the process of cued autobiographical remembering by personal possessions through a simplified model (Figure 1.1). In this model we draw attention to a few essential elements that are relevant to this thesis, and therefore many details of the cognitive memory processes have been omitted. We refer to Conway (2005) and Conway and Loveday (2015) for detailed explanations of the steps 'encoding & storage', 'cuing and construction', and 'autobiographical memory', which we only briefly explain here, and other processes affecting remembering, such as 'the working self', which is not mentioned in this model.

The model in Figure 1.1 describes two main processes that start outside the mind. One process illustrates how an experienced event is converted to knowledge in an individual's autobiographical memory system (from which a memory can be constructed later), which we discuss in Section 1.3.1. The second process illustrates how autobiographical memories can be cued by personal possessions, which we discuss in Section 1.3.2. The latter is most important in this thesis, but can be understood best by a short explanation of how experiences enter and are retained in the autobiographical memory system.

There is a third process depicted in the model, which we acknowledge but do not provide details about, namely, the creation of an intentional association between an event and a possession. Situations where this occurs are when an individual intentionally takes home an item to remember, for example, by picking up a stone from the beach or buying a souvenir from a museum. In these cases the person makes an intentional decision to remember the event using the object as a memory cue, while in other cases such as heirlooms or objects of use the cued remembering may occur without making an intentional association between memories and the object. This process is relevant for cued autobiographical remembering, and we will discuss many examples of the intentional creation of memory cues in this thesis, but this process is not the focus of this model. We will explain the first two processes depicted in the model using an example in the next two sections.

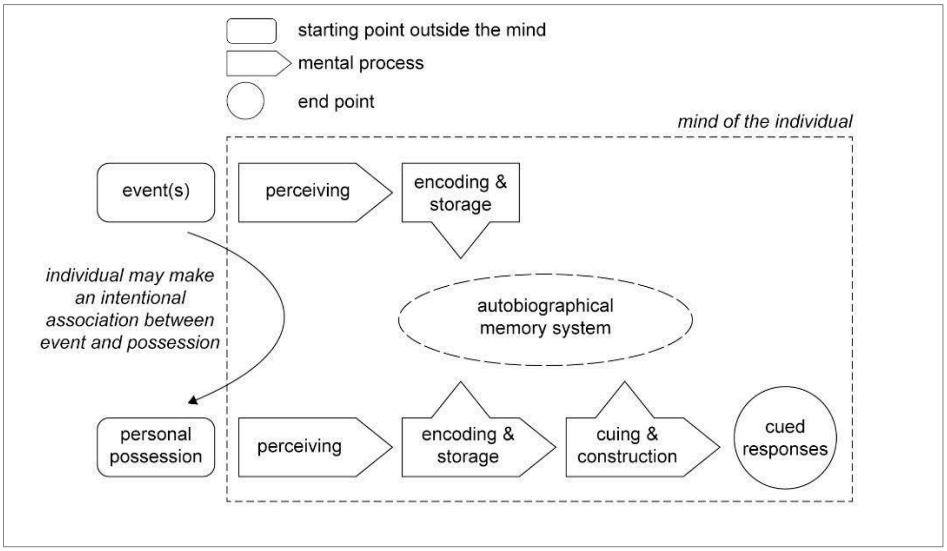


Figure 1.1. Model of cued autobiographical remembering by personal possessions.

1.3.1 The transformation of an experienced event to autobiographical memory

To illustrate the process shown in the model in Figure 1.1, we will use a scenario of Lisa, who travelled to New Zealand and went on a kayak trip. In Figure 1.1 we see outside the dotted box the step **event(s)**. Imagine Lisa, who had the experience of taking a kayak tour in a fjord in New Zealand with her friend approximately two years previously.

Lisa **perceived** the event with her senses. The weather was cold and the tour guide pointed out to them a seal playing in the water. Then a pod of dolphins passed by and swam below the kayak group. She and her friend were excited. Sternberg & Sternberg (2011, p. 85) have defined perception as 'the set of processes by which we recognize, organize, and make sense of the sensations we receive from environmental stimuli'. An event may for example be sensed by vision, touch, smell, taste or hearing. However, not everything in Lisa's environment was perceived with the same focus. Lisa's focus was on animals, nature and the guidance of the tour guide and less on boats, the seagulls in the sky, her tour mates or muscle pain from kayaking. Attention plays a role in directing perception (Sternberg & Sternberg 2011), resulting in other details being missed, such as gorillas showing up in a ball game (see Simons & Chabris 1999).

The next process in the model after perceiving is **encoding & storage**. Encoding is a process in which the experience is transformed into constructs that can be retained in

memory and retrieved later (Brown & Craik 2000). The perceived information is also enriched and embedded in existing knowledge in memory (Conway 2005). In the case of Lisa, it may have been linked with the New Zealand trip as a whole, with her friend, with the location of Milford Sound, or with other kayaking experiences. The way it is encoded is important for the effectiveness of later memory retrieval, because it is suggested that a cue is most effective if it matches aspects at the time of encoding the event, (known as the encoding specificity principle, see: Tulving & Thomson 1973). In the **storage** stage the encoded constructs, which form a summary of Lisa's kayak experience are stored in the brain (patterns in the neural networks) as an episodic memory (Conway 2009). Often we lose access to episodic memories after a short time (e.g. a few days), but they can remain accessible for much longer if they become integrated with autobiographical memory.

The last step in Figure 1.1, **autobiographical memory system**, is where the episodic memory has become integrated with autobiographical knowledge (e.g. her trip to New Zealand, her friendship with her travelling companion) in autobiographical memory (Conway 2009; Squire 1986). This non-conscious process is called 'consolidation' and can continue for years. As at this stage her episodic memory is integrated with the autobiographical knowledge structures (system), this memory can be retrieved as a specific autobiographical memory, in which both the episodic memory and related autobiographical knowledge is activated (see cued responses in the next section). The specific autobiographical memory is not in a permanent state and may reconsolidate over time. For example, when Lisa's memory of her kayak trip is cued, the act of retrieving may modify the episodic memory and autobiographical knowledge structures in the autobiographical memory system.

1.3.2 Remembering cued by personal possessions

Imagine Lisa two years later, looking at a framed photo of a mountain view on the wall in her living room. This is a **personal possession**, which we define as a 'digital or physical object' and can possibly act as a memory cue. Furniture, souvenirs, books and jewellery are all examples of personal possessions. In this case, it is a photo that Lisa took herself when travelling in New Zealand.

When Lisa looks at the framed photo, she sees the green and grey mountains, the blue sky, the calm water and the tip of a kayak. In the model in Figure 1.1, this is represented as the step of **perceiving**, a mental process.

Let us look further at what happens when Lisa looks at the photo. Lisa recognises the mountain view in the photo as a place where she has been herself, and where she was sitting in a kayak while taking the photo. She remembers her friend was sitting behind her in the kayak. It was two years ago, in March, and it was cold on the water. The tour guide

pointed them to a playing seal in the water. What was the name of the tour guide? The guide was wearing a red jacket, but she does not remember her name. A bit later in the tour, a pod of dolphins came by and swam under their kayaks. Such an exciting moment! It was a highlight of the holiday, she thinks. In this example of Lisa looking at her framed photo, we see that the photo acted as a memory cue for remembering Lisa's kayak trip in New Zealand. In Figure 1.1, this process of recognising and recalling what happened at that event is called **cuing and construction**, leading to a **cued response**.

What happens in the **cuing and construction** stage is that the perceived external cue (for example, the framed photo and its details) acts as an internal cue in the **autobiographical memory system**. The cue activates autobiographical knowledge and one or more episodic memories in the autobiographical memory system, sometimes by elaborating the cue (activated knowledge can serve as a new cue to activate more knowledge and memories). An autobiographical memory is **constructed** when a pattern of activation stabilises and autobiographical knowledge and an episodic memory enters consciousness (Conway & Loveday 2015). In psychology, this step in the memory process is often called *retrieval*. As shown in the earlier mentioned example, Lisa could **construct** a memory of what she experienced when she was on the kayak trip. External cues, such as a framed photo, can be elaborated in the mind to cue other knowledge and memories (Conway 2005). We define **cuing and construction** in this thesis as 'the mental act of accessing or constructing knowledge, emotion, memory, or a thought'. Our definition is slightly broader than retrieval as used in cognitive psychology (e.g. Sternberg & Sternberg 2011) because it includes other mental responses, such as knowledge or emotions in addition to memories.

The cued autobiographical memory (cued by the framed photo) that came to Lisa's mind, including the emotions and thoughts, is what we call in this thesis a **cued response**. Through the details in the photo, Lisa accessed knowledge from the autobiographical memory system that was not present in the photo, such as the friend who was sitting behind her, the temperature, the animals they saw – and again she gets excited when thinking about the pod of dolphins. For Lisa, not all details from the past event came to mind; for example, she did not remember the name of the guide. We define a cued response as 'a mental representation such as a memory, an emotion, or a thought, activated by a cue'. In the case of Lisa, the cued response is an autobiographical memory. This, however, may not always be the representation that comes to mind when cued, and for this reason we use the term cued response(s) in this model. When a cued response has occurred, the process may continue with cuing and construction of other knowledge or responses.

1.4 Scope of the thesis

The research in this thesis focuses on the process described in Section 1.3.2, the part in Figure 1.1 that depicts a personal possession as a starting point and a cued response as the outcome. Although our interest lies in autobiographical memories, personal possessions may cue other responses as well.

One point related to the scope of this research is that we focused mainly on private cuing between individuals and their possessions, in contrast to storytelling and shared remembering, which involves an audience and social interaction. This decision was made because we believed it would be beneficial to first understand cuing in a private setting as it would allow us to investigate the extent a possession is responsible for cued remembering, without additional cues (e.g. questions) provided by other people or social norms and expectations (e.g. what to tell). In addition, the majority of our encounters with personal possessions in daily life are private, and an increased understanding of these encounters would represent a larger part of cuing by personal possessions in daily life.

A second point is that the personal possessions in this thesis included digital as well as physical possessions, because they reflect the reality of most people's personal environment. However, any comparison between the qualities of digital and physical items as memory cues is not intended, nor do we intend to apply the knowledge to either digital items/devices or physical items, to improve one or the other. Further, we focus on possessions in the personal environment, that is, the area where the person lives, or has control, such as the home, a handbag or a car. Personal possessions such as photos on a mobile phone, or possessions in a handbag may sometimes be viewed in public spaces, but in general, the focus will be on the home environment. This decision was motivated by the assumption that these items are to some extent actively curated and will almost always have an established connection to its owner, and possibly memories attached.

Summarised, this thesis includes the following topics (which is explained further in Section 1.7 *Thesis outline*):

- people's behaviour with personal possessions that can act as memory cues
- the outcomes of cuing by personal possessions (cued responses)
- the changes in responses cued by personal possessions over time, and
- the possessions and features that can act as cues.

Examples of what does not lie within the scope of this thesis is whether the cued memories are accurate compared to the original event, the context in which cuing occurs, such as the factors surrounding the personal possessions (e.g. the housing, the style of furnishing), the possession's biography and life cycle (e.g. where it comes from, the process from acquiring

to discarding), or people's attitude towards possessions in general (e.g. minimalists with very few possessions vs. hoarders with many).

1.5 Motivation and contextual influences

Autobiographical remembering cued by personal possessions is an omnipresent activity that is part of people's everyday life. Its importance is supported by research showing that autobiographical remembering plays a major role in people's daily functioning, and shapes our identity (Bluck & Alea 2002). In addition, as also mentioned in Section 1.1, personal possessions in people's homes contributes to their wellbeing (Sherman 1991). Together, these findings show the relevance of investigating cued autobiographical remembering by personal possessions. The aim of this research is to gain an understanding of the process of cuing autobiographical memories by personal possessions.

One motivation for this research is that both academia and industry, have an interest in design for remembering (see Section 1.2). The increase in the quantity of digital possessions currently stored on computers and in cloud has brought up a need for systems or products that help people organise their media and present their media in a meaningful way. New products are being developed and tested but without a clear understanding of externally cued remembering. In this research, we intend to gain knowledge of possessions as memory cues and knowledge of the cuing process so that we can contribute to the design of products developed to cue memories, and hence increase the success of the desired effects that these items can have on people. Later in this thesis, we translate our collected knowledge on the item-memories relationship and the cuing of memories into design considerations.

From a societal perspective, our research is motivated by our observation that products nowadays are quickly replaced by newer models of the same (mobile phones are a good example) or replaced when products are broken or out of fashion (furniture is a good example). In addition, digital items seem to be ephemeral, and not truly treasured or cared for. We have seen in recent years minimalist trends (the fewer possessions the better) and the Japanese tidying up guru Marie Kondo (Kondo 2014) who proposed in her bestseller to throw away the things that do not bring you joy. This current trend in society is interesting, as research has indicated that possessions and remembering are good for us, but people seem not to be aware of this or not to worry about losing memory cues.

A few works of research were in particular responsible for the direction of this research. One inspiration came from existing work on personal possessions and their value as reminders for memories, (in particular: Csikszentmihalyi & Rochberg-Halton 1981; Petrelli & Whittaker 2010; Petrelli, Whittaker & Brockmeier 2008). These works showed the rich

meanings and value that personal possessions can have for people, in particularly in their role as memory cue. A second inspiration was the fascinating complexity of how (autobiographical) memory operates (Conway 2005; Conway & Pleydell-Pearce 2000). In addition, the paper 'The Cue is Key: Design for Real-life Remembering' (Van den Hoven & Eggen 2014) contributed to the motivation to look at cued autobiographical remembering by personal possessions. Their paper focused on external memory cues (personal possessions and devices) and posed many questions from an interaction design perspective. These sources were to a high degree responsible for our interest in what was happening in the relationship between possessions and memories, and why.

This PhD research was carried out in the context of the Materialising Memories program (www.materialisingmemories.com) and team. The program is a multidisciplinary research body focusing on research 'to support or facilitate specific remembering experiences' (Van den Hoven 2014, p. 371). In 2013 four joint PhD projects started, two at the University of Technology in Eindhoven and two at the University of Technology Sydney, studying 'materialising memories' from the capture of personal media to the retrieval of media (photos in particular) and the remembering experience. The research presented in this thesis was mainly (but not entirely) carried out in Australia. The four PhD projects are connected to each other in the sense that they all focus on facilitating remembering in daily life for people without memory problems. The PhD projects were all carried out independently, complementing without depending on each other.

1.6 Research approach

The research in this thesis is multidisciplinary and involves three disciplines, which contribute to our research in different ways:

- HCI/interaction design: the perspective from which this research is conducted methodologically and towards whose audience it is mainly directed
- cognitive psychology: a discipline from which we adopt knowledge about memory and use for interpretation of our findings, and
- consumer behaviour: a discipline from which we adopt knowledge about people's relationships with possessions and use for interpretation of our findings.

The research in this thesis was carried out from an HCI/interaction design perspective, and our methods and analyses were inspired mostly by these disciplines. As we explained in the previous section, the aim of the research was to gain knowledge that could be applied to design for remembering. However, we adopted knowledge on cuing and autobiographical memory from cognitive psychology, and knowledge on people's relationships with personal possessions from consumer research (relevant work in these disciplines is explained in

Chapter 2). Together, these two disciplines have the greatest expertise on cued autobiographical remembering by personal possessions, and this will be used most to interpret our findings.

Most of our research was analysed using thematic analysis, which looks for themes and patterns in the collected data using bottom up coding (Braun & Clarke 2006). In this approach, the research questions of the study may be reconsidered during the coding process. As Braun and Clarke stated in their article: 'You can either code for a quite specific research question (which maps onto the more theoretical approach) or the specific research question can evolve through the coding process (which maps onto the inductive approach)' (Braun & Clarke 2006, p. 84). The research in this thesis started with an explorative study (Chapters 3 and 4), where we deviated from the question that motivated the study, and the research questions became more data-driven. When the research progressed and our understanding of our research topic increased, our coding and analysis focused stronger on our research question (e.g. Chapter 5). When we introduce the research questions or topics in our chapters, these are the questions that had already been revised if necessary and had been leading in our analysis.

As the aim of this research is to contribute to knowledge for the design of personal items that can cue memories, we follow an approach called 'research for design' (Downton 2003). This approach focuses on collecting information that will aid the designer to achieve her/his design goal. As opposed to 'research through design', designing objects or prototypes was not part of our research process, nor did we study designers' practices, as is done in research into or about design (Archer 1995; Frayling 1993; Zimmerman, Stolterman & Forlizzi 2010).

Much knowledge in this thesis is adopted from psychology, in particular on the topics of memory, memory retrieval and cued responses (e,g, types of knowledge and memories). Our research draws in particular upon knowledge from the cognitive psychology paradigm, which studies how people perceive, learn, remember and think. Our research relates to the 'ecological approach' prompted by cognitive psychology researcher Neisser (Neisser 1976). Neisser criticised traditional laboratory research in his time (e.g. memorisation word-lists) for lacking 'ecological validity', as it was not generalisable to real life. This shifted the field of memory research to more frequently study real-world scenarios or phenomena as opposed to artificial laboratory situations, while still keeping sufficient experimental control (Barnier 2012; Kvavilashvili & Ellis 2004). Our research also relates to the approach of studying memory 'in the wild' (Hutchins 1995), meaning that it is studied in the real world, as opposed to the more common quantitative experimental approaches that are often carried out in controlled settings. 'In the wild' studies, often with limited experimental control, are common in HCI and interaction design research.

The research presented in this PhD thesis has been carried out using qualitative methods. We collected data through interviews, observations and questionnaire cards, often using open questions. We followed a qualitative research approach because of our interest in people's feelings, behaviour and experiences regarding personal possessions and cued remembering. Because we were looking for meanings rather than facts, and wanted to investigate the topic in a natural context, qualitative oriented research methods were considered to be the most appropriate (Creswell 2014). In this thesis we present findings of three empirical studies that together cover four main themes, as presented under Section 1.4 *Scope of the thesis*. We applied different methods depending on the aim of the study, and we will explain the details of each method and why they were suitable for these studies in the chapters following Chapter 2 *Background: possessions & memories*.

With the focus on qualitative outcomes and the use of qualitative methods, the exact number of people who said something, or the number of items we encountered to show something, was less important than the variety of what we observed and its meaning. Therefore, in several places in this thesis we explain results in terms of 'the majority', or 'some participants', as the value lay in the qualitative findings.
Regarding the terminology used in this thesis, we use the term 'personal possession' and 'personal item' interchangeably. Especially in communication with participants, the term 'personal item' was used, as we believed it was a neutral term for both digital and physical possessions, and did not imply a particular type of item (e.g. souvenir or object of use), or an emotional relationship with the item. In some parts of the thesis, the term 'object' is used explicitly to indicate physical possessions. However, we also noticed that the term 'item' was not self-explanatory for everyone and we therefore also used the term 'personal possession'. The term 'we' is used in this thesis to address the researcher, and to acknowledge those who have advised and contributed to her thinking and writing. Interviews and other communication with participants was carried out by the author, but is nevertheless indicated as 'we'.

1.7 Thesis outline

This chapter introduced the topic of cued autobiographical remembering by personal possessions and put forward the multidisciplinary research that is presented in the rest of this thesis. It discussed that the research was carried out from an HCI/interaction design perspective, was methodologically qualitative of nature, and that its aim was to gain an understanding of cuing autobiographical memories to support designing for remembering.

The current chapter is followed by Chapter 2 *Background: possessions and memories*, in which we discuss the most relevant work from the literature. This literature comes from several disciplines. The literature on autobiographical memory and cuing originates mainly

from cognitive psychology, while the literature on personal possessions and product attachment relationships has been derived especially from the research area of consumer behaviour. We also discuss relevant research and examples of designs that facilitate remembering. At last, we contextualise our research using the theory of 'distributed cognition', and introduce the concept of user experience and remembering experience. These topics provide context and help to interpret the research in this thesis.

Chapter 3 *Effects of use on possessions as memory cues* is the first of four chapters that discuss our empirical research and findings. We discuss the use of personal possessions as memory cues and the tensions that occur in their use in the home. Our findings were based on nine home-tour interviews that focused on personal possessions related to a holiday. These findings provide insights into the dynamic relationship of owners with personal possessions in the home and the impact of their use on their potential as memory cues.

In Chapter 4 *Outcomes of cuing by personal possessions*, we explore what comes to mind when people encounter personal possessions related to a holiday. It is based on data collected from the same nine home-tour interviews described in the previous chapter. This chapter provides insights into the possible outcomes of cuing by personal possessions, and what types of items were likely to cue these responses. However, it does not explain how the memories were associated to the items, which is explored in the next chapter.

Chapter 5 *Changing item-memories relationship over time* investigates the cuing process over time. By conducting a longitudinal study with 20 participants who filled in questionnaire cards about what their personal possessions cued, we observed the differences in cued responses with intervals of 6½ and 3½ months. These findings provide insights into the consistency of cued responses associated with a possession; we also discuss what cued the responses, such as the item as a whole or specific features of the item. The role of a particular item feature for cued remembering and the material traces of ageing and use are investigated in more depth in the next chapter.

Chapter 6 *Exploring the meaning of material traces on personal possessions* is the last chapter to present research findings and looks at a particular category of item features. We present findings from interviews with repair professionals and owners of objects with material traces of ageing and use on the role of these traces and the role of repair. These findings provide insights into what these traces contribute to cuing memories.

The collected findings of the three studies presented in the previous chapters led to knowledge that can facilitate designers to influence cuing with the design of their products, as presented in Chapter 7 *Design considerations for cued remembering*. We discuss 10 design considerations that could aid designers to influence the cuing of memories, to design for use and behaviour that facilitates the possibility that the possession cues, or that aid the

designer to steer towards the desired cued response. We also discuss our research in the context of the remembering experience and the user experience.

In Chapter 8 *Conclusions* we close the thesis with a discussion of the conclusions contributions, and reflect on the findings and methods of all three studies together. We also look into possible future directions for research.

2 BACKGROUND: POSSESSIONS AND MEMORIES

Abstract

This chapter provides a theoretical background into personal possessions as cues for autobiographical remembering. A central topic in this thesis is autobiographical memories, which are defined as memories of events of our own life. We adopt the framework of the self-memory system (Conway & Pleydell-Pearce 2000), which explains the cognitive processes of how autobiographical memories are constructed. We then build our research on two areas of related work, that is, the literature on cued autobiographical remembering and people's relationship with personal possessions. Memories play a role in people's attachment relationship with personal possessions, and research with naturalistic cues of different modalities shows us that external cues can aid autobiographical remembering but vary in effectiveness. The motivation for the research in this thesis is to gain knowledge for the purpose of designing for remembering, which is done in the field of human-computer interaction. People value digital and physical cues differently, and research prototypes of products that can facilitate remembering have been created to make digital cues more accessible. We situate our research by discussing the distributed cognition theory, which views cognitive processes, such as remembering, as being distributed across things, people and interactions in the external world outside the mind. We then explain interaction design, HCI and the remembering experience, which constitutes the research context from and for which this research was conducted.

2.1 Introduction

In the previous chapter, we briefly introduced the research topic of this thesis. Before discussing our first study and research findings, we provide the theoretical background of the research. This chapter aims to contextualise the research by clarifying the theories and concepts we have adopted in this thesis (Section 2.2 *Autobiographical memory*), by reviewing the literature of the areas on which we build further (Section 2.3 *Cued remembering* and Section 2.4 *Meaningful relationships with personal possessions*), by discussing the differences between physical and digital personal possessions and current designs of products facilitating remembering from the field of human-computer interaction (Section 2.5 *Digital personal possessions)* and by situating the research as a whole (Section 2.6 *Remembering in context*). More specific related work relevant to understanding and interpreting our findings will be discussed in the individual chapters on the empirical studies.

2.2 Autobiographical memory

In this thesis, we focus on a specific type of memory, that is, autobiographical memory. In the next section we discuss what autobiographical memories are, followed by a section that discusses a model that explains how autobiographical memories are constructed in the mind.

2.2.1 The concept of autobiographical memory

Autobiographical memories are defined as memories of events from our own lives (Williams, Conway & Cohen 2008), for example, memories of our childhood, of holidays, or hobbies or activities we used to do with friends. Autobiographical memories are personally significant and relate to the self (Conway 2005). They define who we are and how we think about ourselves and they affect our future goals and plans. This type of memory can be differentiated from other types of memory, for example, memory for learning and remembering skills, remembering faces and names of people, or memorising new information for a test in school.

Autobiographical memory is of major importance in daily life, and serves several functions (Bluck et al. 2005; Harris, Rasmussen & Berntsen 2013; Webster 2003), of which we mention four. Bluck et al. (2005) identified three main functions of autobiographical memory, based on the literature. These are, the social, the directive, and the self function. The social function of autobiographical memories entails developing and nurturing relationships, for example, by introducing yourself, or self-disclosure by sharing past experiences with a friend (and increasing intimacy). Autobiographical memories can also

have a directive function, such as solving problems and making sense of the past, for example resolving a conflict, or learning from past relationships. Of major importance is the function of the self, 'to have and maintain a biographical identity' (Bluck et al. 2005, p. 110), which includes reflecting on beliefs and values, or understanding why things happen or have happened. A fourth function suggested by Harris, Rasmussen & Berntsen (2013), is the function of emotion regulation, such as remembering positive memories to keep a positive mood.

In the past, different views existed regarding the veridicality of autobiographical memories, such as memories being exact copies of how the original event was perceived (*copy theories*), or being entirely or partially reconstructed (Brewer 1986). Nowadays, the common view is that autobiographical memories are transitory mental constructions (Conway 1996; Conway & Loveday 2015), also termed 'the modern view of human memory' (Conway & Loveday 2015, p. 580). The constructions are temporary mental representations that are influenced by contextual factors, such as mood (e.g. with a negative mood one remembers negative memories more easily) (Lewis & Critchley 2003), and even constructing memories can alter the information in memory, resulting in a different construction of the event when it is cued again (Bridge & Paller 2012).

There are two levels at which autobiographical memory is discussed in this chapter: autobiographical memory as a memory system, responsible for autobiographical remembering, and 'specific autobiographical memories' as an entity (called 'an autobiographical memory' in this thesis), which are personal memories that are activated and constructed through this system (Conway 2005). In this section, we discussed mainly autobiographical memory as an entity. The next section will discuss autobiographical memory as a memory system (the organisation of memory related cognitive processes), by discussing the self-memory system.

2.2.2 The self-memory system

The self-memory system (SMS) model is a framework that explains how a specific autobiographical memory (as an entity) is constructed. The SMS consists of the following components: episodic memory, autobiographical memory (as a system of knowledge structures), and the working self (Conway & Loveday 2015; Conway & Pleydell-Pearce 2000). All these components are involved when autobiographical remembering takes place (see Figure 2.1). We explain these components in the following paragraphs.

Episodic memories are mental representations that are sensory-perceptual in nature (often imagery) and may contain feelings of past personal experiences (Conway 2009). Sometimes they cause a feeling of 'reliving' a past experience. Often when people talk about 'a memory', they are referring to an episodic memory. Many episodic memories of

our daily lives fade over time, making them less accessible even in a few days (Conway, Loveday & Cole 2016). For example, a memory of an uneventful dinner you had yesterday, including the food you ate and the clothes you wore, may still be accessible today, but could be hard to remember if it was further in the past. These episodic memories may almost never be remembered, and 'only be accessed by a cue that corresponds in some way to the content or features of the episodic knowledge' (Conway 2009, p. 2309). However, some episodic memories become integrated with knowledge structures in autobiographical memory and remain accessible long-term.

Autobiographical memory (as a memory system) consists of knowledge structures that relate to personal long-term goals (Conway 2009). This includes personal knowledge, such as *lifetime periods* (e.g. time at university as a PhD candidate), *general events* (e.g. supervision meetings) or personal factual, cultural, and generic *knowledge* (Conway & Jobson 2012; Conway & Loveday 2015). Through internal cue elaboration, other knowledge and memories can be activated; the knowledge on one level can act as an internal cue to access knowledge on another level, and can eventually activate episodic memories via internal cues (Conway & Loveday 2015). For example, the knowledge of a person's time at university as a PhD candidate (which is on the level of a lifetime period) may cue autobiographical knowledge of supervision meetings (which is on the level of general events), which contains knowledge leading to a vivid memory coming to mind of the last supervision meeting before submitting the thesis (which is on the level of an episodic memory). An autobiographical memory as an entity always consists of an episodic memory, in combination with autobiographical knowledge. It is these patterns of knowledge activation together with the episodic memories that result in the temporary construction of autobiographical memories. In summary, episodic memories are single mental representations, many of which are accessible only short term, whereas (specific) autobiographical memories include an episodic memory (last supervision meeting) and autobiographical knowledge (PhD period, regular supervision meetings, time in Australia), which provide a structure and possibly a life narrative. Without being aware, the autobiographical memory system is always active, even during sleep, but the resulting constructed memories do not always enter our consciousness (Conway & Loveday 2015). This is mainly due to control and executive processes in the

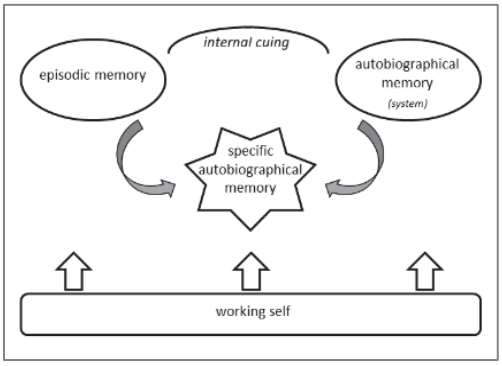


Figure 2.1. The SMS model, partly replicated and adapted from Figure 2 in Conway & Loveday (2015).

brain, which is depicted in the SMS as the 'working self'.

The working self consists of the conceptual self and the goal system, and influences many processes in autobiographical memory (Conway & Loveday 2015). Examples include encoding and consolidation, steering internal cues and determining what knowledge is activated when constructing autobiographical memories, and determining whether retrieved episodic memories come to mind. The conceptual self and the goal system influence these memory processes to maintain coherence with the self (e.g. the self-image of being a creative person) and the person's goals (e.g. completing an arts degree) (Conway 2005; Conway, Singer & Tagini 2004). Sometimes this distorts autobiographical memories in terms of accuracy, to increase coherence with the working self and prevent change in goals or self-images.

In this thesis, we adopt Conway's model and approach to autobiographical memory. However, alternative models and theories exist that are not included in this thesis, such as the 'Basic-Systems Model' (Rubin 2006, 2012), 'Transition Theory' (Brown 2016; Brown et al. 2012), and a view from the perspective of developmental psychology and culture on autobiographical memory can be found in Fivush (2011) and Fivush et al. (2011). Conway's model of autobiographical memory was chosen over others because it is currently the most comprehensive model and widely adopted within memory research in the psychology domain we mostly use in this thesis, the cognitive psychology domain.

2.3 Cued remembering

In the previous section we discussed autobiographical memories, which can be activated by memory cues. The next section provides an introduction on memory cues in different disciplines. This is followed by a section on cued remembering by naturalistic cues.

2.3.1 Memory cues in different disciplines[1]

The main disciplines that study memory cues are (cognitive) psychology, HCI and cultural studies. Cues are used mostly to study retrospective memory (e.g. autobiographical memory) and prospective memory (e.g. remembering to perform future actions). Autobiographical remembering, which we focus on in this thesis, is a type of retrospective

[1] This section is partly based on:

Zijlema, A., Van den Hoven, E. & Eggen, B. 2017, 'A qualitative exploration of memory cuing by personal items in the home', *Memory Studies* ahead of print, pp 1-21.

remembering. Therefore the following sections discuss memory cues related to retrospective remembering.

In psychology, a (memory) cue is something that can activate the search process in the mind to reconstruct a memory. The source of the cue can be in the mind, such as a thought or an idea, or something in the external world such as a conversation, a personal thing or a place. This distinction between the internal and external sources is also referred to as internal and external cued remembering (Berntsen 2009; Van den Hoven 2014), and the two can be mixed (a combination of internal and external cues). In the majority of memory studies, a cue is used to prompt memories in memory tasks, often with the use of word cues (e.g. Harris et al. 2014; Maki et al. 2012), and sometimes other modalities, such as smells, sounds or images. This will be discussed further in the next section. The focus of these studies is on studying remembering, especially autobiographical memory, and the (external) cue is a tool to activate remembering in an experimental setting.

When the focus is on personal cues and how they aid remembering, research has often been carried out in less experimental settings, with external cues referred to by different terms. In his theory of learning and memory, Schank (1999) calls them reminders, for example, physical objects, events, new experiences or abstract ideas. Others call them memory aids, such as props and techniques to assist prospective as well as retrospective remembering, for people in everyday life or as aids specifically for the elderly (Caprani, Greaney & Porter 2006; Intons-Peterson & Fournier 1986). Van den Hoven & Eggen (2014) refer to the term ‘external memory cues’ as cues with a physical embodiment, such as people, locations and things, which affect the internal memory construction.

In the HCI field, a cue is usually external and has a physical, digital or hybrid (i.e. physical with digital components) embodiment. The primary interest lies in how digital items differ from physical items and what can be done to overcome the barriers that digital items and technology impose. The focus is not always on remembering but also on cherished or personal items such as furniture or art, the memories of which can be one of the reasons the item is valued. The names under which they are referred to are, for example, memory triggers (Cosley et al. 2012) or, when it concerns personal items, mementos (Kalnikaitė & Whittaker 2011; Petrelli & Whittaker 2010; Petrelli, Whittaker & Brockmeier 2008).

In the field of cultural studies, the focus is on cultural or collective memory. External memory cuing is often investigated through artefacts, photos, memorials and places, to find out how significant historical events have been experienced and are remembered. Examples include examining the public’s experience at memorials (Dekel 2009) or studying refugees who revisit places where they previously lived (Marschall 2016).

2.3.2 Cued remembering with naturalistic cues

Mainstream research on autobiographical memory in cognitive psychology uses word cues to evoke memories (e.g. Harris, O'Connor & Sutton 2015; Maki et al. 2012), a method originally developed by Sir Francis Galton (Galton 1879a, 1879b) and adapted by Crovitz and Schiffman (1974); however, in some cases real-world cues, also known as 'naturalistic cues' (Willander, Sikström & Karlsson 2015), have been used. Naturalistic cues have been used particularly to investigate the effects of cue modality (e.g. visual, auditory, odour) on remembering (De Bruijn & Bender 2017; Herz 1998, 2004; Herz & Schooler 2002; Van den Hoven & Eggen 2009; Willander, Sikström & Karlsson 2015). Mostly, the items were not owned by the participant, because for experimental control reasons the past events that needed to be cued were recent and the same for all participants. We mention some examples below.

We found a few studies on autobiographical memory using people's own items as cues. In a well-known study by Wade et al. (2002), three photos provided by a family member were used from the participant's childhood and one fake, manipulated photo of the participant with a parent in a hot air balloon ride (which the participant had never been on) was used as prompts for reminiscing. By the third interview at the end of the week, 50 per cent of the participants had created a partial or completely false memory of the hot air balloon ride. Burt et al. (1995) tested whether and how fast the participants could retrieve a memory, with photos they had taken of their summer holiday but had not yet seen. They found that rehearsal of the memory was a predictor for retrieval time, but emotion and importance of the memory were not. Van den Hoven & Eggen (2005) also asked participants about their own souvenirs, which were defined as 'physical objects to which memories are attached' (Van den Hoven & Eggen 2005, p. 125). The focus of the study lay in the value and function of these items for the participants, and less on cuing autobiographical memories. Social media has also been used to study remembering. Thomas & Briggs (2016) looked at how social media messages (Facebook) could aid reminiscence. The participants curated their social media messages into a digital scrapbook, and the researchers provided a printed version to them. They found that the scrapbook supported 'connecting with others, learning from the past, and building self-knowledge' (Thomas & Briggs 2016, p. 8).

Naturalistic cues have also been used to investigate remembering with children. Photos turned out to be very supportive in helping children remember a kindergarten trip to a museum when they were five years old, eventhough the photos were not owned, and therefore had not seen and talked about by the participants. The researchers reported that 'Without specific cues the event was forgotten by almost all of the children after 1 year, but with cues, 87 per cent of the children could recall details of the event even after 6 years' (Hudson & Fivush 1991, p. 347). A study of children who saw and participated in a magic act at school showed that their remembering 10 days and 10 weeks later was enhanced by

the presence of relevant cues, such as the equipment used by the magician (Pipe & Wilson 1994).

Several studies have investigated the effects of cue modality, such as visual, auditory, tactile and odour cues. In some cases, instead of triggering a random memory in the participants, an outing for the participants was organised (this was also the case in the above-mentioned studies by Hudson & Fivush 1991 and Pipe & Wilson 1994) and they were then cued with objects, photos, audio, and/or odours associated with the outing. Aggleton & Waskett (1999) used odours from a Viking museum (York, UK) as cues to help the participants recall information they had seen or read in the museum six years before. The participants who received these cues were much better at answering questions about the museum content than were the participants who received other odours or no odours at all. It has also been found in other studies that odour is an effective cue for autobiographical memories, and that they evoke more emotional and more pleasant memories than other modalities (Chu & Downes 2002; De Bruijn & Bender 2017; Herz 1998, 2004; Herz & Cupchik 1995; Herz & Schooler 2002; Miles 2013). Van den Hoven & Eggen (2009) compared cue modalities with participants who went on a trip to a historical theme park. The cues were a hand-crafted artefact (made by the participants themselves), a photo taken during one of the activities, an odour from the park, an audio clip and a video clip. Testing took place one month later and the cued memories were compared for the amount of event-specific knowledge (ESK) they mentioned. It turned out that the no-cue condition (a question only) resulted in the most ESKs.

A few studies have used multi-modal cuing, as these are closer to real-world cues. It was found that the different cues of a single modality (auditory or olfactory or visual) retrieved different memory content, and that of the multi-modal cues (olfactory, visual and auditory) the visual and auditory cues contributed the most to the retrieval of autobiographical memories (Karlsson, Sikström & Willander 2013; Willander, Sikström & Karlsson 2015).

2.4 Meaningful relationships with personal possessions

In the following sections, we review the literature on personal possessions and people's attachment to personal possessions. These two topics are related to our research, because the degree to which an item is imbued with memories can be a reason for its meaningfulness, and memories contribute to people's attachment to an item. Although these are not the focus of their research, cued remembering is part of these research areas.

2.4.1 The meaning of personal possessions

Related work on personal possessions has especially focused on people's favourite possessions. A substantial work on the meaning of personal possessions in the home is the book *The meaning of things* by Csikszentmihalyi & Rochberg-Halton (1981). The authors undertook their research in Chicago, interviewing 315 participants in 82 families about their most special possessions. The research showed a rich diversity of the meaning of personal possessions for individual family members, and revealed differences between gender, generations and families. Particularly interesting was the wide range of special objects, which were often quite everyday objects. The most popular category was furniture, followed by visual art, photographs, books, stereos and musical instruments. This finding was confirmed by more recent research that also found that cherished possessions were often everyday objects (Petrelli, Whittaker & Brockmeier 2008). Csikszentmihalyi & Rochberg-Halton (1981) distinguished two dimensions in relationships with personal possessions: from action to contemplation, and from self to others. Younger participants were more likely to cherish personal items for activities they liked, and the object's meaning referred more often to the self. Older participants preferred items for remembering the past or referring to others, such as family members. The three major themes of meanings attached to objects were 'the self' (e.g. an activity or a use of the object in relation to themselves), 'experiences' (e.g. referring to enjoyment), and 'immediate family' (e.g. a drawing by one of the children). The fourth category was 'memories' (mentioned by 74% of all participants), which included the categories 'memento', 'recollection', 'heirloom', 'souvenir' and 'had it for a long time'.

Many other researchers have confirmed that cherished items represent 'the self' (Belk 1988; Golsteijn et al. 2012; Kamptner 1991; Kleine & Baker 2004; Kleine, Kleine III & Allen 1995; Richins 1994; Wallendorf & Arnould 1988). Belk (1988) proposed that personal possessions were part of the 'extended self'. For example, when a possession is lost or stolen, it can feel like a loss of self. Moving to a nursing home with fewer possessions can feel like a loss of status for the elderly (Carp, cited in Sherman & Newman 1978). Personal items can cue individual and collective memories (memories shared by a social group), such as our personal past and meaning in life, and are also cues to others (e.g. visitors to the home) to form an impression of the owner (Belk 1988). Items such as gifts, souvenirs and especially photographs can facilitate autobiographical memory (e.g. Belk 2013). Research among older people found that the presence of cherished possessions (memorabilia) in the home correlated with positive mood (Sherman 1991), and an absence of cherished possessions correlated with lower life satisfaction (Sherman & Newman 1978).

People all over the world have cherished objects, including tribes and nomads (Wallendorf & Arnould 1988). However, researchers have found that the meaning attached to favourite

possessions was not the same everywhere. The importance of associations to personal memories or the person who made the item, differed in different countries. In the USA, for example, they were often a causal factor for meaning, while in Niger, whose inhabitants also mentioned fewer favourite possessions (some participants could not even name one object), the items were more often associated with social status, including financial value and spiritual efficacy. Differences were also found among gender and age. American females chose handicrafts, antiques and representational objects more often than anything else, while men chose art pieces, functional items, plants and other living things. Older Americans tended to have display objects as opposed to functional objects as their favourite possessions, which, it has been suggested, occurs because as people age 'they acquire social history that appears to be represented in objects' (Wallendorf & Arnould 1988, p. 540).

Research has shown that people often found it harder to retrieve cherished digital items, and these items were also less often associated with memories (Golsteijn et al. 2012; Petrelli & Whittaker 2010). This will be discussed further in Section 2.5. Despite the difficulties found with digital items, research also found that people could make digital items meaningful (e.g. an avatar), by different practices with the digital items (e.g. preservation and crafting) (Denegri-Knott, Watkins & Wood 2012; Golsteijn et al. 2012).

2.4.2 Attachment to personal possessions

Belk has been influential in the consumer behaviour field and has inspired research on product attachment (a review of attachment literature can be found in Kleine & Baker 2004). There is a close link between attachment to possessions and memories. Research has shown that when a possession evokes memories, people are more strongly attached to the possession (Mugge, Schifferstein & Schoormans 2005, 2010; Schifferstein & Zwartkruis-Pelgrim 2008; Wallendorf & Arnould 1988). Besides memories, other aspects contribute to attachment. Mugge, Schifferstein & Schoormans (2008) described in their model on product attachment that three determinants contributed to product attachment: 'utility', 'appearance' and 'memories'.

When people have an attachment to an item, they keep it and maintain it for longer than items to which they have no attachment. The period of time an item is in its owner's life has been found to have distinct relationship stages, from pre-purchase to post-discarding (see Table 2.1). For example, Dazarola et al. (2012) showed that different stages in the person-product relationship have different uses. They distinguish the stages as 'pre-acquisition' (e.g. first looks, try out), 'pre-usage' (e.g. transport, unpacking), 'usage' (e.g. interacting), 'no-usage' (e.g. rest, storage), 'conservation' (e.g. cleaning, maintenance) and 'retirement' (e.g. separation/discarding, remembering afterwards). Some other models focused on the love relationship, often making a comparison with interpersonal relationships, such as

Chapman (2015), who distinguishes the stages 'honeymoon period', 'daily grind', 'growing together' and 'love', and Russo, Boess & Hekkert (2011), who applied Levinger's five stages model for interpersonal (human) relationships to relationships with products, namely, 'the attraction phase', 'the building phase', 'the continuation phase', 'the deterioration phase' and 'the break-up phase'. It seems that memories are not equally important in each stage. Niinimäki & Armstrong (2013) found four stages when investigating attachment to clothes: 'use enjoyment' (owning for 0-6 years), 'liking and loving' (owning for 7-18 years), 'reflective' (owning for 19-21 years), and the 'cemented memento' stage (owning for 22 years or longer). In the last two stages ('reflective' and 'cemented memento'), it was the memories that contributed mostly to the attachment. These stages could imply that items studied in this thesis are in different stages of the product-attachment relationship, and that memories can be more prominent at different stages.

Table 2.1. Stages in product-attachment relationships.

Use (Dazarola et al. 2012)	**Love** (Chapman 2015)	**Relationship** (Russo, Boess & Hekkert 2011)	**Attachment** (Niinimäki & Armstrong 2013)
Pre-acquisition	Honeymoon period	Attraction phase	Use enjoyment
Pre-usage	Daily grind	Building phase	Liking and loving
Usage	Growing together	Continuation phase	Reflective
No-usage	Love	Deterioration phase	Cemented memento
Conservation		Break-up phase	
Retirement			

Researchers have also distinguished different types of attachment relationships with personal possessions. Battarbee & Mattelmäki (2002) present a framework of meaningful product relationships: meaningful tool (the activity is meaningful, but not necessarily the object), meaningful association (such as showing one's identity, or an association to a personal memory) and living object (a long-lasting personal relationship with a loved item). In addition, Jacob, Torán & Esteve (2012) developed a model of the different roles that personal items can play in the attachment relationship ('Roles of Product Model'). Again, names from interpersonal relationships have been used as metaphors: 'self-extension', 'romantic partner', 'family', 'friend', 'pet' and 'home servant'. Items with different roles have different expectations to the owner, and evoke different feelings.

The literature on product-attachment mentioned above shows us the complexity and variation of the bond with personal possessions. These bonds form a context when studying cuing memories with personal possessions.

2.5 Digital personal possessions

While technologies such as a digital cameras and smartphones have become a normal part of our daily lives, people's digital media collections are large amounts yet poorly curated and rarely accessed (Gulotta et al. 2013; Whittaker, Bergman & Clough 2010). In the last two decades, researchers have studied the differences between digital and physical possessions and explored ways to overcome them. In the following sections, we discuss what is known about the differences experienced between digital and physical possessions (Section 2.5.1), present a selection of explorative designs from the field of human-computer interaction (HCI) and summarise people's responses to these designs (Section 2.5.2).

2.5.1 Differences between digital and physical possessions

Researchers observed a number of differences between physical and digital sentimental possessions in the home. They identified barriers to using digital possessions and why they were not appreciated in the same way as physical possessions. We discuss these findings below, which were derived from studies in which people (often families) were interviewed in their homes about their physical and digital possessions (Golsteijn et al. 2012; Kirk & Sellen 2010; Nunes, Greenberg & Neustaedter 2008; Odom, Zimmerman & Forlizzi 2014; Petrelli & Whittaker 2010).

Researchers found that digital possessions were of a different type and also had a different meaning to the owner. People's most special or sentimental physical possessions varied greatly, and included items such as artwork, mundane everyday objects, wearables and photos (Golsteijn et al. 2012; Kirk & Sellen 2010; Nunes, Greenberg & Neustaedter 2008; Petrelli & Whittaker 2010). However, digital possessions were less varied, the majority consisting of photos and videos (Kirk & Sellen 2010; Petrelli & Whittaker 2010). Other common categories were digital artefacts (e.g. a poem created by a child) and email correspondence (Kirk & Sellen 2010; Petrelli & Whittaker 2010).

Petrelli and Whittaker (2010) found that the meanings of physical possessions were multi-faceted, in that they had representational and symbolic meanings, while digital possessions were often purely representational. Material qualities play a role in meaning-construction; physical possessions can accrue marks and traces that remind the owner of past use, that make them singular and increase their personal value (Odom, Zimmerman & Forlizzi 2014). In contrast, digital possessions can be easily reproduced and keep the same qualities, making them feel less real and original. However, through sharing on social media, these items can acquire new social narratives, which can add value (Odom, Zimmerman & Forlizzi 2014).

A major difference between physical and digital possessions lies in their storage, which affects who can access the possessions. Some researchers found that physical possessions were stored in a range of different places and rooms in the house and sometimes were on display for visitors and other family members to see (Nunes, Greenberg & Neustaedter 2008; Petrelli & Whittaker 2010). These physical possessions were easily accessible; other family members knew what they had, where the items were located and the possessions were curated over time, e.g. the owners had disposed of unwanted items and kept the most special ones (Nunes, Greenberg & Neustaedter 2008; Odom, Zimmerman & Forlizzi 2014; Petrelli & Whittaker 2010). This was not the case for digital possessions, which were mainly stored in folders on computers, sometimes on other devices or external drives (Nunes, Greenberg & Neustaedter 2008; Petrelli & Whittaker 2010). Often only the person who had stored and organised the files knew what they had and in which folders the family's digital possessions were stored and other family members were hesitant to search (Nunes, Greenberg & Neustaedter 2008; Petrelli & Whittaker 2010). It was found that digital possessions are often unorganised (Whittaker, Bergman & Clough 2010) and tend to keep growing, because they do not take up much space (Odom, Zimmerman & Forlizzi 2014). An advantage of digital possessions is that they can be reproduced and stored in different places (e.g. the cloud), allowing access from multiple places (Odom, Zimmerman & Forlizzi 2014).

These findings inspired interaction design researchers to investigate how curation, accessibility (e.g. browsing), and display of digital possessions could be improved, especially in relation to photos.

2.5.2 Research designs facilitating remembering

In the field of HCI, many case studies have been conducted to design systems that facilitate curation, browsing and sharing of digital photos and other media. We will discuss a selection of these systems intended for the home environment and the outcomes of their user-tests or evaluations of the systems. The aim of this section is to provide a brief overview of what these explorative designs look like, what features the researchers experiment with, and how people have responded to these designs. All examples are related to digital photos, which is the medium the majority of designed systems focused on. We discuss the system by their main feature: Physical souvenirs, audio, serendipity, decay, and storytelling.

Some designs explored the combination of digital photos and **physical souvenirs**. Van den Hoven and Eggen (2003) developed a photo browser (in the shape of a large tablet) that changed its content when a physical object, such as a souvenir, was placed nearby. In their evaluation they found that the experience of remembering with the device was important,

such as whether it would put people in the right mood for reminiscing. A similar design exploration was *Souvenirs* (Nunes, Greenberg & Neustaedter 2009), where physical objects could activate a set of photos on a television display intended for shared photo viewing. Participants' opinions about the use of souvenirs as the entry point were mixed. They thought it would allow for more serendipitous photo displaying and liked this, but some participants did not like the dependence on souvenirs for various reasons. These included aesthetics (items cluttered the living room), photos did not relate to a personal item or they were concerned about breaking or losing the items.

Frohlich & Murphy (2000) and Stevens et al. (2003) both designed devices that connected physical memory cues with **audio**. *Memory Box* (Frohlich & Murphy 2000) is a device in the shape of a jewellery box that allows people to record and replay audio stories in response to physical memory cues. Families who provided feedback on the device, reported that they did not see a need to record stories for themselves, but could see a use in passing on objects as gifts or heirlooms. A larger box that could capture audio, video, and take photos of the physical object was developed by Stevens et al. (2003). The Steven et al. *Living Memory Box* was demonstrated to potential users, who responded that they liked the fact that the device allowed them to do these activities away from the computer, but 'were concerned about the long-term durability of the Living Memory Box and its content' (Stevens et al. 2003, p. 215).

Several case studies explored **serendipity** and the display of photos. *Meerkat* for example, was a device with three displays on a robot arm which at random times made a movement and displayed a different set of photos (Helmes et al. 2011). An evaluation of the device revealed that its slow behaviour provoked more reflection on the photos. Another design exploration aimed at serendipity was the *Photostroller*, a small screen on a mobile unit, running a slide show of non-personal photos (Gaver et al. 2011). The *Photostroller* was designed and evaluated in an aged care home. Their evaluation revealed that these photos acted as cues for personal memories and functioned as a conversation starter.

Some designs explored the phenomenon of **decay** in digital objects, similar to decay and patina in physical objects, such as a fading photo. One of these was *Pearl,* a photo-projection device for organising, browsing and sharing photos in the home (Jansen, Van den Hoven & Frohlich 2014). Less popular photos slowly faded away (but would become clear again when touched), while more popular photos stayed clear. The researchers found that most participants did not interact with the faded images, and some thought the display would be improved without the faded images. It was also mentioned that the device contributed to the right setting for remembering: 'The projection set a pleasant mood, which could stimulate the reminiscing process. Also the projection was perceived as less invasive than a screen' (Jansen, Van den Hoven & Frohlich 2014, p. 1272). Another study using decay tested three provocative systems that caused inaccessibility or decay of personal photos (Gulotta et al. 2013). The systems were: *Blackbox*, where once a photo had

been uploaded, only information about the photo would be given, but the photo itself could not be accessed, *DataFade*, where uploaded photos would decay over time, and *BitLogic*, where photos would transform into digital data bits over time (zeros and ones). Participants were sceptical about the decaying function of digital photos, saying it was a quality that should not be taken to the digital world. Participants were reluctant to upload photos of loved ones or precious memories to the decay-causing prototypes, as it was 'heartbreaking' to see them disappear.

Golsteijn and Van den Hoven (2011) and O'Hara et al. (2012) developed designs for stimulating social interaction using photos. *Cueb* is a set of two cubes with photo displays on all sides, intended to stimulate storytelling between parents and teenagers. The personal photos of teenagers and parents would change or lock when the cubes were shaken, connected to each other, or the displays were pressed. Participants appreciated the surprise factor (random photos as opposed to a photo album, where photos are organised in a chronological order), and it stimulated telling stories both ways, often in turns. The intention of another device, *4 Photos*, was to stimulate conversations at the dinner table, displaying photos from the guests' Facebook profiles (O'Hara et al. 2012). Evaluation of the device revealed that, similar to the Golsteijn and Van den Hoven (2011) device, the photos were a source for conversation and social bonding, as well as being a cue to the past.. Sometimes they served as an association to ask a question or support a natural narrative during dinner time. It was also found that people expressed contrasts between their past and current selves.

Most of the above mentioned systems' evaluations focused on the device, such as their (ease of) use, and whether people liked the functionalities. Little is mentioned on how effectively they facilitated remembering. A few studies mentioned the setting that was created by the design, such as bringing the person in a certain mood that stimulates reminiscence, or their function as conversation starter. These circumstances influenced by the device relate to the concept of 'remembering experience', which we will discuss further in Section 2.6.2.

2.6 Remembering in context

In the sections below we first discuss distributed cognition, which provides a context for the research in this thesis. We then discuss interaction design, HCI and the remembering experience. The research approach in this thesis is mainly derived from interaction design, as explained in Chapter 1. We briefly explain the main approach and interest of the interaction design discipline, and the concept of the remembering experience.

2.6.1 Distributed cognition

Distributed cognition is a theoretical approach that looks at cognitive processes not just in the mind, but distributed across people, artefacts, systems and the environment and the interactions between them (Hollan, Hutchins & Kirsh 2000; Michaelian & Sutton 2013). For example, we may employ pen and paper to cognitively offload our 'to-do' list, or use a map to find our way in a new city; similarly, memories may be distributed across photos and other personal possessions. According to this theory, cognition extends the mind of the individual, and is embodied in interactions with the external world. The external world thus becomes part of the cognitive system when the individual is interacting with it. Distributed cognition originates from cognitive ethnography research by Hutchins, who observed that the navigation of a ship was operated through information processing that is distributed across tools, the people in the team and the environment (Hutchins 1995). He concluded that cognition could extend beyond the mind of the individual. In human-computer interaction (HCI) and information technology (IT), researchers observed the need to view cognition as being socially distributed in social behaviour and in the use of tools (Boland Jr, Tenkasi & Te'eni 1994; Norman 1993). This holistic view towards cognition has since been applied and studied in several disciplines, such as anthropology, philosophy, psychology and HCI. Although there is no one research method that has to be used when following a distributed cognition approach, ethnographic-inspired methods, such as cognitive ethnography, are often used to study work situations (Perry 2003).

One of the cognitive processes that is studied using a distributed cognition approach is remembering (Michaelian & Sutton 2013), for example, socially-distributed remembering, in which remembering among family members or friends is studied (Sutton et al. 2010). Through complementing and cross-cuing each other, memories that would otherwise not be remembered may become accessible.

Of particular relevance to this thesis is that autobiographical memory can also be distributed across personal possessions in our environment, as claimed by Heersmink (2018) and Belk (2013). Our selves partly depend on these personal possessions (artefacts) surrounding us, as they cue our autobiographical memories on a daily basis (Heersmink 2018). In this view, autobiographical memory extends the brain and can comprise the individual and his or her environment. To what extent personal possessions become part of cognition varies according to the item. Heersmink (2015) proposed a multi-dimensional framework of eight separate dimensions to establish to what degree personal possessions (or other 'situated cognitive systems') are complemented and integrated within people's cognition. Examples of these dimensions are durability (whether it is used a single time, such as a shopping list, or repeatedly, such as a notebook), information transparency (a photo is easy to interpret, but an MRI-scan needs interpretive skills), and the degree of

transformation (the map of a city is internalised after it has been used for a while or the contents of a post-it note to oneself may be remembered when seeing it but not reading it).

The research in this thesis relates to autobiographical memory distributed across people's personal possessions in their home environment. It focuses on cued autobiographical remembering, which is a cognitive process distributed across personal possessions. Personal possessions may aid the retrieval of memories, or complement knowledge otherwise not remembered, and thus extend the mind.

2.6.2 Interaction design, HCI and remembering experience

Methodologically, this multidisciplinary thesis rests mostly on the research disciplines of interaction design and human-computer interaction (HCI). Interaction design is an area that focuses on 'designing interactive products to support the way people communicate and interact in their everyday and working lives' (Preece, Sharp & Rogers 2011, p. 9). Although we did not apply it to the research in this thesis, it is common that interaction design research involves the creation of novel, tangible objects with embedded technology (or embedded into existing objects), which is used to gain knowledge on the topic of interest; an approach that is called *research through design* (Zimmerman, Stolterman & Forlizzi 2010). The application areas for interaction design research are diverse (e.g. health, education, industry), and among them are designs that facilitate remembering and storytelling (Van den Hoven, Sas & Whittaker 2012). Researchers have compiled insights and guidelines to design devices and systems for remembering (Kirk & Sellen 2010; Sellen & Whittaker 2010).

Interaction design aims for pleasant or satisfying *user experiences*, that is, interactions with a product, system or service that enhance people's lives (Preece, Sharp & Rogers 2011). When designing products that facilitate remembering, e.g. devices providing memory cues, it is suggested that they create *remembering experiences* (Van den Hoven 2014). These experiences entail not only the experience of remembering, but may also include the experience of the activity that was involved when a memory was cued, for example, sharing the memories with others, or interacting with a device that contains memory cues (e.g. a digital photo frame displaying multiple photos). Cued autobiographical remembering, as studied in this thesis, is part of the remembering experience (this is discussed further in Chapter 7).

A research area related to, and partly overlapping with interaction design is human-computer interaction (HCI) (Zimmerman, Forlizzi & Evenson 2007). This area covers research on human-centred information technology (IT), and especially the design of interactions between humans and IT, in a range of disciplines, such as 'human factors, information systems, computer science, and library & information science' (Grudin 2008,

p. 4). The area emerged from IT applying knowledge from cognitive science to create more usable and user-friendly software and technology, all related to computers (e.g. computer programs) (Carroll 2013). Nowadays, HCI is not limited to computers, as the use of IT is embedded in our lives through multiple devices (e.g. apps on tablets and mobile phones, and the internet), and is even being incorporated into other household applications and objects (e.g. smart fridges and fitness tracking devices), as is studied in the research area called the 'internet of things' (Koreshoff, Robertson & Leong 2013). While the area of HCI traditionally has focused on computers and the human mind (Carroll 2013), and interaction design on interactive products/artefacts and experience (Löwgren 2013), the areas overlap in their goals and methods. Nowadays, both research areas have broadened their scope, making the distinction less clear-cut. The research in this multidisciplinary thesis is (methodologically) situated in this area of overlap of HCI and interaction design. Therefore, we will often refer to both disciplines in this thesis, and sometimes refer to one if it applies more strongly to either HCI or interaction design.

2.7 Conclusion

In this chapter, we reviewed related literature on people's relationships with personal possessions and on cued autobiographical remembering. We also introduced the distributed cognition approach, explained interaction design/HCI and the concept of remembering experience, and described autobiographical memory to contextualise and introduce the research we discuss in the next chapters. These are the main research areas in which our research is situated, and on which we build our knowledge.

To provide an explanation of the type of memory this thesis is about, we started with a discussion on what autobiographical memories are and their function in people's life, and described the self-memory system (SMS) (Conway & Pleydell-Pearce 2000). We then discussed cued remembering, and reviewed the literature on the meaning of possessions and on attachment relationships with possessions, followed by a discussion of what is known about the differences between digital and physical cues, and presented examples of designs to facilitate remembering. With these accounts, we intended to provide an understanding of the theoretical background of the research in this thesis. We ended this chapter with a discussion of the distributed cognition approach. This approach contextualises the research in this thesis, as it accounts for cognitive processes (remembering) with the inclusion of possessions.

It is evident from the literature on possessions (mainly from consumer behaviour research) that memories play a role in the attachment relationship between people and personal possessions. Past research has not yet shed light on how possessions cue memories, or how possessions get imbued with memories; this is investigated in this thesis. From memory

research (mainly cognitive psychology research) into memory cues we have seen evidence that external cues in a variety of modalities can aid the retrieval of memories with different effects. We will investigate this further with personal possessions as cues and their effects on remembering. Thus, in this thesis we build further on two research areas, namely, people's relationships with personal possessions and cued autobiographical remembering.

3 EFFECTS OF USE ON POSSESSIONS AS MEMORY CUES

Abstract

This chapter describes the use of personal possessions as memory cues and the tensions that occur in their use in the home. We conducted home-tour interviews, which focused on memories and use, with nine participants, and discussed 71 digital and physical items related to a holiday. In this chapter, we present how the participants used the items after they came into their personal possession and why, despite or because of their function as a reminder of the past. This chapter also zooms in on the 'companion' relationship, which are mundane objects that accrued meaning over time by travelling with their owners. Because digital companions were not found in the home-tour study, we discuss what it would entail to facilitate the companion relationship with digital items. The findings indicate that the relationship between items and memories is reciprocal. Different uses affect their potential as memory cues and their preservation as an item in the home; in turn, the memories affect their use. The study also revealed tensions in the relationship with items that influence their use and longevity. A remarkable finding was that many of the personal possessions found in the home regularly left the home, accompanying their owners in their daily routines. These findings provide insights into the dynamics of personal possessions in the home and their potential as memory cues.

This chapter is partly based on:

Zijlema, A., Van den Hoven, E. & Eggen, B. 2016, 'Companions: Objects accruing Value and Memories by being a Part of our Lives', *Australian Computer-Human Interaction Conference (OzCHI '16)*, ACM, Launceston, Australia, pp. 170-4.

3.1 Introduction

In Chapter 1 we explained that the aim of this thesis was to gain an understanding of the process of cued autobiographical remembering with personal possessions. To understand this process better, we carried out an explorative study on cuing memories with items from a holiday or related to a holiday (e.g. bought for the holiday). We discuss this study in the current chapter and in the next chapter, Chapter 4. In the current chapter, we present the findings related to the use and location of items. An understanding of the use and location of items in relation to cuing contributes to our knowledge of how cuing can be facilitated or perhaps hampered by everyday use. In Chapter 4, we will present the findings related to what comes to mind when people encounter personal possessions related to a holiday.

People's relationships with personal possessions are dynamic and as a consequence the use of these possessions may differ over time. Memories that are cued by personal possessions may change over time, as do the possessions themselves and our interaction with them. Not only do possessions come and go, or move location in the home when we tidy up and redesign the home (Garvey 2001), the possessions themselves change in appearance, be it passively or actively, through change brought about by their owners. Examples include the breakage of a porcelain cup, the adornment of a travel bag with patches from destinations visited or qualities intrinsic to an item's materiality, such as fading colour. Digital items, nowadays a common type of possession in our personal environment (e.g. digital photos), face less material deterioration and can be used and shared multiple times on different devices or applications (Odom, Zimmerman & Forlizzi 2014). A concern regarding digital photos, however, is that their growing number, often in poorly curated collections, risk being difficult to retrieve and fading into oblivion (Whittaker, Bergman & Clough 2010).

Not only may the qualities of an item change and impact the owner's relationship with it; memories also are prone to change. Memories are dynamic constructs that may alter every time they are retrieved (Bridge & Paller 2012). In addition to retrieval, contextual factors, such as mood, environmental factors and current goals, influence remembering significantly (Bluck & Alea 2002; Godden & Baddeley 1975; Lewis & Critchley 2003). Besides these dynamics in possessions and memories, changes occur in the interaction with the possession, such as location, and whether it is used or encountered. These are just a few examples of how the item–memories relationship evolves and changes during the owner's and object's biography (Kopytoff 1986).

In this chapter, we present a selection of findings based on an explorative study of cued remembering by personal possessions. We carried out a home-tour study with nine participants, discussing different items related to one specific holiday. The findings of this study are presented in two chapters, this one (Chapter 3), in which we will address the changing role of personal possessions and the tensions between owner and possessions, and

Chapter 4, in which we look at what comes to mind when people look at their possessions. Changes in the items' roles and locations are relevant to the topic of cued remembering, as these factors may also influence the effects that the items have on remembering. In this chapter we look at the owners' use for all items they presented to us, regardless of their value as memory cue. A qualitative analysis using open coding resulted in themes representing the different uses and the tensions in their use, which will be discussed in Section 3.4. A better understanding of how an individual's relationship and interaction with possessions change may help us to support remembering with personal possessions in the home.

3.2 Literature on the role of personal possessions in the home

An important work on personal possessions and their meaning in families is the extensive study by Csikszentmihalyi & Rochberg-Halton (1981). In particular, the authors stressed the role of identity as expressed by cherished objects in the home. Around the same time, the research field of 'material culture' arose. In this field, the relationships between people, objects and spaces are studied to understand a culture at a particular time (Prown 1982). One area of interest in the field of material culture in the last few decades is home and domestic objects, often studied by using ethnographic and anthropological research methods. Church et al. (2010) investigated the mutual relationship between the use of media devices and the design of the home. Cieraad (2010) described the practice of homemaking in relation to objects and object-practices by Dutch university students who had left their parental home to live in a university town. Sometimes specific practices were studied, such as the presence of cluttered cabinets in Slovakia (Makovicky 2007) or a living room overflowing with kitsch (Miller 2006). Other researchers used objects to focus on a specific period, a group of people and the narratives attached to objects (Doolittle 2011; Grossman 2015; Pahl 2012).

Whereas material culture focuses on understanding a time or culture through its objects, other disciplines have focused on understanding individual relationships between objects and their owners. For example, the field of product and consumer research is interested in understanding people's attachment to objects (Ball & Lori 1992; Mugge, Schifferstein & Schoormans 2010; Wallendorf & Arnould 1988). Another example is that of human-computer interaction (HCI) investigating how reminiscing and storytelling can be facilitated using technology (Banks 2011; Van den Hoven, Sas & Whittaker 2012).

In the HCI field, researchers have also studied how people manage physical and digital items that are used for remembering, and how to facilitate and improve people's experience

with digital mementos (Banks, Kirk & Sellen 2012; Odom, Banks, et al. 2012; Thomas & Briggs 2016; Van den Hoven 2014; Van den Hoven, Sas & Whittaker 2012). Digital objects offer different qualities from their physical counterparts (Odom, Zimmerman & Forlizzi 2014) and HCI research has experimented to overcome barriers and use these qualities by embedding digital objects through prototypes in the home (e.g. Jansen, Van den Hoven & Frohlich 2014; Odom et al. 2014; Oleksik & Brown 2008; Petrelli et al. 2017). We refer to Chapter 2 (Section 2.5) for a more thorough discussion on existing literature on digital personal possessions and prototypes. Our aim for this study was to explore the relationships people have with their personal possessions that were associated with a holiday and their use. By investigating the role of these possessions and interactions by the participants with the possessions, we draw insights that may support design for personal remembering activities.

3.3 Study of items from a holiday

This chapter examines the use of personal possessions based on interviews with nine participants in their homes. This study was an open, qualitative exploration on what makes an item a cue, and the use of the item was one aspect of this study. The study also revealed different types of cued responses, which we will discuss in Chapter 4. In the following sections we will explain more about the method, the participants and their recruitment, the procedure and data collection, and the analysis and results.

3.3.1 Method

We interviewed nine participants living in Sydney, Australia, using a ‘home memory tour’ (shortened as ‘home-tour’ in this thesis) and card-sorting method. The home-tour required the participant to take the researcher on a ‘tour’ of their own home to where the items for discussion were located. The researcher prompted the participant with open questions about the items being visited. The method was adopted from a study by Petrelli, Whittaker & Brockmeier (2008, see also: Petrelli & Whittaker, 2010) who studied digital and physical mementos in the home, by asking participants to select three things in three rooms that were special to them. This method was ethnography-inspired and allowed the researchers to ‘collect autobiographical narratives, observations about object location and other accompanying emotions displayed by informants e.g. how an object was caressed or held’ (Petrelli & Whittaker 2010, p. 156). A similar method can be found in Shenk, Kuwahara & Zablotsky (2004), in which interviews, including a home tour, were undertaken with four widows. Both these studies applied an informal interview style while discussing the objects, in which the interviewer asked part or all of the questions spontaneously to encourage the participant to speak freely.

The main goal of the interviews in our study was to explore a variety of items but related to similar memories from the same period, in this case, a holiday. We expected these limitations would help us to gain knowledge on how the item affected the cuing, which would have been more difficult if we had studied a wider variety of memories (e.g. remembering a deceased family member versus a recent birthday party). Because holidays are a type of event that often involves bringing home objects and photos, it was chosen as a topic to frame the time span of the memories and type of events and thus the variety of memories.

We asked open-ended questions about the item, the use of the item, such as its history and current use, and what comes to mind when looking at the item. The researcher took a photo of each item that was discussed. When the home-tour was completed, we asked the participants to rank the items on different scales (Fabbris 2012). The interviews were audio recorded and afterwards transcribed by the interviewer.

Before the actual series of interviews, we conducted a pilot interview, which led to revisions to the interview questions and ranking scales. One question, about when the item was acquired, was removed because it did not yield valuable information, and one of the scales was replaced because the pilot participant interpreted the scale exactly the same as another scale.

The full study resulted in a wealth of information, providing much richer information on memory cues and the responses evoked by items than originally expected. It was decided to put the original research question that had motivated the start of the study aside and to start with a thorough examination of a few transcripts using open coding (data-driven coding, as opposed to question-led coding). From there, a couple of new research questions were formulated, based on the available interview data and codes. This led to the decision to examine in depth the use of items (current chapter) and the cued responses (described in Chapter 4) of all the transcripts, whose main research questions are presented in the Introduction sections of these chapters. One part of the data collection, the ranking of the items on different scales, turned out not to be relevant for our (new) research questions, and was therefore left out of the analysis. The main focus of this chapter's analysis was the use of the item and the (changing) roles and meaning of that item.

3.3.2 Participants and recruitment

Following approval from the institution's human research ethics committee, we recruited participants via an invitation posted on online media, such as the university's staff mailing list, Facebook and the research project's website. There were no particular requirements for participating in the research, but it was explained that the interview would be about a holiday taken by the participants. In total, nine participants participated in this study (see

Table 3.1), six women and three men, all living in Sydney, Australia, and between the ages of 27 and 66 years (average 42 years). The majority of the participants had completed a university degree (eight out of nine), varying from bachelor to PhD. Their occupation ranged from jobs in IT and media (three participants), to administration (one participant), writing and editing (one participant) and research/education (four participants). All participants lived independently in houses or apartments, some (six participants) with a partner, child or sibling. The interviews took place between 7 January and 12 March 2014.

We completed this explorative study with a number of nine participants because when we reviewed the interview data, we had collected data about 71 personal possessions and there seemed to be enough data to develop themes using the thematic analysis approach (Braun & Clarke 2006, 2012).

Table 3.1. Participants, their holiday and number of items.

Participant number	Gender	Holiday	Number of items
P1	Male	6 weeks in Europe travelling alone in 2012	9
P2	Female	3 weeks in Jordan and Turkey with her (adult) daughter in 2012	6
P3	Male	1 week boat cruise around the Pacific Islands with his partner in 2012	8
P4	Female	2 weeks in the USA with her partner in 2010	9
P5	Female	3 weeks in Japan with her partner in 2012	8
P6	Female	4 weeks in Patagonia and Antarctica travelling alone in 2010	12
P7	Male	4 weeks in South-America with his partner in 2012	10
P8	Female	10 days in Bali travelling alone in 2010	4
P9	Female	5 weeks in Europe travelling alone in 2012	5

3.3.3 Procedure and data collection

An explanation of the procedure was given in advance by email, in which the researchers assured the participant that they did not need to prepare anything for the interview. Our visits at the participant's home began with an introduction to the study and interview, and consent was obtained through signing consent forms. Thereafter the audio recorder was turned on, and the researcher asked the participant to choose a holiday that had taken place between one and five years previously. We chose this time frame to ensure that the holiday had taken place long enough ago that the items could help them remember it (rather than because it happened recently) and recent enough to increase the chance that they still had six or more items related to that holiday in the home. Each participant explained briefly which holiday they chose and was then asked to think of the items, digital as well as physical, they had in the home that related to this holiday. These items could be souvenirs, photos, passports, cameras, or other possessions. The participant wrote these items down on

cards until they had mentioned 10 items (less if they could not think of any more). The participant could choose their items freely, as long as they referred to the same holiday. After writing down each item on a separate card, the home-tour could begin.

On average, each participant mentioned eight items. In cases where the participant wrote down a term that consisted of more than one of the same type of item, such as all the holiday photos, several items of clothing or fridge magnets, the participant was asked to select one particular photo, clothing or fridge magnet per card. It was irrelevant how many of the same type of item was selected; the participant was interviewed in relation to each item separately. We made an exception when the participant had organised photos in albums or a website. In those cases, the photos were considered as a whole and listed as one item.

With the cards in hand, the participant would show the items one by one in any order they chose. For each item, a few questions were asked. The interview questions were as follows:

- Could you tell me about this item?
- How did you acquire this item?
- What do you (normally) do with the item?
- Have a look at the item. What comes to mind?
- Do you consider that a memory?
- Do you see this item as a memory cue?

If the participant had already talked spontaneously about a topic, the question would not be asked. A photo was taken of each item to support the transcription and analysis of the interviews afterwards. If new items came to mind during the interview that the participant was very keen to talk about, they could include this item and write it on an empty card.

After all the items had been discussed, the participant and researcher would lay out the cards on a table and start the card ordering task (Fabbris 2012). This part of the method however, was not used for the analysis, and therefore is not be described in great detail. The interviewer would put down two cards on the table, each with a descriptor, and the participant would be asked to rank the cards in between these descriptors (e.g. ‘best cue’/’worst cue’) in the right order. When this was completed, the interview would come to an end. The researcher would ask if any photos were taken they would prefer not to be used in publications and thanked them for their participation. The total visit took between one and a half and two and a half hours, depending mostly on the number of items that were chosen.

3.3.4 Analysis and results

Two topics were analysed in depth using the thematic analysis approach (Braun & Clarke 2006, 2012), incorporating all nine transcripts in the analysis, the interaction with and use of the items, and the history of each item after it had been acquired by the participant. We started the analysis process by reading the interview transcripts and selecting the text pieces that contained relevant information to these topics. Most excerpts from the interview transcripts came from the conversations in the home-tour, such as the general introduction of the item and their answers to the questions 'What do you do with this item?' and 'How did you acquire this item?' The excerpts from the interview transcripts were printed and coded by hand following a bottom-up coding process. Sometimes photos of the items were also studied to support the interpretation of the transcripts. The codes were developed into six themes, which we will present Section 3.4. A spreadsheet was used to organise and compare data.

Participants listed between four and 12 items (eight on average) and a total of 71 items were discussed. The items and locations are presented in Table 3.2. The locations where most items were located were the living room, the bedroom (16 items each), the kitchen and digitally stored items (12 items each). As to be expected, most wearables were found in the bedroom (in wardrobes and cabinets), most images were digitally stored (on computers, phones and social media), and books, guides and papers were generally stored in the living room (bookcases or on the shelf of a coffee table). Quite a large proportion of the decorative objects was located in the kitchen, mainly due to the number of souvenir fridge magnets mentioned in this study. Other common places for decorative objects were the study and the living room. On five occasions, the items were either not in the home or could not be found or accessed during the interview. Those items were still included in the tour and discussed without having them to hand. In some cases, the intended digital photo was not found, or the participant was not certain if the photo they found was the one they had been searching for. Often, however, a similar photo or the same photo in another medium (e.g. Facebook) could be accessed and used instead.

As can be concluded from this table, one third of the 'home' items left the home on a regular basis (wearables, such as bags and clothing) or were accessible outside the home (digital photos and other digital items). Most of the items were acquired during the holiday as a souvenir or for practical reasons (e.g. sunscreen, or warm clothes). Some of the acquired items were transformed after the holiday, such as into canvas printed photos, collages, or digital or physical photo albums. Six items were acquired before the start of their holidays (e.g. a travel guide, a Gore-Tex jacket or a travel adaptor), and one was acquired immediately after the holiday (a welcome home image drawn by a child).

Table 3.2. Overview of items and their locations.

	Total	Digital	Living room	Bedroom	Kitchen*	Study*	Hallway	Bathroom	Mobile / worn	Storage space*	Not found or outside home
Wearables	**17**		**2**	**12**			**1**		**2**		
Clothing and shoes	*11*		*1*	*9*					*1*		
Jewellery	*3*			*2*					*1*		
Bags and wallets	*3*		*1*	*1*			*1*				
Images	**16**	**10**	**3**			**1**	**1**				**1**
Single photos or postcards	*10*	*7*	*1*			*1*	*1*				
Organised photo or video collection (album, website, or collage)	*5*	*3*	*1*								*1*
Canvas printed photos	*1*		*1*								
Decorative objects and souvenirs	**15**		**3**	**1**	**7**	**3**				**1**	
Fridge magnets	*6*				*6*						
Drawings (by children or artists)	*3*		*1*		*1*	*1*					
Others	*6*		*2*	*1*		*2*				*1*	
Books, guides and papers	**9**	**1**	**5**							**1**	**2**
Books and guides about destination	*5*	*1*	*4*								
Random papers and leaflets	*3*									*1*	*2*
Leisure reading books	*1*		*1*								
Handwritten and typed notes and journals	**3**	**1**	**1**						**1**		
Food and drink	**3**				**3**						
Body and shower creams	**2**							**2**			
Others	**6**		**2**	**3**							**1**
TOTAL	**71**	**12**	**16**	**16**	**10**	**4**	**2**	**2**	**3**	**2**	**4**

* In homes with an 'open kitchen', items placed in the kitchen zone were considered as located in the 'Kitchen'. If the item was located in a study space and this was located in another room, such as the bedroom or living room, this item was categorised under 'Study'. If the item was located in a storage space that was not a separate room but part of another room, this was categorised under 'Storage space'.

3.4 Findings: the use of personal items

We looked at the use of the travel related items in relation to their purpose as a cue to a memory of a past holiday. In this section we present different uses, such as repeated use of items, changing use where items obtain a different role over time, and the degree to which the items were exposed in the home. We also found tensions in the owners' interactions with items and the decisions they made as to whether to use it or discard it, put it on display or hide it, wear it in public or only indoors etc. We conclude this section with how participants wished to use the item in the future.

3.4.1 Repeated use

We found that some of the items, such as clothes and jewellery and travel items, had accrued meaning through being with the owner during one or more journeys, events or activities and being used multiple times during and after the holiday. The multiple uses seemed to come at a cost with regard to the reminding function of the items. Many participants said they valued the item because they could use it, but also that it did not cue memories very often. When it did cue a memory, participants said it was a general memory, such as the country or continent the item came from, rather than of specific events. However, in other cases, participants remembered multiple events where they had worn or used the item.

Some of these items that had been used repeatedly were mundane and had accrued meaning over time and carried marks or traces from the events at which they had been present with their owners. We call these items 'companions' (see Section 3.5 for more details). A typical example of such a companion was a passport containing stamps of the Pacific Islands, including the names of the islands and the dates the participant visited them (Figure 3.1). These stamps were not official customs stamps and were not needed to access the Pacific Islands. They had been bought for their own sake, mainly because the participant wanted them as 'memory joggers' for the different destinations visited, and if visited multiple times, to notice the dates of each visit.

Figure 3.1. Passport with stamps from the islands visited during a cruise holiday.

> *'If I ever need to look at my passport for any reason. I have a flick through and look at all the stamps, just to remember where I've been.' [P3]*

Other examples included a travel journal and a wallet with scraps of paper from several events. These items accrued associations with participants' memories over time even though they were often utilitarian. Interestingly, we did not find any digital items that were companions. This is covered in Section 3.5, which explores how companions can be brought into the digital world.

3.4.2 Changing use

Some of the items participants had kept from their holidays had gone through a role transformation. The most common pattern was for an object of use to become a souvenir. For example, one participant showed us some bracelets bought and worn during and after a trip. At some point, these bracelets were taken off and placed in the living room on display on a chest, as though it was a small shrine to his holiday. Later they were moved to a cabinet in the bedroom together with other souvenirs from the trip. Other examples include a jacket, provided by the ship's crew on an Antarctica trip, which was no longer used and was moved to a storage box, or a broken key ring, where the figure of a penguin, which was part of the key ring, was now kept as a decoration on the desk. The reason for keeping them was often for the memories they evoked or for their symbolic meaning. One of the participants showed a camera that was bought for the trip but had been replaced by a better model. The fact that it was the first camera that sparked her interest in photography, kept her from selling it. She explained:

> *'It opened a new avenue of creative exploration for me. People have said, you have a new camera, so you will sell your old one?! And I am like, mm, yeah, it may take a while before I sell that one.' [P6]*

In most cases, a change in an item's function or location involved moving it from being on display, or an 'easy-to-grab' location to a more hidden location or to being stored away or from being used a lot to being used hardly at all. Books and guides from the destinations were used to tell friends and family after the holiday about what the participants had seen, and photos were selected and put in slide shows. After a while, however, the books were covered under a pile of other books and digital photos were viewed less and less.

We also found transitions in the opposite direction. For example, a travel diary (Figure 3.2) that was given as a gift a few weeks before the participant embarked on his travels to Europe was hardly used during that trip, but was then used frequently one and a half years after his return.

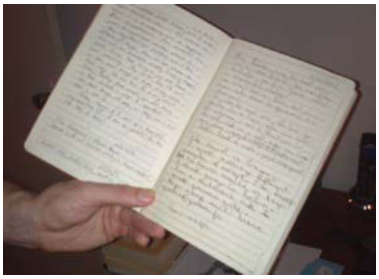


Figure 3.2. Journal that is more in use now than it was when travelling.

> *'I took a journal, it was fresh, there was nothing in it, and I didn't really write that much. I [wrote] in it like the first day or two and never again. […] When I got back home, I just put it away somewhere. A month or two ago I took it out and started writing in it. I wanted to put my thoughts down about life and everything.' [P1]*

Thus, the item was repurposed from a travel diary that contained very little of the owner's travels to a home diary for personal non-travel related reflections.

Another type of transition was from being hidden to being on display. For example, the owner of a vase (Figure 3.3) bought in a store in Tokyo described its transition as follows:

> *'It used to be over in the kitchen, with all the other crockery stuff. But, um, it was behind some other things and I never looked at it, so, I moved it over here. So I can see it.' [P5]*

Figure 3.3. Vase that moved from kitchen cupboard to living room for more exposure.

The participant liked the design of the object, but she did not see it as much as she wished because she never needed a vase for flowers. Therefore, she moved the vase from the kitchen to the living room where it now serves as a decoration. How we label things can dictate where our possessions get stored, as in this case; while crockery and other porcelain usually belong in the kitchen cupboard, this can change when it is not the participant's preferred place and role for the item.

If we look at the digital items, the photos in particular, the roles do not change sequentially, but perform different roles simultaneously. One of the participants said that he had posted a photo on Facebook, on Instagram, in his digital collection and as a desktop screen photo at work after he returned from his holiday. The activities of using and publishing the photos on different platforms became part of the memory that the photo cued. The photo of a sculpture that had evoked strong emotions when he saw it in Spain also cued feelings now when seeing the photo, but in addition to this also other aspects came to mind. He said:

'It is almost a memory cue for a lot of things that have nothing to do with the trip. It is a memory cue for when I came back, and posted it up on Instagram. It is a memory cue for…' [P1]

3.4.3 Exposure and use

The frequency with which we are exposed to items in our daily life affects our relationship with and perception of these items. Participants mentioned that items that were seen very regularly, for example, fridge magnets or bags, were noticed less and were weaker cues. Conversely, people mentioned that items that they rarely saw triggered memories easily. The more items become part of the home décor seen on a daily basis, the less people pay attention to them. One of the participants said of a fridge magnet (Figure 3.4):

'You know what's funny, I haven't even looked inside this thing since we bought it. So I don't even know what's in it. It's got a boat and uh, a fish, a dolphin. The cool thing is, you actually see these fish when you go diving. They are this big [showing the size with his hands] […], and they are really aggressive. They will attack your goggles. Right between the eyes and they will bash you in the face and they are completely harmless.' [P3]

Figure 3.4. Fridge magnet, seen often in passing but rarely paid attention to.

Although he never looked at it and the cuing of this memory was probably not a rehearsed response, the memories of the fish and his experiences when seeing the fish while diving came right to mind now he looked at it.

Participants said that the item cued more if it had not been seen for a while. One of the participants said that if she had not seen or interacted with an item for a while, it evoked memories. She explained:

> *'I think when you got something with you all the time, you don't need the memory jogger. Because it is there. And you know that it…, where it came from. But as I said, if you put it away, and you haven't used it or worn it or seen it or something like that, as soon as you pick it up again, then that's the memory cue I think.' [P4]*

Items can have functionalities that distract from the memories associated with them. Another participant said that the fact that the bottle of sake was an object of use distracted her from thinking about the memories.

'I think it kind of distracts it from being a cue, in a sense. Because I am thinking of it in terms of how I would use it. I am thinking it in that way. Rather than just the memory that is associated with it.' [P5]

3.4.4 Discomfort and use

Our participants showed us items that they kept in their homes but had been given a special hidden place because of the discomfort or embarrassment they aroused. One example was a handbag made of deer fur in the shape of a cat head (Figure 3.5). The owner cherished this item and put it on a shelf in the living room. However, animal loving friends who visited her home found the item 'obnoxious', as a result of which she covered it under a big hat.

'It is a bag. Which I hardly ever use, because it is very weird... And it scares people.' [P5]

Figure 3.5. Cat bag made of deer fur hidden under a hat because friends did not like looking at it.

However, the item evoked fond memories in the owner. It reminded her of a second-hand shop in Tokyo and the lady in the shop. It had once been used at a public event (book launch) on purpose because it served well as a conversation starter. There was a story behind this peculiar handbag that she liked to tell when people asked her about it.

The consideration of 'what other people think of it' also played a role with clothes, for example in the case of a t-shirt with the text 'I am a [Bolivia] Death Road survivor'. The owner explained:

'I don't wear it very often. So, I don't know why I don't. But, probably because I'm self-conscious. Like, people will think I'm an idiot. Like, why would this guy do that.' [P7]

Some participants felt that limited exposure also preserved the cuing potential of the related memories better, as the owner of the cat bag explained:

> *'[B]ecause it is stored out of sight, I don't see it very often. So when I do see it, it makes me automatically think of...' [P5]*

Sometimes items were deliberately hidden to avoid confronting undesirable memories or nostalgic feelings. In daily life we do not always want to dwell on the past; even pleasant memories may be a distraction. A clear example of this was a participant's suitcase with papers and leaflets, called the nostalgia box. The participant said,

> *'I don't usually like sitting down and going over it […] it makes me sort of wishful, or, you know, not sad, but like, I don't know how to describe it. […] Because that's it, maybe, I had such a good time. And I'll never go there again.' [P7].*

Personal items have different functions, and the items used explicitly for remembering are sometimes kept out of sight.

3.4.5 Postponed use

Some functional items were deliberately not used because they were cherished as souvenirs, and the participant felt they would lose some of their 'souvenir property' when used. We saw this in relation to items with liquid content, for example a full bottle of sake from Japan, which was kept together with other full bottles on a shelf in the living room.

> *'[Y]eah, we really should have had this by now. But I really like the bottle [laughter]. So I don't want to drink it.' [P5]*

Here there was a conflict between the role (function) and meaning of these items, and the behaviour that went with them. If a bottle is empty, people usually want to discard it, because its meaning has changed and it is considered as waste. However, because for this participant it was a cherished souvenir and she had fond memories associated with it, she did not want to discard it or use its contents. Participants in these cases did not use such items, and as long as they still had the potential to be used, they did not need to be discarded. There was a similar tension in the case of a participant who kept a bottle of body wash and a bottle of sunscreen, the smell of which brought back memories of the holiday (Figure 3.6).

'Yeah, I think one day I will use it, because it is sunscreen. You know. But then again, I don't want to use it, because it was when I went to Roland-Garros, in France. […] And the smell of it reminds me of when I was there. I haven't smelt anything just like that. Every smell is different. When I smell that I remember I was there at Roland-Garros. I love tennis. I play a lot of tennis. It was a big deal for me to be there […].' [P1]

Figure 3.6. Bottle of sunscreen from Roland-Garros.

Preserving the content was important in this case, especially because the content was crucial for remembering. From a cognitive perspective, using the sunscreen and smelling it while watching the tennis match at the French Open encoded the event in the participant's memory and allowed him to retrieve this experience whenever he smelled the sunscreen. The smell of the sunscreen was a memory cue. There was a tension about whether to keep or discard the item. During the interview he said:

'But in the end, I prefer to throw it away and I'm gonna keep this bag [plastic case], because it has the [Roland-Garros] logo on it.' [P1]

Liquids were not the only items to cause tensions; broken souvenirs did too. One of the participants showed a broken fridge magnet (Figure 3.7), a figure of the Statue of Liberty but without its head. Despite its aesthetic diminution, it was a precious memory cue that evoked vivid memories in her, and this held her back from throwing it away. Interestingly, she did consider replacing the item:

'This one looks very sad, because she has lost her head, but I can't bring myself to throw it away. […] I should get someone next time they go to New York to get me another one.' [P4]

In this example, the breakage of the item caused tension between the aesthetic and the personal memory value of the item.

Figure 3.7. Broken fridge magnet of the statue of liberty.

3.4.6 Future use

In relation to several items, an intention for future use or disposal was mentioned. People sometimes expressed regret or guilt that they had not done with the item what they felt they should have. One of the participants had a book about Arlington National Cemetery near Washington, of which she said:

> *'I haven't done it [read more of the book], and I feel bad that I haven't done it, but, I can do it one day when I find some time, just to read a little bit more of some of the stories.' [P4]*

People's intentions for items usually involved using or displaying them more than they did at the time of the interviews, for example, putting something on display that was currently packed away. Other participants intended to use the item again, which appeared in two types of 'reuse'. Sometimes people wanted to use the item again in its current function or state, like rereading a book or using a lanyard again. Other items were intended to be repurposed, such as creating a diary or scrap book and using the collected leaflets and notes, or after putting a photo to several uses such as on Instagram and as a desktop screen photo, to reuse it for something new, but not yet knowing how. Several other items were mentioned in relation to an intention to dispose of them in the future, despite their connection with precious memories. This was the case for the sunscreen mentioned earlier, the smell of which evoked strong memories of the place where the participant had used it. The intention to dispose was linked to the type of item, for example, those that were not intended as something to keep forever:

> *'They're just, they're not going to be around forever. So I accept that, so I will throw them out very soon.' [P1]*

Interestingly, one of the participants said she considered disposing of her hardcopy photo albums (Figure 3.8), which went against the common research finding and belief that people are attached more to physical items (including photos) than to digital items (Petrelli & Whittaker 2010).

'[I]t's just, it is a reproduction. So, I can throw that away and I can just print new ones. Also the print quality wasn't as good as what I'd hoped. […] Because I do have the digital versions. So, you know, and I see the photo program on my computer as much as I see the albums on the shelves. So, for me, they're just a thing, they don't really mean anything.' [P6]

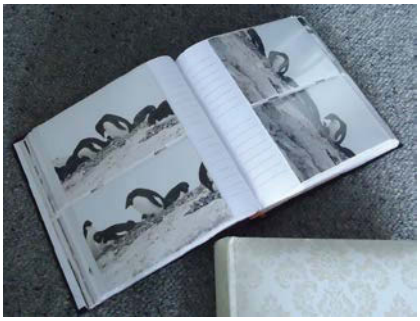


Figure 3.8. Participant considered to throw away her printed photo album.

For this participant, the items that were of real value were the digital photos, rather than the printed, annotated and curated ones in the album.

3.5 The companion relationship: applying companion qualities to the digital

In Section 3.4.1 we mentioned the companion relationship. In short, companions are mundane objects that accrue meaning over time by travelling with the owner, carrying marks from past experiences and evoking tiny pleasures when encountered. The companion relationship emerged from observations in the home-tour interviews and their transcripts, and is part of the theme 'repeated use'. While we originally did not intend to investigate attachment relationships, such as the companion relationship, we considered it an interesting concept to explore in relation to memories and cuing due to its involvement in the owner's activities. We developed the concept further by revisiting relevant parts of the transcripts, focusing on defining the companion's characteristics by using open coding. We included 21 items for this analysis. Interestingly, the companion relationship was not found in relation to the digital items in the study, even though this type of relationship with digital items may also have value. In this section, we focus on the companion relationship, which was found especially among objects of use, to investigate how we could enhance the chance that digital items become companions. We do this by specifying companions further and presenting the main insights based on a literature review of digital attachment relationships.

3.5.1 Defining companions

Companions are items that 'travel' with the owner and are involved in activities that allow personal value and associations with memories to accrue. By 'travelling' we mean being a companion in parts of the owner's life journey. This could be by literally travelling, such as items brought on holidays, or by being involved in activities or traditions at home.

Examples of companions from our data collection were a journal, a passport and a wallet. In the case of the journal (see Figure 3.2), the owner wrote a bit in the journal at the beginning of his trip, as did two other people whom the participant had met on a train during his trip. A year after the trip, the journal had been used again as a diary at home, to write down his thoughts. The passport of one of the study participants had been taken on many travels, and the stamps reminded the owner of where he had been and when (see Figure 3.1). The wallet of another participant contained scraps of paper from several experiences and travels. The examples presented here are all physical items, although this does not necessarily mean that people do not also possess digital companions. Denegri-Knott, Watkins & Wood (2012) investigated how people make virtual possessions their own and bond with them; in other words, they have a companion relationship with a virtual object. However, this was not found in our observation of companions in this study. Below we discuss companions in relation to their characteristics of 'modifications', 'memories' and 'interaction and use'.

Companions often had modifications, intentional or unintentional, that cued memories of the events during which they had accompanied the owner. One example is the passport discussed in Section 3.4.1 (see Figure 3.1), in which each stamp represented a place where the participant had been. The presence of these subtle marks in the passport cued memories of the places he had been to and they evoked pleasure every time he looked at them.

Companions have a double role. They are often a utilitarian object, involved in performing activities with the owner; they are also a memory inducer and perhaps a cherished object. A characteristic of companions is their ability to accrue associations to memories over time and remind the owner of these past experiences. The fact that companions may be involved in multiple events may also make their memory associations less specific, unless they contain clear marks of individual memories. One of our participants showed scraps of paper that he kept in his wallet (see Figure 3.9) that sparked joy whenever he saw them.

> *'Each time I look at it, oh yeah that song, I really enjoyed it!' [P7]*

The participant had asked a staff member in a pizza restaurant in Peru for the name of a song he was hearing through the speakers at that moment, and had written it on the back of the receipt. The receipt also contained other notes made during the holiday. Although he intended to find out more about the song at a later point, in practice this receipt then served as a memory cue when he saw it in his wallet.

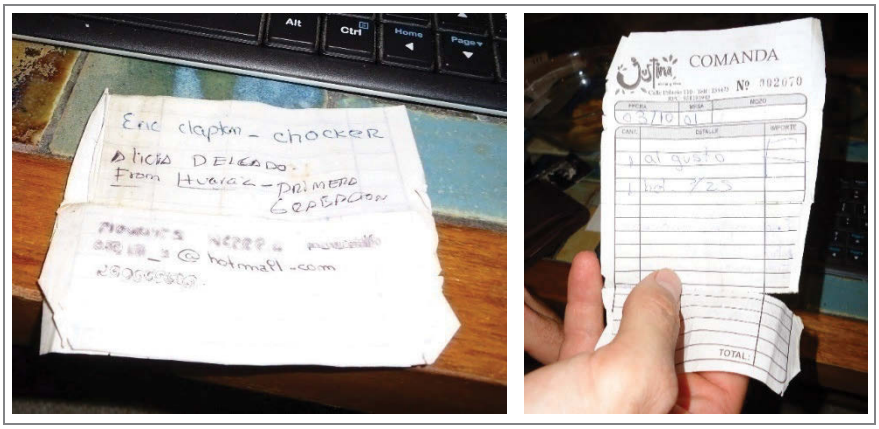


Figure 3.9. Scraps of paper with notes kept in wallet.

The involvement in activities and routines such as 'joining the owner on holiday' is an important aspect of an item for it to become a companion. Owners may not consciously recognise them as meaningful items at the time and it was stated earlier that companions are often utilitarian objects. However, this role may change over time, for example when an item is being replaced or not needed anymore. The item may then change from being one of everyday use to a souvenir and these roles may overlap during its lifetime.

Our concept of companions shows overlap with the product relationship category 'living object', as proposed by Battarbee & Mattelmäki (2002). The companion differs from the 'living object' in that we do not define the companion as something with human properties. Companions are items that have a function and play a role in the background, providing comfort and contentment to the owner when he or she is interacting with them.

3.5.2 Motivation for exploring digital companions

We know from the literature that the perception of digital items, such as photos, music and social media profiles, differs in many ways from their physical counterparts. Physical items have qualities that can engage all the senses, whereas digital items are mainly visual and sometimes auditory (Banks 2011). Digital items have qualities that physical items do not have and the other way around (Banks 2011; Odom, Zimmerman & Forlizzi 2014). When physical items and processes are digitised, items that can serve as memory cues are often hidden or less accessible, allowing for less serendipitous encounters. For example, visas to foreign countries are now increasingly stored digitally and are hardly accessible to the owner, in contrast to the passport itself, which accompanies the traveller wherever he or she goes. Handwritten scribbles on different pieces of paper in a wallet become on a smartphone a neatly organised collection of almost identical looking notes, with little reference to where they came from or when they were written. The focus when digitising

utilitarian objects (e.g. money, passports, and notebooks) and the processes involved in organising those objects is generally on efficiency, usability and user experience. The user may be able to personalise certain software aesthetically, for example, the layout of a text processor, but there is little that allows memory cues to accrue and emotional bonds to form. Efficiency and utility may be the major goal of digital companions, but they could also be a subtle reminder of the owner's past. The following sections present insights based on the human-computer interaction (HCI) literature on how digital companionship can be supported.

3.5.3 Designing for digital companions

We reviewed the literature of case studies on digital attachment relationships and improved remembering experience. Below we list a couple of insights that could be applied when embedding companion qualities in digital items or systems. The majority of the work in this area comes from interaction design, software design and HCI research into remembering. For reviews on these topics, we refer to Lee & Nam (2013) for a case study analysis on using interaction history for emotional bonding and to Van den Hoven, Sas & Whittaker (2012) for an overview of design for remembering. The field of product and consumer research has an abundance of literature on attachment to material items; we found work on bonding with electronics (Turner & Turner 2013), but little on bonding with products or applications in digital format. An exception was the work by Denegri-Knott, Watkins & Wood (2012) on virtual possessions. Based on our review of case studies in the literature on digital attachment relationships and improved remembering experience, we came to four insights that may provide design opportunities for digital companions.

3.5.3.1 Insight 1: Modifications need to be meaningful

We found that it was important that alterations or augmentations made to an item (that can cue remembering) are to be seen as improvements. Although patina on material items often increases their emotional value (Odom & Pierce 2009), findings indicate that this is not the case for electronics and digital photos. Participants wanted digital technology such as laptops and smartphones to look like new (Odom & Pierce 2009). They perceived 'digital patina' for digital photos as undesirable, impractical and a quality that did not belong to digital photos (Gulotta et al. 2013). However, they did think that augmenting the digital items with information (e.g. narratives) could potentially enrich them.

In the literature about digital traces, we found not only that traces were augmented to digital applications or files, but also digital traces materialised into physical things. Findings indicate that this increases the emotional bond both with the product and with the individual's past. An interesting example of companions comes from Lee, Son & Nam

(2016), who conducted a study in which cyclists' digital cycle-history was gradually engraved as patina-like patterns on a bicycle bag over a period of three weeks. One important design implication leading from their research (Lee, Son & Nam 2016) is that augmented material traces need to be tailored to their users. Participants felt the material traces had to be personally meaningful. Similar findings were reported by Kleine, Kleine III & Allen (1995), who found that people attach to possessions that cue memories they identify with (personally meaningful) and detach from possessions related to memories from which they would rather disconnect. We can conclude therefore that when adding traces or augmentation to items, we need to consider whether the associations will be meaningful for the users.

3.5.3.2 Insight 2: Allowing control

In the case of passively captured traces (e.g. by logging information behaviour or geo-information), people expressed the desire to control what information was kept and shown (Gulotta et al. 2013; Lee, Son & Nam 2016), not only in relation to privacy concerns (what is captured about them and where) but also to which experiences were traced. Experiences may not always be meaningful to the owner, they may evoke negative emotions or they may turn out to be less important in hindsight (e.g. Alallah & Hinze 2011). Such control can be enabled at the moment of collecting the traces, such as 'marking moments' that can be revisited and augmented later (Alallah & Hinze 2011), or afterwards, for example by allowing the user to select which traces should be permanent, or by creating erasable traces (Lee, Son & Nam 2016).

3.5.3.3 Insight 3: Usage -- awareness of time spent together

It has been known for a long time that the amount of time and energy invested in a physical possession is an indicator of its significance to the owner. Csikszentmihalyi and Rochberg-Halton proposed that items gain meaning when the owner invests time and energy in them (Csikszentmihalyi & Rochberg-Halton 1981). Studies have found that crafting (spending time creating digital possessions) is also linked to bonding with items (Banks 2011; Denegri-Knott, Watkins & Wood 2012; Golsteijn et al. 2012). Based on this, we can conclude that the awareness of time spent with a digital item may contribute to the companion relationship with that item.

3.5.3.4 Insight 4: Augmentation and repurposing

In the HCI literature on reminiscing and storytelling we observed examples of digital items enriched with (other) digital information and the integration of the digital and the physical to obtain the best of both worlds (e.g. Banks & Sellen 2009; Frohlich 2004; Lee, Cha & Nam 2015; Van den Hoven & Eggen 2005). We also found differences in how closely the

traces (acting as memory cues) that the item collected or provided were attached to or incorporated in the item. The original item and added traces could be completely separate, which also allowed the item that acted as a trace to be repurposed, or closely connected. For example, in a study on traces to movie content by Lee, Cha & Nam (2015), pictures of the audience were automatically printed after the movie had finished, as a trace of the movie-watching experience. These images were separated from the digital item and could be used in other locations and situations. For example, one participant commented she wanted to keep the images in her diary (Lee, Cha & Nam 2015). This kind of repurposing was also seen in research among teenagers by Odom, Zimmerman & Forlizzi (2011), where people would print Facebook conversations and put them on their bedroom wall. Opportunities for repurposing allow the owner to store items in locations where they are likely to be seen and reflected on, and they may provide ways to express identity. We can conclude from this that augmenting an item with additional information and allowing users to take a trace from the item can act as a memory cue and may contribute to the companion relationship.

3.5.4 Reflecting on digital companions

In the previous section (Section 3.5.3) we discussed design opportunities based on findings from the literature that allow companionship with digital items. Companions play a role for the owners individually in providing tiny pleasures when in use. Additionally, in their ability to cover a life period, companions may also play a role in storytelling to friends or significant others.

The findings suggest that devices and data unrelated to a companion item may be a useful source to represent the owner's past with that companion item. The recent spurt in the emergence of the Internet of Things (Koreshoff, Robertson & Leong 2013) may be an opportunity for a wide selection of meaningful information (and pattern creation) to become available. Companionship is not so much about the item's past but the owner's past, to which the companion is, or has been, a witness.

The memories that a companion triggers play a modest but important role. Companions are often utilitarian objects, and the emotional response and memories they evoke may be side effects of the utility-relationship, perhaps hardly consciously perceived. Nevertheless, they are part of the user experience and would be missed if the item was replaced by another item that did not have the companion status.

3.6 Discussion

We approached our research from the perspective of items' potential to cue personal memories. Memories play a crucial role in people's wellbeing, and personal possessions

can facilitate everyday remembering. The home-tour study presented in this chapter yielded observations about the use and tensions of memory-evoking items in the home.

The distribution of holiday-related items shows that they can be found almost anywhere in the home. All possible rooms, sometimes even areas outside the house, such as a storage room, contained possessions that evoked memories. This is in line with findings from studies on personal possessions in the home by Nunes, Greenberg & Neustaedter (2008) and Petrelli, Whittaker & Brockmeier (2008). There were also places we did not visit, such as balconies or gardens. They might have been overlooked when selecting items for this study, or perhaps outdoor items are rarely collected on holidays.

Several categories of items found in this study were not bound to the home, but were taken out of the house or apartment and used elsewhere. These included digital items such as photos, which are placeless in their nature (Odom, Zimmerman & Forlizzi 2014), wearables (jewellery) and mobile items located in pockets or handbags (a jacket for rainy weather, pieces of paper in a wallet). Over one-third of the personal items were accessible outside the home. This poses the question as to whether and how the role and meaning of possessions may change when they are in different locations. In relation to memories for example, research has shown that environment factors influence remembering (Smith 2013). In these studies, participants studied word lists in one environment and were tested in another environment, such as under water versus on land with divers (Godden & Baddeley 1975), and in the air versus on the ground with skydivers (Thompson et al. 2001). Besides that these experiments have shown that remembering is improved when tested in the same environment where the memory was originally encoded (and reduced when in a different environment), they also found that in some environments, e.g. in the air, participants performed worse in general. Thus, it is likely that memory cuing by personal items is affected by a different environment, and while not investigated, possibly their role and meaning as well, which may influence the cuing of memories.

In our findings, we saw many tensions related to the different meaning of items when their form or context changed. For example, some favourite clothes may not be worn outside the home because of potential embarrassment. A handbag (i.e. the cat bag, Figure 3.5) may be purposely taken out as a conversation starter, and ‘worn’ with pride, or hidden under a hat when at home so as not to disturb visitors. A topic that needs further investigation is the effects of changes in an item’s context and use on its role as a memory cue.

Based on the findings in this chapter we see tensions between 1) the owner’s personal memories associated to an item (personal value), 2) the aesthetic value the owner ascribes to the item (aesthetic value), 3) the practical usability of the item, such as whether it is empty or broken (utility value), and 4) the social or cultural context, in the sense of what other people think of the item (social value). We saw that memories (personal value) and the appreciation of its aesthetics (aesthetic value) played a role in the use and non-use of

items, for example by the extent to which items were displayed (e.g. not discarding the broken fridge magnet because of memories or attachment, or the vase that was moved to the living room). The tensions in relation to utility (utility value) could be observed in the use or non-use of sunscreen, or drinking a bottle of sake. The social value was evident when people were not happy with displaying or wearing an item (e.g. the cat bag). These tensions show overlap with the determinants in Mugge et al.'s model about product attachment, in which the determinants 'utility', 'appearance', and 'memories' lead to product attachment (Mugge, Schifferstein & Schoormans 2008).

About two-thirds of the items did not leave the home, and, as illustrated by our findings, inside the home these items changed location, and did undergo role transitions over time. They changed from objects of use to souvenirs, from items on display to being hidden or moving from a location in the background to the foreground. With these transitions, their meaning changed, as did their potential as memory cues. Results from this study also indicate that objects of use evoked less specific memories than other, more typical, souvenir items or photos (see Chapter 4 for more details). The findings described in the current chapter indicate that the items that were seen every day cued less, or less specific memories, than items that were rarely seen. This may also indicate that habituation takes place; we become accustomed to a stimulus (i.e. a memory cue) we have been exposed to a lot and start paying less attention to it (Sternberg & Sternberg 2011). Frohlich, Wall & Kiddle (2013) found that photos that had been forgotten cued a much broader memory (not just the event itself, but also what happened after the photo was taken) than a photo that was seen repeatedly.

We saw that digital items could act in multiple roles simultaneously, whereas physical items change roles in a more sequential way (e.g. from object of use to decorative object). Digital items possess different qualities compared to physical items. Odom et al. summarised these qualities as spacelessness (in the sense that they do not occupy any physical space), placelessness (meaning they can be made available and accessed anywhere through multiple media) and formlessness (they can easily be replicated or altered) (Odom, Zimmerman & Forlizzi 2014). This also implies that owners do not experience the same tensions that they do with physical items. For example, digital items were sometimes difficult to find (which is in line with findings from Van House & Churchill 2008; Whittaker, Bergman & Clough 2010) but could be accessed through another medium (e.g. social media). There was no hesitance about using such items, as they do not deteriorate over time or transform into waste, and several participants had ideas in mind for using them in the future.

We investigated companions, items that had accrued meaning over time by travelling with the owner and carrying marks from past experiences, and explored how the companion relationship for digital items, processes or applications could be supported. The findings of

our review of related work suggest that devices and data unrelated to the companion itself may be a useful means of representing the owner's shared past with that item. We concluded that companionship is not so much about the item's past, but about the owner's past, to which the companion has been a witness. The memories that companions triggered were often quite general. Companions are often utilitarian objects, and the emotional response and memories may be side effects of the utility-relationship, perhaps hardly consciously perceived. Nevertheless, they would be missed if the item was replaced by another item that did not have the companion status.

3.7 Conclusion

In this chapter, we looked at the use of personal possessions in the home and the tensions in the relationship between the owner and the personal possessions. Seventy-one (71) items that related to a holiday were investigated, the majority of them located in the living room, bedroom, in the kitchen or stored in digital format on electronic devices. As we saw that one-third of the personal possessions were regularly taken outside the home, or could be accessed outside the home, we concluded that items in the home were less tied to the 'home' than previously assumed.

We observed several uses affecting owners' relationships with the possessions and their effect on their function as memory cues. First, we presented examples of repeated use in which items developed into companions. We then showed examples of how the use can change over time. A decrease in use was most common, but an increase in use and display could also occur. We found that increased exposure often led to less remembering and vice versa. We also saw how items were hidden or kept private, or used and accessed less because they caused discomfort or tensions (such as embarrassment) on a social level. What other people thought played a role in the use and display of personal items. We observed similar tensions about the use of items containing creams or liquids, such as a bottle of sake or sunscreen. Participants were hesitant to use them and felt that they could not keep these items as a souvenir, once they were empty. We discussed people's intentions of how they would use the items in the future. In general, people intended to use the items more, repurposing them or putting them back on display, and sometimes they expressed that they felt they had neglected the items in the past. Some of the mentioned changes and tensions may have a positive effect on the relationship, for example not being liked by others may make the item more special. Or, enabling an item to transition its role (instead of discarding it after it served one role) could extend its lifetime.

We concluded with a short investigation of how companions, which we found only among physical items in this study, could be brought into the digital world. We identified four insights from the HCI literature that could be applied to digital items to facilitate the

companion relationship. First, the traces or modifications that the companion might undergo needed to be meaningful to the owner, in a way that they connected with experiences that the owners themselves identify with. Second, allowing control over which experiences were traced enhanced ownership and provided the opportunity to choose marks with pleasant associations. The third insight, awareness of time spent together, meant that the owner was aware of the item's presence by having spent time and energy with the item. The fourth insight was enhancing the digital item by augmentation and allowing for repurposing. The insights were meant to inform the design of companions.

Although the above-mentioned findings were based on an exploratory study with only nine participants, they provide insights into the dynamic relationship between owners and their possessions. The tensions determine if and how possessions are used, and thus their ability to fulfil their function as reminders of the past.

4 OUTCOMES OF CUING BY PERSONAL POSSESSIONS

Abstract

We collect items to remind us of past events, but not all items bring back memories to the same extent. In this chapter, we explore people's responses to personal possessions related to a holiday, and, as described in the previous chapter, discussed these personal possessions during a tour of the home. We were interested in the variety of responses that personal possessions in the home can evoke. In total, nine home-tours were conducted and 63 accounts of cued responses were obtained and then analysed using thematic analysis. The qualitative analysis resulted in four categories of cued responses: A) 'no-memory' responses, i.e., responses that did not relate to a memory, but instead evoked practical thoughts related to the item. Alternatively, the participants felt the holiday item cued nothing, B) 'knowledge' responses, mainly evoking semantic knowledge regarding the associated events, C) 'reflection' responses, such as thoughts, feelings, judgments or reflections, based on a memory, and D) 'episodic memory' responses, such as episodic memories where an experience was relived. For each of these cued response categories, we looked into the types of items and their characteristics. In addition, we found that some items can evoke multiple memories. The majority of the memory content referred to events that took place close to the moment when the item was acquired. These findings thus provided insights into the possible effects of cuing by personal possessions.

This chapter is based on:

Zijlema, A., Van den Hoven, E. & Eggen, B. 2017, 'A qualitative exploration of memory cuing by personal items in the home', *Memory Studies,* ahead of print, pp. 1-21.

4.1 Introduction

Retrospective remembering is often cued by things, people, locations and situations. Our personal space often contains possessions that we cherish or that remind us of our personal past and these personal possessions can act as cues and bring back past experiences. We know from existing research that the presence of memorabilia has been found to correlate positively with mood (Sherman 1991). We know that visual and auditory information contribute to the retrieval of autobiographical memories more than olfactory information (Willander, Sikström & Karlsson 2015). In the previous chapter we saw that personal possessions can have different effects on their owners' behaviour. Thus, while it is evident that personal possessions can have different effects on people, we have yet little knowledge of the possible outcomes of the cuing process.

In this chapter, we explore the variety of cued responses evoked by holiday items. A better understanding of cued responses may facilitate the design for enhancing remembering (Van den Hoven 2014). We analyse a different aspect of the home-tour described in Chapter 3, and we look in particular at the self-reported responses, which we call cued responses, when participants look at or interact with the item. In psychology research the study of how remembering is experienced, as opposed to the content such as its accuracy, is referred to as the 'recollective experience' or 'experiental approach' (Dewhurst & Conway 1994; Gardiner & Java 1993). We will also look into the number of memories attached to the items, and the time lapse between the event and acquiring the item.

Nine participants were interviewed using a semi-structured interview during the home-tour (Petrelli & Whittaker 2010; Petrelli, Whittaker & Brockmeier 2008), in which the participant guided the interviewer through their homes and discussed the holiday items from one particular holiday. Examples of holiday items included souvenirs, museum guides, fridge magnets, clothes and body and shower creams. Among other set questions, we asked what came to mind, while having the item present at its original location. We were interested in the variety of responses, ranging from items that evoked vivid memories to items that evoked no memories at all, regardless of whether digital or physical, cherished or not cherished, acquired for remembering or not.

This chapter focuses especially on the following research questions:

- What types of cued responses do personal items evoke?
- What is the number of cued responses attached to the items?
- What time periods do the cued responses refer to?

4.2 Literature on personal possessions and the retrieval of memories

In the next sections, we will introduce the literature related to this research. Research on external memory cues in people's personal environment, such as objects, people and events, and their effects on human memory in psychology research is scarce (Van den Hoven 2014; Van den Hoven & Eggen 2014). The majority of memory research is performed using word-cues, though it is sometimes with other modalities like visual, auditory and olfactory stimuli (see also Section 2.3.2). In addition, the research is generally undertaken in controlled settings, the aim being to unravel the processes that take place in the memory system (for an overview of cuing methodologies, see Miles 2013). We will start by discussing the topic of digital and physical items in the home and their role as memory cue. In the second section, we will go deeper into the mental processes of cuing memories, namely, the concepts of autobiographical, semantic and episodic memory and memory retrieval.

4.2.1 Possessions in the home: personal memory cues

In our home environment, we surround ourselves with things that we keep for a range of different reasons, for example, photos of our loved ones on the cabinet, text messages on our phone, souvenirs from our travels and carefully chosen furniture that we cherish. Things in the home often reflect the personal self and personal relationships (Csikszentmihalyi & Rochberg-Halton 1981; Golsteijn et al. 2012; Kroger & Adair 2008; Petrelli & Whittaker 2010; Petrelli, Whittaker & Brockmeier 2008).

Only some of the cherished possessions in our personal environment are valued for their role as memory cue. In fact, most of these possessions are not and are primarily valued for other reasons, such as their utilitarian qualities or the personal values they represent (Csikszentmihalyi & Rochberg-Halton 1981; Sherman 1991). The difference between an item acting as a memory cue and a general object is often blurred, as memory cues can be everyday objects (Csikszentmihalyi & Rochberg-Halton 1981; Habermas & Paha 2002; Petrelli, Whittaker & Brockmeier 2008; Van den Hoven & Eggen 2005), and the role of an item can switch between utilitarian and memory cue.

Cherished items in a digital form are notably different from physical items (see also Section 2.5 in Chapter 2). Previous research has demonstrated that digital items are less valued than their physical counterparts (Golsteijn et al. 2012; Petrelli & Whittaker 2010; Petrelli, Whittaker & Brockmeier 2008). Moreover, the functions of digital versus physical items seem to be different; where physical items often have a symbolic meaning, such as personal identity or relationships, digital items such as photos are often literal representations of past

events or people (Petrelli & Whittaker 2010). Researchers have suggested that this difference is possibly caused by the short period digital items have been in people's lives, as opposed to physical items, that have sometimes been passed on through generations. Nevertheless, research on remembering using Facebook posts indicated that events posted online were better retained in memory than events not posted (Wang 2016) and social media had the potential to support reminiscence (Thomas & Briggs 2016).

4.2.2 Autobiographical and episodic memory: retrieval and construction

Autobiographical memories are the memories of personal experiences in our own lives (Williams, Conway & Cohen 2008). They play essential roles in our daily lives, such as social bonding, shaping our personal identity and directing future behaviour (Bluck et al. 2005). The prevailing view is that autobiographical memories are mental constructions, the process of which has been described in a model called the self-memory system (Conway & Pleydell-Pearce 2000). To construct a personal experience from the past, the self-memory system makes use of autobiographical knowledge (such as personal factual knowledge and cultural knowledge) and episodic memory (memories of personal events), governed by current goals (part of the working self) (Conway 2005; Conway, Loveday & Cole 2016; Conway & Pleydell-Pearce 2000). The memory construction process takes place in what is called the remembering–imagining system (RIS), where both remembering the past and imagining the future take place (Conway & Loveday 2015; Conway, Loveday & Cole 2016).

An important aspect of autobiographical memories are the episodic memories. the concept of which was initially proposed by Tulving (1972). Episodic memory consists of three main components: a sense of subjective time (travelling backwards or forwards in mind), autonoetic awareness (a feeling of oneself in the past and mentally travelling back in time), and a self that also exists in subjective time (Tulving 2002). Examples of episodic memories are events like a holiday trip to New York or having been to a concert of your favourite band. When retrieved during the act of remembering, episodic memories are often represented as visual images (Conway 2009).

Tulving contrasted episodic memory with semantic memory. Semantic knowledge is general world knowledge, not defined by a time period and often not personal (Tulving 1972). Tulving proposed that the primary use of semantic knowledge is for language, such as the meaning of words. Nowadays, researchers question the explicit distinction between the two memory systems; the line between them may be more blurred than originally put forward. It has been proposed that between the two extremes of semantic and episodic memory lies an intermediate entity, called personal semantic memory (for a review on

personal semantic memory, see Renoult et al. 2012). Renoult et al. drew four types of personal semantic memory from the literature: autobiographical facts (e.g. 'My sister has a cat named Tiger'); self-knowledge (e.g. 'I am an analytical person'); repeated events (e.g. 'On Sundays, we would always visit grandma'); and autobiographical significant concepts, which are semantic concepts associated with vivid episodic memories (e.g. school musical + recollection of seeing my niece's school musical last week). Often these types of memories are categorised under semantic memory, but research with EEG equipment indicates that personal semantic memory activates neural bases of both episodic and semantic memories, and thus, from a neurological perspective, personal semantic memory can be differentiated from semantic and episodic memory (Renoult et al. 2016).

The distinction between semantic and episodic memory is often referred to as 'knowing' versus 'remembering' (Tulving 1985). It can be difficult to conclude from verbal accounts what type of mental representation participants had in their mind, and this is often resolved by asking participants whether they 'know' it or 'remember' it. If participants say they 'remember' it, participants can bring back to mind the moment it was encoded, and to do so, they have accessed the episodic memory base. If participants say they 'know' it, it is assumed they have accessed the semantic knowledge base only.

The cue modality, such as pictures versus words, can influence the likelihood of evoking a 'know' or a 'remember' response. A study consisting of five laboratory experiments found that picture cues led more often to a 'remember' response than did word cues (Dewhurst & Conway 1994). Dewhurst and Conway concluded that it depends on which information is activated during retrieval. If the name of the picture is retrieved (as was tested in the experiments), and not the sensory (pictorial) information, this leads to a 'know' response. Memory research using different modalities has found different effects on remembering, and it is suggested that these distinct modalities directly affect the search strategy in the retrieval process (Goddard, Pring & Felmingham 2005). Moreover, research has shown that contextual factors, such as culture and social interaction, can influence autobiographical memory processes from the start (such as perception and encoding), to the end (such as a memory being constructed) (Dudai & Edelson 2016; Wang 2016).

The effectiveness of the retrieval cue is believed to depend for a large part on the encoding of the event; this is known as the encoding specificity principle (Tulving & Thomson 1973). The principle suggests that a cue is most effective if it matches aspects of the event at the time the original encoding took place, that is, at the time the event was experienced. Norman & Bobrow (1979) incorporated the notion of encoding specificity in their model of memory retrieval. In this model, they proposed that retrieval takes place in a cycle, by forming a retrieval specification, called a 'description' of the entity sought, which is then matched against the available knowledge in memory and evaluated by verification criteria to assess the suitability of the information retrieved. This model was further elaborated by

Conway (1996) and Burgess & Shallice (1996) and incorporated in the earlier-mentioned self-memory system, a model that explains the constructive nature of autobiographical memory (Conway & Pleydell-Pearce 2000).

In autobiographical memory research, the retrieval of a specific memory often happens through elaboration of the cue (Conway & Pleydell-Pearce 2000). One may first retrieve generic memories, such as a 'lifetime period' (e.g. 'when I was together with boyfriend X'). This may serve as a cue for a 'general event' ('those times when we would visit his parents'), which may cue an 'episodic memory' ('that evening we rescued their cat from the roof'), after which the retrieved memories are input for the retrieval cycle again. In general, 'lifetime periods' and 'general events' are retrieved faster than episodic memories. In some cases, however, an 'episodic memory' seems to be retrieved immediately without any steps in between. This is called 'direct' retrieval as opposed to 'generative' retrieval (Conway & Pleydell-Pearce 2000).

Specificity may not be what the person is aiming to achieve, and a more general response may also be satisfactory (also concluded in Belcher & Kangas 2013; Norman & Bobrow 1979). People with emotional disorders such as depression, however, often have difficulty recalling specific memories and it seems that the (generative) retrieval process is terminated before an episodic memory is found (Haque et al. 2014).

4.3 Home-tour interviews and analysis of cued responses

In the following sections, we summarise the study and focus especially on the analysis and results, as those are somewhat different from those conducted in the previous chapter. For a detailed discussion of the method, the participants and the procedure, we refer to Chapter 3.

4.3.1 Method, participants and procedure

In this chapter, we examine cued responses based on the same study that was described in Chapter 3, that is, interviews with nine participants in their homes, focusing on their belongings. This study was an open, qualitative exploration of what makes an item a cue, and cued responses was one aspect of this study. We asked open-ended questions about the memories, the usage of the item and about the cued response the item evoked. When the home-tour was completed, we gave the participants a task in which they had to rank the items on different scales. Both these parts are explained in depth in Chapter 3.

Participants were recruited via an invitation posted on online media, such as the university's staff mailing list, the research project's website and Facebook. Six women and

three men participated, all residing in Sydney, Australia, and were between the ages of 27 and 66 years (average 42 years). More details on the participants and their holidays can be found in Section 3.3.2 and Table 3.1.

All participants were asked to select one of their holidays between 1 and 5 years previously and which had lasted five days or longer. After a short explanation of the chosen holiday, each participant wrote down the items on cards. During the home-tour the participant showed the items in their original location. For each item, a couple of questions were asked, if the answers sought had not already been given spontaneously. They were asked, for example, what came to mind when they saw the item and did they perceive it as a memory cue. More details on the procedure can be found in Chapter 3.

4.3.2 Analysis and results

After a first thorough analysis of a few interview transcripts, it was decided to focus on a few topics and research questions. The research question we focus on in this chapter is 'What is the (actual) cued response?' We looked at the types of cued responses, the number of memories attached to the items and the time lapse between acquiring the item and the events cued.

The cued responses were analysed using a bottom-up coding process, based on the coding and analysis approach of thematic analysis (Braun & Clarke 2006, 2012). The inductive nature of this approach makes it suitable for open-ended research questions, as in this explorative study. The selected excerpts from the transcripts for analysis concerned in most cases the participant's answer to the question, 'If you look at this item, what comes to mind?' from the home tour interview. This question, however, was not always asked; if the participant had already told the interviewer what came to mind, the interviewer would pass over it. Such spontaneous description of what came to mind occurred in four interviews, often when the participant started to understand the question routine and after at least four items had been discussed. We observed no substantial differences between the spontaneously-expressed cued responses and other responses. Excerpts from the transcripts that related to the cued response in other parts of the interview were selected for analysis if relevant. We focused on the first response and coded them singularly (one code per excerpt). These codes were developed into meaningful themes afterwards. Ultimately, a total of 63 items from nine interviews were included in the analysis. An overview of the item categories is presented in Table 4.1, which is a simplified version of Table 3.2, but provides the numbers of categories that were included for analysis of the cued responses, presented in this chapter. This final total arose because eight items from the original 71 in this study were excluded from the analysis. Five were disqualified because they were either not in the house or the participant could not find them. This meant that the participant could

not see the item(s) at the moment of the interview, which in turn required them to answer the question, 'What comes to mind when you see this item' from memory, which then possibly affected the reliability of the answer. We excluded two other items because an earlier question that would have allowed the participant to tell the story behind the object and event ('Could you tell me about this item?') was not asked, which made it uncertain whether the answer on the question 'What comes to mind?' was a cued response. This occurred for example if the participant started talking without prompt, or if background information about the item was already given when discussing another item. Therefore, their answer to the question 'What comes to mind?' was possibly a mixture of a cued response and background information such as an explanation of the acquisition of the item. The last item was excluded because what the item evoked was not explicitly expressed by the participant. The remaining 63 items and cued responses formed the basis of the analysis.

We used NVivo software (QSR International Pty Ltd 2012) for coding the data and we made memos during the transcription and analysis phase. The analysis aimed at interpreting and gaining a deeper understanding of what was happening in the reported cued responses. The focus in this chapter is on presenting the findings solely from a qualitative perspective and exploring what kind of cued responses we found among participants in connection with their holiday items.

Table 4.1 shows that 63 holiday-related items in the home-tour interviews were selected for analysis, of which 51 were in physical form and 12 in digital form. The items were grouped into eight categories: 'Wearables', 'Images', 'Decorative objects and souvenirs', 'Books, guides and papers', 'Handwritten or typed notes and journals', 'Food and drink', 'Body and shower creams' and 'Others'. Most often the items chosen were wearables and images. The latter category consisted of 10 digital photos and collections, and five items were printed images, like photos, sometimes as collages or postcards. This was the only category that included more digital items than physical items. Other categories were clothes and shoes, decorative objects and souvenirs (many fridge magnets), jewellery, bits and pieces such as random papers and leaflets or food and drink. No music or audio media were mentioned. Some items had been intentionally acquired as mementos. Others were acquired before, during or after the holiday but with no intention of serving as a reminder of the holiday.

Table 4.1. Overview of items physical and digital in the home-tour study.

	Physical	Digital	Total
Wearables	**16**		**16**
Clothing and shoes	*11*		*11*
Jewellery	*3*		*3*
Bags and wallets	*2*		*2*
Images	**5**	**10**	**15**
Single photos or postcards	*3*	*7*	*10*
Organised photo or video collection (album, website or collage)	*1*	*3*	*4*
Canvas printed photos	*1*		*1*
Decorative objects and souvenirs	**13**		**13**
Fridge magnets	*5*		*5*
Drawings (by children or artists)	*3*		*3*
Others	*5*		*5*
Books, guides and papers	**6**	**1**	**7**
Books and guides about destination	*4*	*1*	*5*
Random papers and leaflets	*1*		*1*
Leisure reading books	*1*		*1*
Handwritten and typed notes and journals	**2**	**1**	**3**
Food and drink	**3**		**3**
Body and shower creams	**2**		**2**
Others	**4**		**4**
TOTAL	**51**	**12**	**63**

4.4 Findings: cued responses and types of items

In the following sections, we present the four main cued response types that we found, as well as other findings revealed by the analysis. We introduce the main types of cued responses found from the analysis. We also relate this to the types of items that correspond with the particular cued response.

4.4.1 Cued responses

In this thesis, we differentiate between cued responses and the associated remembered events, as explained in Chapter 1 (Section 1.1). The first question asked in the interviews (Could you tell me about this item?), invited the participants to tell the story about the item to the interviewer, resulting in a description of the remembered events. Later in the interview, we asked participants to describe what comes to mind (spontaneously) when they

look at the item. We considered these answers as cued responses. They may overlap with the associated remembered events, but not necessarily.

After a bottom-up analysis that focused solely on cued responses, four different types of responses were identified: (a) 'no-memory' responses, (b) 'knowledge' responses, (c) 'reflection' responses and (d) 'episodic memory' responses (see Figure 4.1). These four types depict the relationships between the cued responses in two dimensions, namely the experiential and the resemblance to the original events (see the arrows in Figure 4.1). About half of the cued responses fell in the 'episodic memory' responses group, while the other half were spread across the other three types. We will go through each of the four types one by one, starting with 'no-memory' responses.

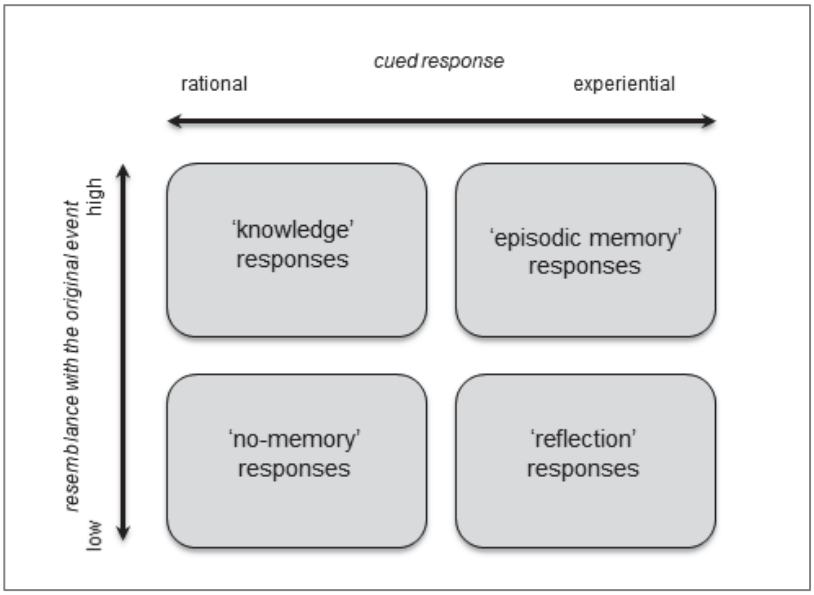


Figure 4.1. Cued responses triggered by holiday items.

4.4.2 'No-memory' responses

The cued responses in the 'no-memory' responses group were either not related to personal memories at all (such as practical thoughts related to the item) or hardly cued at all. Some participants reported that by thinking hard, they could come up with a memory. What these responses indicated was a difference between a memory associated with the item and whether this memory was coming to mind. In fact, all the items did have some kind of association with the holiday attached; otherwise, the participant would have never selected them for this study. However, we see in this group that these memories seemed to stay

subconscious, were perhaps not fully accessed, or other thoughts not related to any memories came to mind instead. The following example shows this dividing line between cuing a memory and not cuing a memory with regard to a much-loved skirt a participant bought on her holiday in Japan (Figure 4.2):

> *'The first thing that comes to mind, is what I would wear it with, when I would wear it. [...] [W]hen I tell the story, it makes me think of the memory. But I don't think it is a memory cue. Unless, I'm asked about it.' [P5]*

Figure 4.2. A skirt bought on holiday in Japan cuing a 'no-memory' response.

The participant told the researcher about the experience of fitting and buying the skirt in the Japanese store and the occasions on which she wore it during the holiday. This refers to the remembered event, which we distinguished from the cued responses in Sections 1.1 and 4.4.1. As a reason for the remembered event not being cued, the participant explained that the item was just part of her wardrobe and she also wore it very often.

What almost all the items in the 'no-memory' responses group had in common was that participants had used them, such as clothes or food items. Some items were used during the holiday, others after the holiday or both. Possibly the frequent use has weakened the original relation with the memory of the holiday.

4.4.3 'Knowledge' responses

Participants reported cued responses that were rather factual in nature, but as opposed to the 'no-memory' responses, where associated to a past event. They knew that the item represented an event from the past, as in autobiographical knowledge (Conway & Loveday 2015), but the cued response only superficially touched the memory and rather evoked mainly semantic knowledge regarding the associated events. Sometimes the holiday was remembered as a whole, as a so-called lifetime period (Conway & Pleydell-Pearce 2000). Similar to the previous theme of 'no-memory' responses, participants reported they would easily be reminded of memories if other people asked about the item. However, spontaneously, it touched the memory only on a topical level. We see this explained in the following example about a desktop background photo of a seal (Figure 4.3):

'Yeah, so it does evoke memories, and oh this, and this, you know, you go, when you are in the context of talking to someone about it, when you start going into the depths of the memory. But, when I see that every day, you know, a lot of the times it is just.., keeps you.., oh I took that photo. That's cool.' [P6]

Figure 4.3. A holiday photo of a seal as desktop background image cued a 'knowledge' response.

The participant explained that mainly factual knowledge became apparent when she saw the item, and the reliving experience remained absent. The episodic memories did not come to mind unless she made a conscious effort to recall them (being engaged in remembering), or when other people asked about the photo. The explanation given by this participant (and by some other participants) for the 'knowledge' response was that she saw the item every day.

Most of the items in the 'knowledge' responses group were seen a lot after the holiday; they also included some typical souvenirs and some had an image or name of the destination on it. Examples included a photo used as a desktop background image (Figure 4.3), a watch bought during the holiday, a fridge magnet, a camera (bought for the holiday), a key ring and shopping bags (souvenirs). Seeing the items frequently may have toned down the cued response, as one of the participants explained,

'[B]ecause I just know it. [...] I think when you got something with you all the time, you don't need the memory jogger. Because it is there. And you know that it, where it came from.' [P4]

One item that was unlike the types above that served as a memory aid for the participant was a piece of paper in his wallet with some scribbles he wanted to look up. It contained factual information (e.g. the name of a song) and that was also what it reminded him of.

4.4.4 'Reflection' responses

In this category, participants reported thoughts, feelings, judgements or reflections that appeared in the present and were based on their memory; some examples include pride, happiness or nostalgia. Most of the time, the memory remained rather abstract, sometimes even semantic in nature. The difference between this category and the 'knowledge' and 'episodic memory' responses is that 'reflection' responses are thoughts or feelings that occurred *after* the original event itself. This could be seen as a result of the process of remembering, a labelling or 'meta feeling' of the past event. We cannot be certain from

these data whether the thought was evoked at the time of looking at the item or whether the thought was cued by the memory that came to mind. However, the immediate reaction in the cued responses were all thoughts or feelings, and these thoughts or feelings related to the memories associated with the item.

We often saw nostalgic longing, not only for the past but also for the future, as a kind of daydreaming based on the memories. A participant said while looking at some canvas photos from the holiday (Figure 4.4):

> *'That I want to go again [grin]. [...] I guess it reminds you that life is not crap.' [P3]*

Figure 4.4. Canvas photos cued a 'reflection' response.

The participant mentioned no specific memories or any semantic knowledge related to the holiday; the cued response was derived from memories but seemed to remain at an abstract level.

In the next example, the participant tried to describe the mixed feelings the items evoked. The suitcase in which he had stored bits of papers from multiple holidays was called 'the nostalgia box'. In response to the question, 'What comes to mind?' he answered:

> *'[I]t's a, almost nostalgic ideas. As soon as I think about all of this stuff, I kind of think, o, it's a great trip that I've had. I enjoy going over it. […] [I]t makes me sort of wishful, or, you know, not sad, but like… I don't know how to describe it. […] I had such a good time. And I'll never go there again. […] [I]t is just a memory now.' [P7]*

The participant struggled to express what came to mind and it seemed to be a mixture of feelings and thoughts. As can be seen, the participant did not mention any specific memories, nor any semantic knowledge related to the holiday. The cued response was derived from memories but stayed at an abstract level.

The strength of the link between the memory and the thought differed widely among the responses within this theme. The next participant reported that his thoughts, evoked by a photo of a sculpture in Barcelona, were kind of separated from the memory:

> *'[T]his gives me more strong feelings about ... the nature of things than the actual holiday maybe. [...] There is something about it, it is really intimate. [...] You know, it's a big part of my trip, it is a memory I always have. When I think of my trip I think of this photo. [...] Yeah, when I think about it is, it is a part of the trip. But somehow this can be taken out of the trip.' [P1]*

The items in the ‘reflection’ responses predominantly had visual qualities, for example, photos on canvas, a child’s drawing, a hand-drawn poster, a collection of random papers that had partially visual qualities, and two photos, one digital and one framed. Another characteristic of this theme was that some of these items consisted of multiple cues. For example, the framed photo mentioned earlier was part of a photo collage (not all from the holiday), the poster consisted of handmade drawings from multiple events over a couple of weeks and the collection of papers covered several events from the holiday.

4.4.5 ‘Episodic memory’ responses

‘Episodic memory’ responses are accounts where the experiences of past events come to mind as personal memories. Often these accounts came with descriptions of how things looked or felt. In this group, the items brought back episodic memories from the holiday, and they could be extremely detailed, as though the participant was reliving the experience.

We heard verbal accounts that evolved as if the person went through the experience again, step by step. One participant, who described what came to mind when she saw a bottle of sake bought at a distillery in Japan, seemed to walk through the sake museum again (connected to the distillery) until she reached the point of buying the bottle she now had in her cupboard. However, this was not always the case. We also saw cued responses in which the participant remembered a very specific moment. This was illustrated by the smell of a body wash, which the participant had bought and used during his travels (Figure 4.5):

> *‘So, when I smell this, [P1 opens bottle] it reminds me of when I was in Barcelona in a hostel. And I was using this every day, and it reminds me, it takes me back to the shower. Right there. Straight away, in that hostel. And Barcelona and that street I was on [...].’ [P1]*

Figure 4.5. Body wash cued an ’episodic memory‘ response.

Some items really helped the participant to construct the memories and fill in missing details. The participant in the next example showed the researcher a book about a temple, and after explaining the cued response, she explained how the book helped her to remember (Figure 4.6):

'I mean, seeing it reminds me how much I forgot. [...] I would have forgotten the detail of the individual deities. [...] and I had forgotten how impressed I was by these individual statues. [...] And even, it feels like I can remember the smell of it.' [P5]

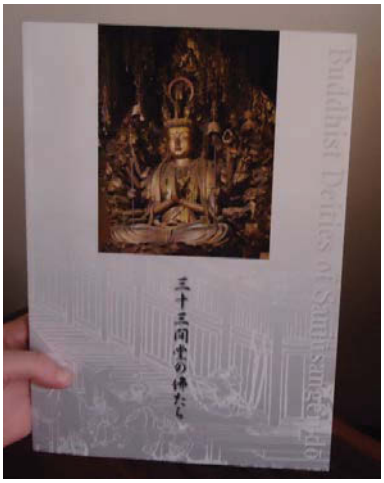


Figure 4.6. Book of Japanese temple cued an 'episodic memory' response.

The book not only reminded her of the appearance of the temple but also of how she felt at that time (impressed), with the memory of the smell (of incense) coming back to her.

The group of 'episodic memory' responses contained the majority of items and had a rich variety of item types. Almost all the digital photos could be found in this category (apart from two other photos − of an artwork and part of a collage − that prompted 'reflection' responses and another − a desktop background photo − that prompted a 'knowledge' response). One of the participants explained why he valued photos:

'You know, with something like a picture, […] I'm almost remembering what was really there. Because a picture tells what's really there. You can't alter a picture. You know. It makes you remember the real facts in a way.'

Some of the clothes, fridge magnets and city guides, all acquired during the holiday, were also found in this category. This suggests that almost any item, whether intended as a souvenir or not, can become a memory cue for a past event.

4.4.6 Multiple memories attached to one item

Initially, it was not taken into account that one item could evoke multiple memories. However, when participants in this study were asked what came to mind, they sometimes spontaneously mentioned up to four different memories. For example, the participant who explained her cued response when seeing the bottle of sake declared that she remembered the tour in the distillery and museum and choosing the bottle (one memory); she also remembered how she carefully packed the bottle in a box when she was in her hotel room, to send the bottle home (another memory).

Some memories seemed to be cued by a previous memory, while others seemed to be cued by the item. Some items comprised multiple cues that then cued different memories, for example, a canvas collage showing four images referring to different days and events

(Figure 4.4). Thus personal items can cue multiple memories by association, and can cue multiple independent memories, sometimes referring to events months or years apart from each other.

4.4.7 What memories become attached to the item?

Almost half of the memories of the 'episodic memory' responses referred to an event that took place around the time the item was acquired. Such an outcome can be expected from holiday items, as items are often acquired specifically to remember an experience. We also found a fair number of memories relating to the specific moment it was acquired. We found accounts of stores, aisles and stalls where the items had been found and bought, sometimes events as trivial as choosing a fridge magnet in a souvenir shop. This sometimes included the conversation with the sales person or other customers. One participant showed some Facebook messages sent to her (now ex-) boyfriend, saying it reminded her of when she wrote the messages, rather than the content they referred to or the person it was sent to:

> *'Mostly reminds me of writing the messages. I was writing the messages when I was in the hotel room, when I was by myself [...].' [P8]*

Not all the items were typical souvenirs, and they were not always bought for the purpose of remembering. Items also cued memories from further in the past that were not holiday-related. One of the participants was reminded of an event of his childhood told to him by his mother. Items can also trigger memories of events that happened after the holiday. One participant was reminded of the barbecue where she wore a particular item of clothing sometime after the holiday.

The majority of the memories reported in this study related to just before, at the moment of or just after the moment when the item was acquired and these memories sometimes spanned a few days. Only in a few cases did a memory relate to something later in or after the trip, for example, a significant moment when an item had been used.

4.5 Discussion

In the following sections, we reflect on the home-tour interview as a research method, the cued responses and memory retrieval, the item–memories relationship and the times of the events in the memories in relation to the acquisition of the item.

4.5.1 Reflections on the home-tour method

The home-tour interview provided an informal way to collect rich descriptions of people's cued responses in a relatively natural setting. Participants enjoyed the activity and often spoke passionately about their items and holidays. They rarely needed prompts to elicit what was going on in their minds. Besides these positive effects, the interview set-up and the storytelling nature of the method may also have biased the cued responses. The whole interview was about one holiday, and explaining the item and the story behind it may have impacted the cued response and primed the participants to remember events from their holiday. The cued responses in this study are for that reason not a spontaneous representation of what normally came to mind when the participants saw the items; however, they do give an indication of the different types of responses that can be evoked by personal possessions.

The participants chose the items by free choice. These items were not equally distributed among item categories, with the majority of items in the wearables and images category. Therefore, we can only carefully draw conclusions about the spread of items across the types of cued responses and the relationships (i.e. which items cued which response) need to be interpreted as indicative only.

There was a notable difference between the questions 'Can you tell me about this item?', which was usually the first question, and 'What comes to mind if you look at this item?', which was usually the fourth question. It turned out to be crucial to have these as two separate questions, since the first question seemed necessary as a scaffold to the fourth question about what came to mind. By preventing the participants from addressing the item itself and the story behind, the cued response became mingled with the item and event information to scaffold the story for the researcher. We realised that the presence of the researcher triggered the interviewee to tell the story of the item, rather than what the item cued to them.

Participants may have interpreted the question 'What comes to mind?' in more than one way. They could have answered what the item cued at the moment of the interview (with the interviewer next to them) or they could have responded with what the item normally cued when they saw it. If the participant asked, the interviewer would explain she was interested in what it would normally cue, as the research was focused on cuing in everyday life. Hence the desired cued response was ideally as close to a normal encounter with the item as possible.

4.5.2 Responses to items

The variety of responses we found could be ranked gradually from 'no-memory' to 'episodic memory' responses. The 'reflection' responses were the odd one out because rather than having a *recollection* as the final retrieval result, the item evoked a *thought* or *feeling*. The thoughts or feelings were strongly connected to what was remembered (knowledge or episodic memory) and would not exist without the memory. These four categories were found with personal items related to a holiday. Additional research would be required to determine whether the four types of cued responses cover also responses cued by other types of possessions in the home.

Table 4.2. Overlap of cued responses with categories from existing schemes.

Current study	AMT/SCEPT (Raes et al. 2007; Williams & Broadbent 1986)	Memory specificity (Conway & Pleydell-Pearce 2000)	Personal semantic memory (Renoult et al. 2012)
No-memory responses	-	-	-
Knowledge responses	Extended memory Categoric memory Semantic associate	General events Lifetime periods	Autobiographical facts Repeated events Self-knowledge
Reflection responses	-	-	-
Episodic memory responses	Specific memory	Episodic memory/event specific knowledge	Episodic memory

As is represented in Table 4.2, two types of responses in this study overlapped with existing schemes, namely, the 'knowledge' and 'episodic memory' responses. In categories such as in the AMT/SCEPT and the levels of memory specificity (Conway & Pleydell-Pearce 2000; Raes et al. 2007; Williams & Broadbent 1986), the time period is generally the defining factor for the different types of responses (e.g. one specific moment, a repeated activity without a particular time, or a period that lasted longer than a day). In the study discussed in this chapter, we took another perspective; the focus was on the participant's experience, rather than the content or time span of the memory.

Another comparison that can be made is with the four types of 'personal semantic memory' (Renoult et al. 2012), which have been described earlier in this chapter. All categories can be paired with the cued response types in this study, except for the 'autobiographical significant concepts' category (a concept plus episodic memory).

The 'reflection' and the 'no-memory' responses are not related to any of the categories found in the literature. However, if a connection to a memory did exist before but is not

cued anymore, the no-memory response could compare to ‘forgetting’. An area of interest by memory researchers is for example that remembering can cause forgetting of other memories, called retrieval-induced forgetting (Anderson, Bjork & Bjork 1994; Storm et al. 2015). The reason why the 'reflection' responses has not appeared in other categorisations is unclear but this may be due to the different setting in which this study took place. All the items in this study were in, and part of, the home, which may allow for more general thoughts, feelings or reflections popping up. Moreover, the fact that items cued these thoughts and feelings may have played a role. The intrinsic qualities of items may evoke feelings or represent an atmosphere that facilitates thoughts or feelings more than cue-words do. Some ‘reflection’ responses resemble imagination, which is supported by episodic memories, as described in the RIS (Conway & Loveday 2015; Conway, Loveday & Cole 2016).

Do we see an iterative retrieval process in the responses? An often-proclaimed exclamation in the ‘knowledge’ response category was, ‘It just reminds me of ..., but if I would really think about it, then ...’. We could relate this to the ‘effort’ needed for retrieval. The view of memory retrieval as an iterative process (from general to specific) could be an explanation, in a way that the retrieval of an episodic memory is terminated before a specific memory has been found. In the ‘episodic memory’ responses category, there was no mention of effort. However, we must bear in mind that it is hard for participants to express their mental retrieval process and that this was not explicitly requested.

4.5.3 The item-memories relationship

When looking at the relationship between items and cued responses, a couple of interesting factors stood out. One was that visual details seemed to be important, another was how often the person encountered the item (seeing it every day was often found with ‘knowledge’ responses) and a third was the role the item played in their day-to-day life (a functional role linked to ‘no-memory’ responses). The findings seem to indicate that strong visual items, such as digital photos that are not seen every day, increase the chance of an ‘episodic memory’ response. The picture superiority effect (pictures retrieve more episodic details than words) has been explained by the fact that its rich sensory-perceptual representation facilitates semantic access to memory (Dewhurst & Conway 1994). In the study presented here, where we have seen pictures particularly in the form of photos, we could say that a picture is very explicit in what it represents and that it contains many cues in itself. These cues are indeed sensory-perceptual but may also contain many details of the experience that help to construct a memory. Our findings can be explained by the encoding specificity principle (Tulving & Thomson 1973). Photos as cues have a high resemblance

with aspects that were present at the time of encoding, when the original event took place. This may facilitate the retrieval of the specific episodic memory.

What the current explorative study indicates is that the items that evoked an ‘episodic memory’ response encompassed all item categories, so in principle all types of items can act as memory cues for episodic memories. However, the findings also indicated that ‘no-memory’ responses were linked to utilitarian and frequently-used items. Items related to ‘knowledge’ responses were seen regularly, and items related to ‘reflection’ responses were often compositions or collections with visual qualities. Digital photos were often found in relation to ‘episodic memory’ responses. This may have been caused by the participants selecting particularly important photos for their interview, as most people had large numbers of photos from their holidays. The relationships are drawn from an explorative and qualitative study and will need to be confirmed.

In their daily lives, people encounter personal possessions that can potentially cue memories of all varieties. We do not argue that an ‘episodic memory’ response is better than one of the other responses. An ‘episodic memory’ response may not necessarily be the desired outcome for people; they could be after a less specific response or a thought or a feeling. Even items that cue a ‘no-memory’ response may be preferred in situations where remembering is not desired, for example when undertaking activities where focused attention is needed.

4.5.4 Event times of memories in relation to item acquisition

As reported in the findings, the majority of the memories cued by the items centred around the moment the item was first seen, such as the store or aisle where the item was found, or the moment and location when a Facebook message was created. The finding that memories centre around the time that the cue became part of a person’s life was also found in several studies by Rathbone et al. (Rathbone, Conway & Moulin 2011; Rathbone, Moulin & Conway 2008). Although their cues were of a different nature, they used self-reported ‘I am statements’ (self-images) as a cue for self-related memories. In their studies, in which multiple memories were collected with an ‘I am statement’ as the cue, most memories of events were dated close to the year of formation of the particular self-image, which supports the idea that the organisation of autobiographical memory is clustered around the emergence of the self (Conway & Pleydell-Pearce 2000). Since the reported memories related to the holiday items seemed to be clustered around the moment of acquiring the item, we speculate that cued memories centre around the origin of the item.

4.6 Conclusion

The study presented in this chapter aimed to investigate the cued responses triggered by personally-owned holiday items. Home-tour interviews were held with nine participants, and the cued responses of 63 items were analysed qualitatively.

We found that possessions related to a holiday can cue a range of responses, which we grouped into four types: 'no-memory', 'knowledge', 'reflection', and 'episodic memory' responses, with the latter containing the majority of responses.

The findings of this study suggest that almost all types of items can become cues for episodic memories and can evoke an 'episodic memory' response, including images, books, guides and papers, decorative objects or souvenirs, wearables, handwritten/typed notes and journals, body and shower creams, food and drink and items from the 'other' category. An interesting finding was that almost all the digital photos evoked an 'episodic memory' response. Items that evoked 'reflection' responses often had visual qualities, and several of these items (e.g. compositions, photos in frames) consisted of multiple cues in themselves. Many items in the 'knowledge' response group, including some typical souvenirs on display, were seen a lot after the holiday. The items in the 'knowledge' response group contained items seen frequently after the holiday, such as decorative objects on display. In the 'no-memory' response group we found several functional items that had been used during and/or after the holiday, for example, clothes and food items.

Items were found to cue multiple memories. Some participants reported up to four different episodic memories cued by one item. Although the majority of memories referred to events from the holiday, memories from (long) before or after the holiday also came to mind. Most of the memories participants recalled referred to a moment in time close to their first encounter with the item. They often remembered the shop or place where they obtained the item or the event just before or after the acquisition. Investigation with other personal items is needed to determine whether this finding is generalisable.

We have to bear in mind that the study has been carried out with a small sample of participants and is limited by particular types of items (holiday items). The findings provide insights in how personal possessions potentially cue at home and they point to a variety of cued responses.

5 CHANGING ITEM-MEMORIES RELATIONSHIP OVER TIME

Abstract

In this chapter, we investigate the cuing process over time to explore *how* memories are cued by personal items. We set up a study with 20 participants, who filled in questionnaire cards about what their personally selected items cued. This longitudinal study covered a period of 10 months on average with three personal items for each participant. The findings show that a personal item often evokes similar responses over time. Changes in cuing by personal items were found to be caused by the following: A) current events on the participant's mind (e.g., going to an event where the item was worn before), B) the participant's emotional state (e.g. the death of a friend versus just coming back from holiday), C) new connections to recent events (e.g. the participant has a replica of a famous painting and sees the original on holiday), D) the item was involved in new events, which generated new memories (e.g., the item was broken and got repaired), E) thoughts about a person or situation changed, resulting in other associated memories coming to mind (e.g. negative memories related to the person instead of positive or the other way around), F) the item revealed other characteristics (e.g., a flowering or non-flowering plant, a musical instrument case that is open, versus closed), and this changed appearance of the item cued other memories.

5.1 Introduction

In the previous chapters, we saw that the item-memories relationship was dynamic and could change over time. For example, in Chapter 4, we saw that multiple memories could be cued, and that they sometimes related to events long before or long after the item was acquired. In addition, items may have been damaged or broken, they may have been given a new location in the home, or their role could have changed. All of these could affect the responses cued or the items' potential to cue, as we saw in Chapter 3. Therefore, to gain understanding of how and why memories were cued by personal items, we studied the items and the responses they cued in their owners *over time*.

In this current chapter, we present a longitudinal study with 20 participants, who filled in cards at three different times about three personal items, with first a six and a half months interval and then a three and a half months (on average) interval, respectively. We discuss the findings of this study on the stability of cued responses at different points in time, the changes in cued responses over time, and the cues that evoked the responses. An understanding of the changing item-memories relationship over time contributes to our knowledge of what cuing is and how it occurs.

The study presented in this chapter builds on two findings from our home-tour study on memory cues, as described in Chapters 3 and 4. The first finding was the number of episodic memories one item could evoke, participants mentioned as many as four spontaneously. However, the home-tour study had not asked how many memories were connected to the items, and data on when these memories became connected to the item were not collected. The number of memories also suggests that cued responses to items are not stable over time, as items can also relate to more recent events. The current study involves items that cue multiple memories, because we expect that we will be better able to study change with items that cue multiple memories. Another finding was that most of the memories related to an event close to the moment of acquisition, but sometimes related to events from long before or long after the moment when the item was acquired. This indicates that associated memories fluctuate during the item's lifetime.

To investigate this dynamic relationship between items and memories, we looked into items that were linked with multiple memories and examined the memories that were forgotten, replaced or altered over time and why. In this chapter we focus on the following research questions:

- How dynamic versus consistent are cued responses over time?
- How does cuing change over time?
- What aspects of the item evoke cued responses?

5.2 Literature on items and memories over time

In relation to items and memory evolvement over time there are two areas that are of interest in this chapter. The field of consumer research and product design has studied how the attachment relationship with personal items can evolve over time. Although memories are not their focus, memories play a role in product attachment. The field of cognitive psychology has looked at remembering and forgetting over time, sometimes with longitudinal studies (e.g. Linton 1975; Wagenaar 1986; White 1982). This was studied using textual or verbal cues (e.g. a short sentence about an event, or the date), but not personal items. These two different research areas are discussed in the next sections, before we look at the method of our study on the changing item-memories relationship over time. We start by discussing the literature on relationships with personal items (product attachment), following which, we turn to psychology literature about cuing memories, and conclude with a description of other longitudinal studies related to cuing memories over time.

5.2.1 Relationships with personal items over time

People's attachment to personal items and the meaning of those items can change over time (Chapman 2015; Dazarola et al. 2012; Karapanos et al. 2009; Kleine & Baker 2004; Myers 1985; Russo, Boess & Hekkert 2011). Often this coincides with the development of the person's identity as they grow through different stages of life. Items that are cherished in childhood, such as a teddy bear, have a different meaning than when the owner is adult, as people's favourite items often reflect their identity (Belk 1988; Csikszentmihalyi & Rochberg-Halton 1981; Wallendorf & Arnould 1988). One of the factors that contributes to attachment to personal items is their connection to memories (Ahde-Deal, Paavilainen & Koskinen 2016; Battarbee & Mattelmäki 2002; Csikszentmihalyi & Rochberg-Halton 1981; Jung et al. 2011; Mugge, Schifferstein & Schoormans 2008; Wallendorf & Arnould 1988). Time allows richer histories between owner and item, which can increase its meaning. In contrast to cherished items, people's least favourite items often represent memories and associations they would rather part with (Kleine, Kleine III & Allen 1995).

Several researchers have identified stages of the attachment process, sometimes comparing it to the development of the human love relationship stages or life stages (See Section 2.4.2). Russo, Boess & Hekkert (2011) found that the love for cherished items could be categorised with Levinger's five-stage model of interpersonal relationships: the attraction phase, the building phase, the continuation phase, the deterioration phase and the break-up phase (Russo, Boess & Hekkert 2011). Chapman (2015) mentioned different steps in the development of long-lasting relationships with products, such as the honeymoon period,

and Dazarola et al. (2012) distinguished different phases of usage, from ‘pre-acquisition’ to ‘retirement’.

While only limited research has been carried out on bonding to virtual items (e.g. digital avatars) and electronics (e.g. mobile phones), this does indicates that people can bond with them (Denegri-Knott, Watkins & Wood 2012; Turner & Turner 2013) . The latter research did not find differences in attachment between physical and electronic items, such as laptops, mobile phones, and televisions, but did find a link between close proximity and attachment (e.g. a mobile phone is often in close proximity). In the case of virtual items, it was found that ‘crafting’ contributed to the item’s meaning (Denegri-Knott, Watkins & Wood 2012; Golsteijn et al. 2012). Based on the literature in this area, we can conclude that the relationship people have with an item evolves over time, and that a bond can evolve with digital as well as physical items.

5.2.2 Factors influencing cuing

Psychology research has identified several factors that increase or decrease the chance that a specific memory in the mind is retrieved when a (word) cue is presented; a selection of these is discussed in this section. One set of factors concerns the cue, another set of factors concern the person’s cognitive state and memory.

One such factor is the ‘cue-item discriminability’ (the word ‘item’ refers to a memory in this term, where the cue retrieves a specific memory, identified as an ‘item’) (Rubin, 1995 in: Berntsen 2009). It refers to the precondition that, for a specific autobiographical memory to come to mind, relevant knowledge related to the original event should be activated and irrelevant knowledge that is also cued by the object or environment, which could interfere with the memory construction, is deactivated. Otherwise, an associated memory related to the cue cannot be distinguished, or isolated, from alternatives in memory.

Berntsen described a couple of factors impacting ‘cue-item discriminability’, for example, cue underload (Rubin, 1995 in: Berntsen 2009). This is the case when the cue, such as a personal possession, has hardly been perceived before and relates to only one single past event. Because the cue does not match with many other experiences or other knowledge not related to the specific autobiographical memory, cue underload increases the chance that this particular memory will be constructed. Another factor contributing to the cue-item discriminability is being exposed to multiple cues simultaneously that are associated to the same autobiographical memory. This makes it less likely that the combination of cues matches with other experiences as well, which could hinder the memory construction. Also the distinctiveness of the memory plays a role. Even if the cue is very general and could

match with several memories (e.g. seeing a bus in the city), if the memory is very distinct, it will be effective as a memory cue for that specific memory.

These are examples of factors affecting the cue and memory discriminability, but there are also factors that have been identified that impact the accessibility of memories, such as the characteristics of the memories themselves or the person's cognitive state. Among others, rehearsal of the memory, strong emotions and recency are factors that increase the chances that a memory will be cued. There are also motivational factors, described by Berntsen (2009), that enhance a person's sensitivity to particular memories being cued. The three main influencing factors are current concerns, unfinished personal business and stirring events (Berntsen 2009). It is suggested that these factors may prime certain subclasses of autobiographical memory. For example, preparing for an exam as an adult, could make secondary school memories more easily available. These factors, whether related to the cue or the person, can impact the sensitivity to cuing. Most of the factors are not stable; they may alter over time and thus cue sensitivity to certain memories and the item-memories relationship may also change (Berntsen 2009).

5.2.3 Longitudinal studies on remembering and forgetting

Longitudinal research, as opposed to other, for example, cross-sectional research, has three characteristics:

A) the data is collected over at least three time periods
B) it is collected from the same participants, and
C) the analysis compares the two or more time periods (Menard 2002).

The methods used for carrying out longitudinal research (the data collection) can range widely, from ethnographies and surveys to experiments and case studies. The purpose is often to investigate patterns of change and the direction and magnitude of a causal relation. In the field of human-computer interaction (HCI), the method is often used to study usage patterns, for example as part of the evaluation of a product (Lazar, Feng & Hochheiser 2017).

Longitudinal studies in which both remembering and personal items are investigated over time are a rarity. We found one study that investigated how the relationship with a personal item (including memories) evolved over time. We found a couple of longitudinal self case studies on remembering and forgetting personal events, but without personal items as cues.

The one longitudinal study that looked at the relationship with personal items over time was conducted by Mugge, Schifferstein & Schoormans (2005). They employed two questionnaires five months apart to investigate the evolvement of students' attachment to a new backpack that they received during their orientation week. One hundred and twenty

one (121) participants completed the study and the researchers analysed the data quantitatively. They found that five and a half months after receiving the backpack, participants had more memories associated to the item, which led to a greater attachment to the item if the participant also used the item regularly.

Linton, White, and Wagenaar all did case studies on themselves in which they recorded and tested their autobiographical memory over periods of one, six or seven years (Linton 1975, 1978; Wagenaar 1986; White 1982). White also retested the same events after two, six and 20 years (White 1989, 2002). In general, the method required the researcher to record descriptions of one or more events every day, and then use one particular aspect of the description as a cue to recall another. For example, Linton used the description of an event to recall the date (Linton 1975, 1978); Wagenaar alternated between the who, what, where and when aspects of the event and he tried to recall one of the other aspects (Wagenaar 1986), and White used a short event description as a cue and then rate the quality (clarity) of the recall (White 1982). The outcomes of these studies provided insights into the working of autobiographical memory, specifically retrieval and forgetting. These insights included, for example, that forgetting personal events occurs almost linearly (Linton 1975, 1978), that the 'what' information was the most successful cue to remember other related information (who, where and when) (Wagenaar 1986), and that 'rare' and 'vivid' events where more likely to be remembered over a longer period of time than other events (White 2002).

Subsequent similar studies were carried out on remembering and forgetting, but with larger participant samples using diary studies (Betz & Skowronski 1997; Larsen & Thompson 1995) and of much shorter duration. Larsen & Thompson (1995) asked their participants to keep diaries for four months and then studied, similar to the Linton (1975) study, the recalled dates for autobiographical events and compared this to the recall of news (non-personal) events. The participants were tested one week after completion and then twice more over a five-month interval. The researchers found that autobiographical events could be dated more accurately than news events when recalled by the participants. Betz & Skowronski (1997) studied remembering and forgetting by providing participants with a diary to record their own personal events and an 'other-diary' to record events in the lives of someone else, such as a roommate or friend, over a period of 10 weeks. Testing took place immediately after the 10 week period. The researchers found that the participants' personal events were better recalled than events of the other person. In addition, they found a-typical events, something that was a bit unusual for the participant or another person they knew well, were better remembered than typical events. Whereas these two studies focussed on forgetting versus remembering, Walker, Vogl & Thompson (1997) investigated how memories changed over time in terms of their 'pleasantness' of both positive and negative events. The memories were collected over 14 weeks and tested one month later.

The researchers found that both the pleasantness and the unpleasantness decreased (i.e. became less extreme over time) and the decrease was greater in relation to unpleasant events. A study by Bauer & Larkina (2016) compared forgetting among children with the forgetting of adults (the children's mothers), over the course of four years. The recording of the memories on a calendar took place over four months and testing took place one, two and three years later. The researchers found that children forgot faster than adults, and younger children forgot faster than older children.

Except for the study by Mugge, Schifferstein & Schoormans (2005), all the longitudinal studies mentioned above used textual or verbal phrases as cues, and these were used as a tool to cue memories, rather than as objects of the study themselves. The focus of these studies was on memory and its changes over time, analysed quantitatively. Mugge et al. used the same item (a backpack) for all participants, not focusing on changes in memory or cuing over time, but to which extent memories are a determinant for product attachment. In the study presented in the next section, we focus on cuing over time. In contrast to the studies above, this will be a qualitative study using personal items that were already owned by the participants before the study.

5.3 Longitudinal study with questionnaire cards

In the previous sections, we presented existing research which showed that autobiographical memories, as well as the relationship with personal items, change over time. In the following sections, we discuss the design of a longitudinal study on cuing by items over time. We explain the set-up and method of the study, describe our participant sample and how they were recruited, the procedure and data collection and the analysis and results.

5.3.1 Method

The study focused on existing item-memories relationships using items owned by the participants and located in their personal environment. We conducted a qualitative, longitudinal study that lasted about 10 months per person with 20 participants. In the next section we will explain the design of this longitudinal study. The main method was a questionnaire card with questions about the items and the responses they cued. The participants filled in one card per item (three in total) at home and returned them to the university using a stamped addressed envelope. We will then discuss the design of the questionnaire cards. The main study was preceded by a pilot study and after the main study, four follow-up interviews were conducted, which we will discuss in the remaining sections.

5.3.1.1 Longitudinal study

We decided to use a longitudinal research study to observe changes in cuing by items at different moments in time. This was carried out with 20 participants and their chosen personal items. The set-up of this study (after recruitment of participants) is illustrated in Figure 5.1.

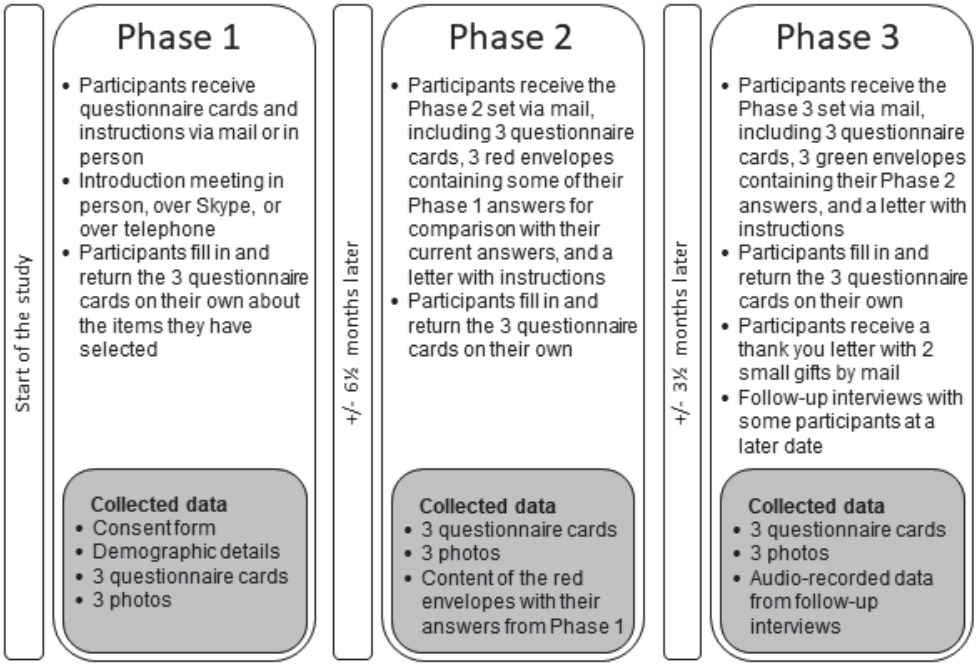


Figure 5.1. **Longitudinal study phases.**

We chose three points in time to collect data: at the start (Phase 1), after approximately five months (Phase 2), and three months after the second data collection (Phase 3). As can be seen in Figure 5.1, in reality, participants returned their questionnaire cards on average after six-and-a-half-month and three-and-a-half-month intervals respectively. The two time frames and time gaps were chosen for two reasons.

The first reason was that we wanted to minimise the effect each phase would have on the next. The conditions under which we collected the data at the second and third phases should be similar to the previous phase. If participants could remember what they had filled in the previous time, their answers to the questions may have been affected. Therefore we chose intervals sufficiently long to make it difficult for the participants to remember what they had filled in previously, namely five months for Phase 2 and three months for Phase 3.

The second reason was that we wanted to 'let things take their course', as would normally happen in a person's and an item's life. In other words, we wanted to allow for natural changes to the living environment and to the item and its location, and to allow for natural remembering and forgetting by the participant as he or she continued to experience their normal life. We therefore used a timeframe as long as feasible. Five and three months were chosen as they were similar to those used in other longitudinal studies (in Section 5.2.3 we mentioned longitudinal memory studies with retention intervals varying from one month to a year). We also thought five months would be long enough for participants to forget that the item was part of a study, and three months would probably be long enough for them to (probably) not remember their previous answers in detail. Also, it reduced the total time span of the study (we originally aimed for two intervals of five months each, similar to Larsen & Thompson (1995), but shortened it after the delays in the first phase).

5.3.1.2 Questionnaire cards

We aimed to study remembering with personal items as close to their natural context as possible. To collect data about the cuing process with three items selected by their owners, we designed cards with questions and tasks about the memories, the item and the cuing by the item. The idea of using questionnaire cards was inspired by the postcards with questions often used in 'cultural probes' (Gaver, Dunne & Pacenti 1999). However, the current study was not intended to collect inspirational responses (as with cultural probes) nor did they contain any other material to provoke responses.

One of the reasons we chose questionnaire cards over interviews was to reduce any effects generated by the interviewer's presence while the responses were being cued and recorded. The questionnaire cards for three personal items could be completed by the participants at home, without the researcher being present. In Chapter 4, we saw that participants tended to tell the story of the item to the interviewer, for example, explaining what the item was and where it came from, even if it cued hardly any memories spontaneously. Having a researcher present may have elicited a stronger storytelling response from participants.

Another reason to choose printed questionnaire cards, rather than an online questionnaire or a digital document file (e.g. Word or pdf), was that cards were easy to have close to the chosen item and to be filled in near the item. We were also concerned that a digital document saved on their device or in their email account would increase the chances of participants encountering their answers between phases. Furthermore, the printed questionnaire cards could serve as a physical reminder for participants to carry out the task.

The questionnaire card contained open questions, multiple choice questions, tasks such as marking a point on a scale or filling in a timeline, and the opportunity to provide drawing if desired. The first five questions were about the cued responses and the cuing process. For

example, what came to mind when they saw the item, whether there was a reason why they came to mind in that order, and how specific the memory was. We then asked three contextual questions about the cued responses, by asking participants to fill in a timeline and indicate when the remembered events happened, when the item started cuing this memory, and what other relevant events happened in relation to the item or the events. The last five questions were about the item's features that served as a cue, and about the item's location. For example, by writing or drawing what feature had cued each response, the current location of the item and whether this had recently changed, and what people did with the item. We concluded with the question to take and send a photo of the item to the researcher. In Appendix 1 we provide a further rationale of the content of the questionnaire cards and why these questions were asked.

The questionnaire cards for Phase 1, 2 and 3 can be found in Appendices 1 to 3. The Phase 2 cards differed slightly from those for Phase 1, in that one question was replaced. In Phase 2, participants were given a small red envelope with their previous answers (from Phase 1, question 1 only) and participants were asked to reflect on possible differences with Phase 1, after filling in the first nine questions of the questionnaire card in Phase 2. Some information, such as their name and the item title, and the answers for questions 11 and 12 (location of the item and what they normally did with the item), was filled in in advance based on the information provided in Phase 1. The cards for Phase 3 were very similar to those used for Phase 2; the main difference being that the participants were asked to reflect on their Phase 2 answers and compare them with their Phase 3 answers.

5.3.1.3 Pilot study

The questionnaire card and the instructions were piloted with four participants (friends and colleagues) for both Phases 1 and 2. The questionnaire card for Phase 3 was nearly identical to Phase 2 and was therefore not piloted. We changed the wording for some of the questions based on the cards and the feedback from the pilot participants. The feedback also gave us an idea of what to draw people's attention to when going through the questionnaire card during the introduction meeting. The pilot participants also gave an indication of how long it took to complete the cards, which provided a more reliable estimate of how much time participation in the study would take. It was estimated three and a half hours in total, including a 30-minute introduction meeting, filling in and posting the cards, taking photos of the objects and sending them to the researcher. However, this estimate did not include a voluntary follow-up interview, to which not all participants were invited.

5.3.1.4 Follow-up interviews

Towards the end of the study, it was decided to expand it with a small sample of follow-up interviews. The aim of these interviews was to collect information about how the

participants had experienced the study and how their participation had influenced their regular behaviour with the items they had selected for the study. Ethics approval for this expansion was acquired before the participants were invited. Two participants in Australia and two participants in the Netherlands took part. Most of them were selected because we also had additional questions about the items or the answers given in the questionnaire cards. We believed that a small sample would be sufficient, as the interviews were conducted to verify our assumptions, rather than to collect more data. On average these interviews took 30 minutes.

5.3.2 Participants and recruitment

Twenty (20) adults participated in the study, 10 of them living in Australia and the other 10 in the Netherlands. The details of the participants are summarised in Table 5.1. Two participants who lived in Australia at the start, lived in the Netherlands during Phase 2, and were living again in Australia during Phase 3. They have been listed under 'Australia'. The two countries were chosen because of the affiliations of the researchers, but no comparison between the two countries was intended. The Dutch participants received a welcome letter in Dutch but all other material (questionnaire cards and instructions) in English. They were allowed to complete the cards in Dutch, which were interpreted and coded by the author, who is a native Dutch speaker.

The age of the participants varied from 28 to 73 and the average age was 49. Their level of education was in all cases high; six participants had a Bachelor degree, two participants had a graduate diploma and 11 had a Master's degree; one had attended university but had not completed her degree. The occupations in this group were: working in government or the not-for-profit sector as an advisor or manager (x6), unemployed (x3), retired (x3), information and organisation professional (x2), ICT professional (x2), community and personal service worker (x1), manager in the for-profit sector (x1), health professional (x1) and student (x1) from a university other than where the research was carried out. All participants had a place where they lived on their own or with their partner or family. Eleven (11) participants lived in houses, eight in apartments, and one on a houseboat.

In one case there was more than one participant in the household and these two were partners. In other cases participants were colleagues, or family members but not living together. Three (3) of the participants were male and 17 were female. All were unknown to the researcher prior to their participation in the study.

Table 5.1. Participants in the study *Memories cued by personal items over time*.

Participant #	Gender	Country of residence	Age range*	Occupation category
P01	Female	Australia	65-74	Information and organisation professional
P02	Female	The Netherlands	45-54	Advisor/manager in government or non-profit sector
P03	Female	The Netherlands	25-34	Advisor/manager in government or non-profit sector
P04	Male	Australia	55-64	Information and organisation professional
P05	Female	The Netherlands	45-54	Manager in for-profit sector
P06	Female	The Netherlands	45-54	Advisor/manager in government or non-profit sector
P07	Female	Australia	45-54	Educator
P08	Female	The Netherlands	25-34	Unemployed
P09	Female	The Netherlands	35-44	Advisor/manager in government or non-profit sector
P10	Female	The Netherlands	25-34	Advisor/manager in government or non-profit sector
P11	Female	The Netherlands	25-34	Health professional
P12	Female	The Netherlands	35-44	Advisor/manager in government or non-profit sector
P13	Female	Australia	65-74	Retired
P14	Female	Australia	55-64	Student
P15	Male	The Netherlands	65-74	Retired
P16	Female	Australia	25-34	Unemployed
P17	Female	Australia	45-54	Unemployed
P18	Male	Australia	45-54	ICT professional
P19	Female	Australia	45-54	ICT professional
P20	Female	Australia	65-74	Retired

***** Exact age is known by the researcher, age ranges are used to guarantee participants' anonymity.

The participants were recruited via advertisement through various media, such as Facebook groups, LinkedIn, the Materialising Memories website, company intranet sites, and via snow balling (friends forwarding the advertisement to people unknown to the researchers). People who had signed up as volunteers through the Materialising Memories website were notified and invited to participate. Via website or email they could read a short description of the study and the tasks to be undertaken, and a two-page information sheet was provided via the website and/or email. There was no incentive in the form of financial compensation,

but all participants who completed the study received a thank you letter with two (memory-related) gifts.

Originally 33 participants started the study, but 13 dropped out. Most of those who dropped out (10) did not return the first set of cards. Three participants dropped out after participating in Phase 1, and did not return the cards for Phase 2. The reasons for quitting are mostly unknown, apart from two participants who said they found the questions complicated, and one who quit because of personal circumstances.

5.3.3 Procedure and data collection

In Figure 5.1 we summarised the different phases of the study. In the next sections, we explain the procedure in more depth. We explain the requirements for the personal items that the participants could select and the different phases of the study. The material that was used for data collection in this study can be found in Appendices 1 to 3.

5.3.3.1 Requirements for choosing items and other instructions

There were a few specific requirements regarding the items the participants could choose; this was explained at the introduction meeting and through instructions given in Phase 1. First, they had to choose items from their personal environment. This included items in their handbag or perhaps items in the house owned by their partner, but excluded for example their neighbour's car or a sculpture in the park. Digital items could be located in the cloud or on social media. Second, the item had to evoke at least two memories. Because we wanted to learn more about the development of the item-memories relationship, we preferred to follow items that cued multiple memories in the participant. A third requirement was that they had to include one digital item and one physical item. Any third item could be either physical or digital. A digital item was anything that needed an electronic device to access it. Examples of such items could be music, digital photos, videos, documents, presentations, emails or e-books. The fourth and last requirement was that the item needed to be singular, rather than made up of several items. This meant we preferred a single photo to an album full of photos, because such composites make it hard to analyse what cued the memory. During the introduction meeting, the researcher and the participant(s) went through the instruction material on how to choose the items and the questionnaire cards. While Phase 2 and 3 did not contain instruction material, we decided to explain questions 6, 7 and 8 (timeline questions about the remembered events, cued responses and other relevant events) in the introductory letter (see Appendix 2), as we noticed from participants' Phase 1 answers that they found these questions difficult.

5.3.3.2 Procedure and data collection in the different phases

The set of material the participants received for Phase 1 was as follows: a welcome letter, an instruction sheet for selecting the items, three cards to fill out, an information sheet about the study, two consent forms (they could keep one of them) and a stamped addressed envelope. In the introduction meeting, which took place either face-to-face, via Skype, or over the phone, the researcher went through the questions on the cards (the cards for Phase 1 only) and answer any questions the participant may have had. Personal and demographic data, such as age and occupation, was also collected. During face-to-face meetings, participant would sign the consent form and give it back to the researcher. In other cases, the participant would return the consent form together with the cards in a stamped addressed envelope. In a few cases the introduction meeting was done with two participants, if they already knew each other (colleagues, friends or partners). After the researcher and the participant(s) had gone through the material together, the participants could select three items (using the instructions for this step) and fill in the cards at a time of their convenience. When they were done, they could return the material in the addressed envelope and send photos via email or their phone (e.g. WhatsApp).

Participants received a new envelope for the start of Phase 2 about five months after they had returned the cards for Phase 1. Some questions were slightly adapted. There was a closed red envelope included for each of the items. At Question 10 they were asked to open the red envelope and compare their current answers to Question 1 with the answers from Phase 1. They were then asked to reflect on any differences in their answers, and to write down any specific reasons for the changes. They were asked to return the red envelope with the answers together with the cards, so they would not accidentally see it and review their answers again before the next phase.

The third package was sent approximately three months after the participant had returned the cards for Phase 2. The questions were the same as for Phase 2. They now received a green envelope with the answers given at Phase 2. Again they were asked to check if there were any differences between their current answers and the answers in the previous phase.

This study took place between October 2015 (earliest sending of questionnaire cards for Phase 1) and August 2017 (last sending of questionnaire cards for Phase 3).

5.3.4 Analysis and results

In this section we explain how the collected data was analysed and describe the data on which we base our findings. The way the data was analysed is described in Section 5.3.4.1, the items in this study in Section 5.3.4.2, and the months it took for participants to complete the study in Section 5.3.4.3. We also report on the influences of the study on participants' behaviour with the items in Section 5.3.4.4.

5.3.4.1 Analysis of the collected data

The collected data was analysed using open coding, by making notes on (anonymised) copies of the cards and keeping track of codes and numbers using an Excel spreadsheet. The number of items that could be used for analysis differed per topic, because not all questions were understood as intended, and not all items made it through the three phases.

The findings in Section 5.4.1 (cued response consistency over time) were based on the first question in the questionnaire cards for all three phases, and only the items that were completed for all three phases were included (55). The analysis was done by hand, on printed copies of the cards and the results were collected in an Excel spreadsheet.

We considered cued responses as overlapping when they seemed to relate to the same event or topic, even if the specificity level of the description differed or if the nuance of the description had changed. If two cued responses appeared separately in two phases (e.g. response A and response B in Phase 1, response A and response B in Phase 2), but were written up as a combined cued response in the final phase (Phase 3 response B containing both earlier mentioned cued responses), the combined cued response was split in two. Sometimes the opposite was done as well, if two aspects of an event were mentioned separately but appeared combined as one cued response in other phases, they were merged into one. These corrections were made for seven items.

For the findings in Section 5.4.2, we focused on the changes in cued responses. We analysed these by coding the (assumed) reasons for the change, based on what the participants reported in Questions 1 and 10, from what we deduced from other answers on the cards, such as the timeline questions (Question 6, 7, and 8), or from explanations of what cued the memory or association (Question 9). The data was coded by hand (post-it notes) and Excel using a bottom-up coding process, following the steps of thematic analysis from Braun and Clarke (Braun & Clarke 2006, 2012). If no reason could be extracted from the answers, nothing was coded, and if multiple reasons could be extracted (for example Response A was added because a new event happened two weeks previously, and Response B changed because the relationship to Person X had changed), they were all coded. The analysis was based on 49 explanations for different cued responses to 38 different items. The labels were transferred to an Excel sheet and put into six categories.

The findings in Section 5.4.3 (Item properties that facilitate cuing) were also analysed using open coding, and categorised and counted in an Excel spreadsheet. Analysis was performed on Question 9 and one phase per item was used (usually Phase 1), from which 152 descriptions of 56 items were collected.

5.3.4.2 Items in this study

The items in this study are presented in Table 5.2. Items in the study on cuing memories over time. The most popular type of item chosen was decorative objects and souvenirs (15), followed by images (13).

Table 5.2. Items in the study *Memories cued by personal items over time*.

Item categories	Total	Digital	Inaccessible during some phases
Decorative objects and souvenirs	**15**		**1**
Paintings	*4*		
Figurines	*3*		
Framed images (not photos or paintings)	*2*		
Soft toys	*2*		*1*
Other decorative objects	*4*		
Images	**13**	**11**	**2**
Single digital photos in folder on a device (laptop/desktop, mobile phone, or tablet)	*5*	*5*	*1*
Single digital photos (also) on social media or profile photo	*3*	*3*	*1*
Screensaver or background photos	*3*	*3*	
Single printed photos	*2*		
Porcelain and kitchen utensils	**6**		
Books and documents	**6**	**4**	**1**
Emails and personal files	4	4	1
Leisure reading books	2		
Wearables	**4**		**1**
Jewellery	*2*		*1*
Clothing	*2*		
Furniture and lamps	**3**		
Music	**2**	**2**	
Electronics	**2**		**1**
Food and drinks	**1**		
Others, e.g. a plant, lip balm, a handkerchief, a digital game	**8**	**1**	**1**
TOTAL	**60**	**18**	**7**

The first column (item categories) shows the items summarised in categories, the second column (total) shows the total number of items from this study in the particular category, the third category (digital) shows the number of digital items in the total number of items in the particular category, the last category (inaccessible during some phases) shows the number of items that were thrown away or could not be accessed during some phases of the study.

Despite the request to include at least one digital item, we had only 18 truly digital items. Eighteen (18) participants had two physical and one digital item. One participant had

included an electronic item, and one participant filled out the questionnaire cards for three physical items. In the introduction meeting it was often mentioned that they could choose three physical items if they could not think of a digital item they could use for this study. Most of the digital items were digital photos (11), some were emails and personal files (4), and two (2) were music, one album and one individual song. One digital item was a game on an iPad (categorised under 'Others').

A major difference between the items in the current longitudinal study and the items presented in Chapters 3 and 4 (items related to a holiday) is that this study contained few wearables. The number of decorative objects was similar to the items related to a holiday, but fridge magnets were absent in the current study. A new category not seen in the study described in the previous chapters was porcelain items and kitchen utensils. Many of the items in this current study were older than the holiday-related items, because only holidays that had taken place less than five years previously could be used, and most items were acquired during or just before that holiday. In this study, many items had been owned for or were known to the participant for at least 12 years.

Five items were not available in Phases 2 and 3 (thrown away or could not be found), one item (a ring) was at a jeweller for repair during Phase 2, and one (digital) item could not be found while filling in Phase 3. The five items that were not available in Phases 2 and 3 were excluded for most of the analysis in this chapter, the other two have been included.

5.3.4.3 Completion time

The moment of sending the next set of questionnaire cards was approximately five months (after participants returned their Phase 1 cards and photos) and three months (after participants returned their Phase 2 cards and photos), as described in Section 5.3.1.1. The participants did not always return the questionnaire cards right away. The completion time of all three phases was on average 10 months (median was 9 ¼ months), ranging from 7 ½ to 14 ½ months. A table of the completion time of all individual participants can be found in Appendix 4.

5.3.4.4 Influences of the study on the participants

Chances were that taking part in the study would influence the natural behaviour of the participants with the items, such as paying specific attention to the items or not selling or throwing them away, because they were part of the study. This change of behaviour, together with other influences on participants and outcomes, is often summarised as the Hawthorne effect (Chiesa & Hobbs 2008). However, our findings indicate that several participants did not attempt to protect the items during the study. Of the 60 personal items, two digital items were removed or could not be found anymore, two items were put into

storage while the owner moved temporarily overseas, one item was thrown away, and one item was not unpacked from the moving boxes approximately four months after moving into a new house. There were also a few cases where the participant may have treated the items differently. For example, one of the participants mentioned in Phase 2 that the item was on its way out, but this would happen only after the study was completed.

The four participants who took part in a follow-up interview stated that the study did not affect their interaction with the items between the periods of data collection (Phases 1, 2, and 3). However, there were some cases where participants indicated they were aware of the items being part of the study. For example, one participant mentioned in the follow-up interview that she would talk to a figurine a bit when hanging it in a new place, telling it that it would soon be photographed again. Two participants also mentioned in their questionnaire cards (Phase 2) that seeing the item reminded them of the previous time they filled in the cards. When we asked the four participants in the follow-up interview whether they tried to remember what they had filled in the previous time, three said they did not purposefully try to remember what they had filled in before. One said she had the feeling she should be consistent, but could only remember the gist of what was previously cued by the item. Two participants mentioned in the interview that the study had influenced their attachment to the item. They became more aware of the item's value and the memories attached. In the researcher's spontaneous communication with other participants it was mentioned that the study had made them reflect on certain memories and items.

5.4 Findings: Cued remembering over time

In the previous section we provided an overview of the data we collected (i.e., the items, participants and the average completion time), and how we approached the analysis. In the following sections we present the findings. These findings are categorised into three sections. We first look at how dynamic versus consistent the cued responses were over time. Then we look at how cuing changes over time, and we conclude with the cues (a detailed specification of the item or characteristic of the item) that led to the responses.

5.4.1 Cued response consistency over time

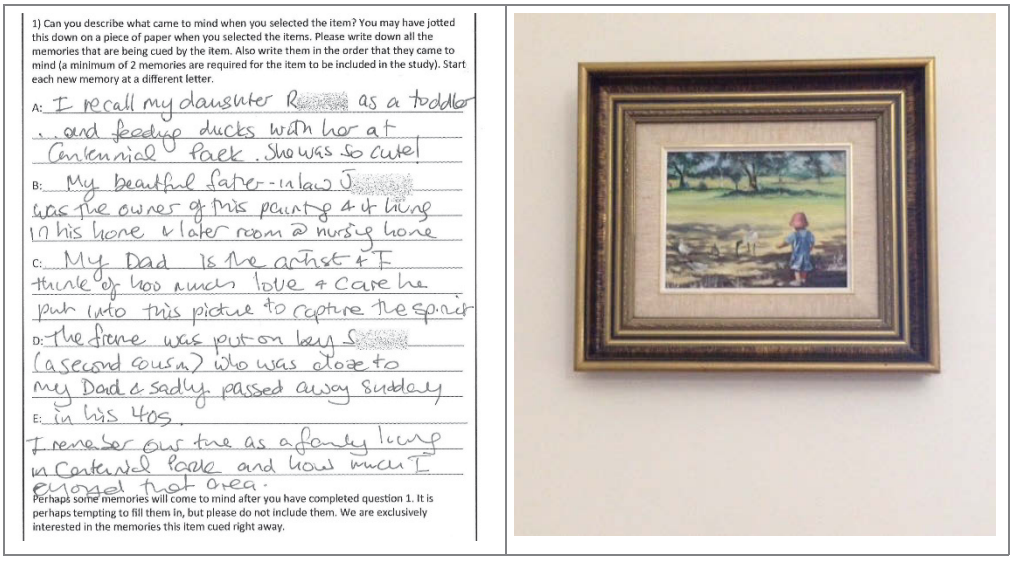
We looked at whether the cued responses were repeated over the three phases that the cards were completed (for the 55 items that were completed for all three phases). Did the item cue the same responses to the participant every time they filled in the cards? Based on the literature discussed earlier in this chapter, we expected cued responses would change to a certain extent, because the attachment relationship to items changes over time and memories also change over time. We expected for example that new memories would be

cued (perhaps from recent events) and other memories would not be cued or be altered. To get an impression of how much cuing by personal items differed at different points of time, we looked at the consistency of cued responses over the three phases in this study. An example of a personal item and the answers to Question 1 over three phases can be seen in Figures 5.2 and 5.3 (names are removed to maintain anonymity).

We based our finding on 634 cued responses that were reported over three phases. As can be seen in Table 5.3, the number of cued responses reported per item (based on 55 items) slightly declined between Phases 1 and 2 (4.1 to 3.8), and then remained about the same between Phases 2 and 3 (3.8 and 3.7). In all phases, the number of cued responses varied between two and seven. Although there were five answer fields on the questionnaire cards (Question 1), we made some corrections by splitting and merging some of the cued responses; this meant that some questionnaire cards now had more than five cued responses (see Section 5.3.4.1 for more explanation). The median was four cued responses per item over all three phases.

To understand how variable or permanent the cued responses were, we looked at whether each of the cued responses in a phase also occurred in another phase. To give an example, in Figures 5.2 and 5.3, the participant had four memories or thoughts appearing in all three phases (first memory/thought: 1A, 2A, 3A, second: 1B, 2B, 3D, third: 1C, 2D, 3C, fourth: 1D, 2E, 3E), and one memory or thought (fifth: 1E and 3B), appeared in two phases.

As Figure 5.4 (left) shows, the majority of the reported cued responses (391 answers out of 634) in this study were repeated in at least one of the other two phases (see Figure 5.4 left). These 391 reported responses consisted of 156 memories or thoughts that were repeated in one (77 times) or two (79 times) other phases.



1) Can you describe what came to mind when you selected the item? You may have jotted this down on a piece of paper when you selected the items. Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind (a minimum of 2 memories are required for the item to be included in the study). Start each new memory at a different letter.

A: I recall my daughter R[redacted] as a toddler ..and feeding ducks with her at Centennial Park. She was so cute!

B: My beautiful father-in-law J[redacted] was the owner of this painting & it living in his home & later room @ nursing home

C: My Dad is the artist & I think of how much love & care he put into this picture to capture the spirit

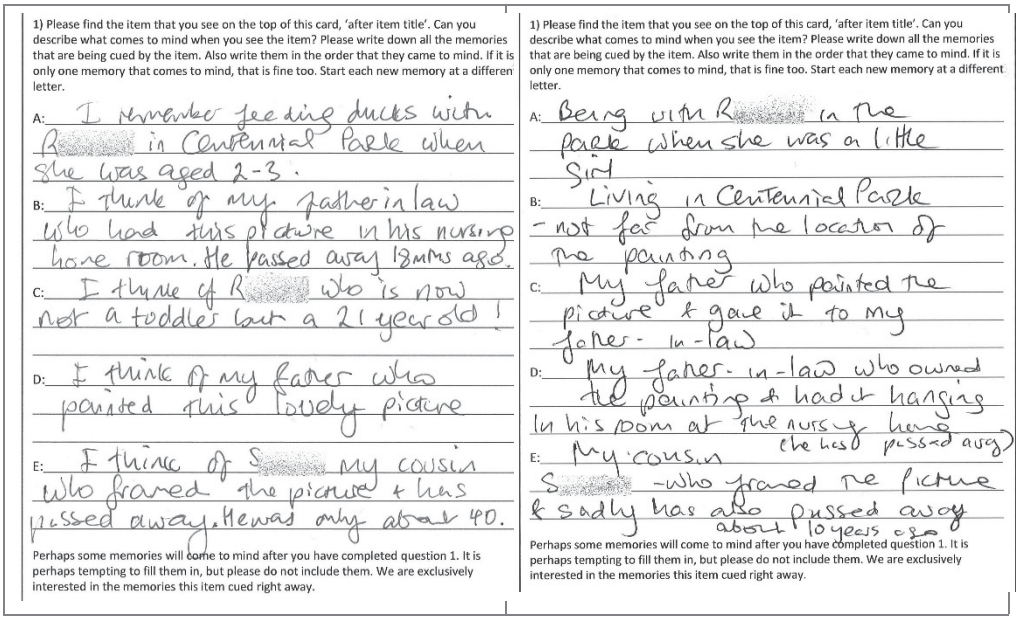
D: The frame was put on by S[redacted] (a second cousin) who was close to my Dad & sadly passed away suddenly

E: in his 40s.

I remember our time as a family living in Centennial Park and how much I enjoyed that area.

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

Figure 5.2. Answers of P07 on question 1 in Phase 1 (left) and P07's framed painting (right).



1) Please find the item that you see on the top of this card, 'after item title'. Can you describe what comes to mind when you see the item? Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind. If it is only one memory that comes to mind, that is fine too. Start each new memory at a different letter.

A: I remember feeding ducks with R[redacted] in Centennial Park when she was aged 2-3.

B: I think of my father in law who had this picture in his nursing home room. He passed away 13mths ago.

C: I think of R[redacted] who is now not a toddler but a 21 year old!

D: I think of my father who painted this lovely picture

E: I think of S[redacted] my cousin who framed the picture & has passed away. He was only about 40.

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

1) Please find the item that you see on the top of this card, 'after item title'. Can you describe what comes to mind when you see the item? Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind. If it is only one memory that comes to mind, that is fine too. Start each new memory at a different letter.

A: Being with R[redacted] in the park when she was a little girl

B: Living in Centennial Park - not far from the location of the painting

C: My father who painted the picture & gave it to my father-in-law

D: My father-in-law who owned the painting & had it hanging in his room at the nursing home (he has passed away)

E: My cousin S[redacted] - who framed the picture & sadly has also passed away about 10 years ago

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

Figure 5.3. Answers of P07 on question 1 in Phase 2 (left) and Phase 3 (right).

The overlapping cued responses are (the number is the phase, the letter is the cued response): [1A, 2A,3A], [1B, 2B, 3D], [1C, 2D, 3C], [1D, 2E, 3E], and [1E, 3B]. 2C does not overlap any of the other phases.

Table 5.3. Number, average, and standard deviation of cued responses per phase.

	Number of cued responses	Average per item	Standard deviation
Phase 1	223	4.1	1.0
Phase 2	208	3.8	1.0
Phase 3	203	3.7	0.9

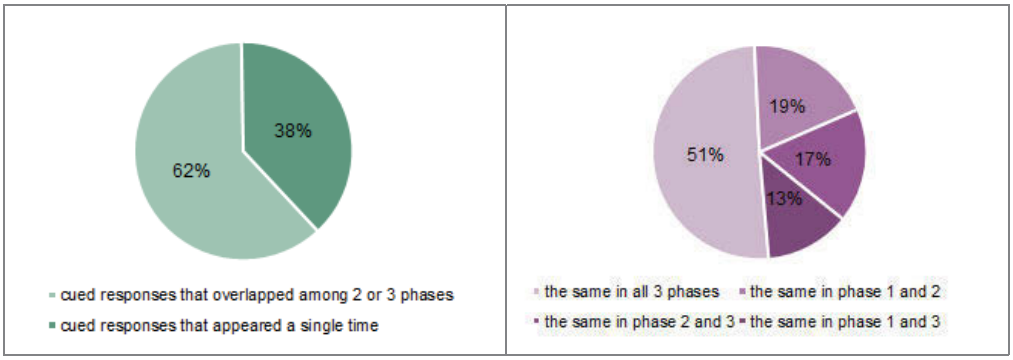


Figure 5.4. (left) Percentage of cued responses that overlapped among 2 or 3 phases, and (right) overlap of cued responses among phases.

Figure 5.4 (right) shows the division of the overlap among the phases. Of the 156 responses that appeared at least twice in the study (repeated cued responses, e.g. in Phase 1 and 3), approximately half of them (51%) appeared consistently in all three phases (79 cued responses, which accounted for 237 cued responses over all phases). This meant that a particular memory or thought was cued every time the card was filled in. For 42 of the 55 items (76%) this occurred for at least one cued response. There were also memories or thoughts that were cued in only two phases of the study. Most often this occurred in two successive phases, such as an overlap between Phases 1 and 2, roughly six and a half months later (19%, 30 memories/thoughts, accounting for 60 cued responses), and overlapping between Phases 2 and 3, roughly three and a half months later(17%, 27 memories/thoughts, accounting for 54 cued responses). There is also a slightly smaller group (13%, 20 memories/thoughts, accounting for 40 cued responses) overlapping between Phases 1 and 3 (and were not reported in Phase 2). In total, 96% of all items had one or more cued responses repeated in two phases or more.

Most items cued a mixture of similar and different responses across the three phases. Some items however, such as a musical instrument case and an email (from different participants) always cued different responses during the three phases. One item (a lamp), however, had all cued responses repeated at least once over the three phases.

We looked at item types and whether there were any striking differences among the types regarding the overlap of cued responses among phases. Although averages differed among the categories, the spread within the category (standard deviation) was wide. Based on these numbers, we could not observe any differences among item categories for the consistency of cued responses over time. Figure 5.5 shows this in columns (the mean percentage of overlap among phases per category) and dots (the distribution of the percentages per item), and Table 5.4 shows the numbers and standard deviations.

Based on the findings, we can conclude that most items (92%) cued at least one consistent response over a period of 10 months. However, as a set of cued responses (all the responses cued in a phase), there was some variety over the 10 months. Sixty-two (62%) per cent of the cued responses stayed the same, and it was thus common to see some memories/thoughts not cued at any of the other moments that were tested. We did not observe any differences in the consistency of cued responses among item categories.

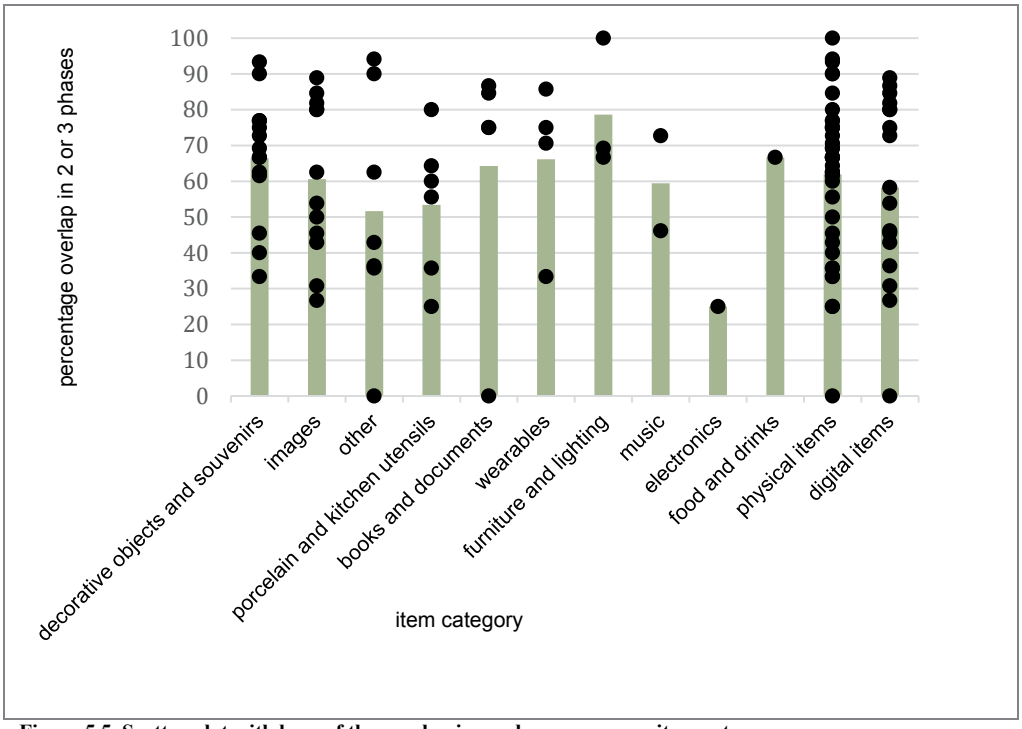


Figure 5.5. Scatter plot with bars of the overlap in cued responses per item category.
Each dot represents one item in that category. The bars represent the average for each item category.

Table 5.4. Overlap of cued responses per item category.

Item category	Number of items	Percentage of total items	Number of cued responses (3 phases)	Percentage of overlap in 2 or 3 phases	Standard deviation
Decorative objects and souvenirs	14	25.5%	161	66.4%	17.3
Images	12	21.8%	135	60.6%	22.0
Other	7	12.7%	77	51.7%	33.2
Porcelain and kitchen utensils	6	10.9%	69	53.4%	20.0
Books and documents	5	9.1%	63	64.3%	36.3
Wearables	4	7.3%	55	66.2%	22.8
Furniture and lamps	3	5.5%	33	78.6%	18.5
Music	2	3.6%	24	59.4%	18.8
Electronics	1	1.8%	8	25.0%	n.a.
Food and drinks	1	1.8%	9	66.7%	n.a.
Physical items	38	69.1%	442	62.0%	22.1
Digital items	17	30.9%	192	58.2%	25.8

Where "n.a." is written, a standard deviation could not be calculated because the number of items in that category was 1.

5.4.2 Why and how cuing changes over time

In this section, we look not only at cued responses that were not repeated (the 38% presented in the previous section) but also at smaller changes, for example where the nuance of the cued response was different in the different phases. We were able to extract 49 explanations for change in 38 items (out of 55 items). Based on this analysis, we found six different categories of reasons why cued responses were different from the previous phase:

A) current events on the participant's mind
B) the participant's emotional state
C) new connections to recent events
D) the item was involved in new events
E) thoughts about a person or situation changed, and
F) the item revealed other characteristics.

5.4.2.1 Current events on the participant's mind affecting what was cued

In our analysis, we found that a number of reasons for change related to current events or thoughts in the participants' mind affected what was cued. These could be current activities or issues, events that had recently happened or were going to happen in the near future. For

example, one of the participants (P13) mentioned it was her granddaughter's birthday the day she filled in the card, which primed her to remember or think more about her granddaughter when looking at the item than at other times when she filled in the cards. In another example, a recent visit to her mother-in-law, reminded one of the participants [P12) of the 'stay over' of her wooden figurine at her partner's mother's house when moving house. P07 mentioned a past event in Phase 2 that was not mentioned in Phase 1 when describing the cued responses to her red dress (Figure 5.6):

> *'Wearing that dress to a formal event a year ago with my husband & having a great time being together in a lovely city hotel [name of hotel omitted]' [P07].*

She was reminded of this event because the event and the hotel were currently on her mind:

> *'I mentioned wearing [the] dress at an event with my husband (in this questionnaire) because I'm going again to [the] event (soon) + wearing same dress.' [P07]*

These examples indicate that everyday life thoughts and activities could steer the cuing of personal items to memories related to both what the participants had on their mind and what was related to the item.

Figure 5.6. Red dress cued different response because of current event on owner's mind.

5.4.2.2 Emotional state affecting the cued response

Participants mentioned that their emotional state influenced the cuing, and they felt that this explained some of the differences in cued responses over time. In their written responses (Question 1), we sometimes see subtle indications that the same memories or thoughts were evaluated differently. Differences in cued responses caused by mood (as reported by the participants) were more difficult to detect in the analysis than changes caused by events (see Section 5.4.2.1), where the presence or absence of associations linked to these particular events are noticeable in the participants' answers. Sometimes the differences could be noticed when the way responses were formulated were looked at closely, or participants pointed out that mood played a role in their cued responses. For example, P06 reported that the recent death of a close friend, around the time she filled in Phase 2, affected her mood and hence her cued responses when she was looking at her antique radio cabinet (see Figure 5.7). In Phase 3, having just been on holiday and being in a 'happy flow', also affected her mood. She formulated similar associations slightly different in Phase 3 compared to Phase 2:

'Misuse of it now because my laundry is on top of it.' (Phase 2) [P06]

'Useful to be able to put some stuff on top.' (Phase 3) [P06]

Figure 5.7. Radio cabinet cuing different responses due to the owner's emotional state.

In another cued response evoked by the same radio cabinet she said:

'[I] [w]ant to see the pictures again that are put in.' (Phase 2) [P06]

'Such nice photos are stored in this little cabinet.' (Phase 3) [P06]

The differences in the cued responses, either more critical or melancholic in Phase 2 (e.g. 'misuse') or seeing the bright side of things in Phase 3, was also observed in the cards for two other items that the participant filled in.

Apart from participants' general mood while filling in the questionnaire cards, the way a previous card had been filled in could influence participants' responses in the next card. One of the participants mentioned that filling in the previous card (which had evoked emotions of grief) had influenced the answers on the next questionnaire card, for an item that normally cued very happy responses.

5.4.2.3 New connections to recent events

In between the different phases, participants had new experiences which sometimes brought new associations to the item. These new experiences altered the item-memories relationship because of its new connections to memories of recent events.

For example, a participant (P02) who filled in her cards for a painting she had of the Sistine Chapel ceiling (see Figure 5.9), actually saw the Sistine Chapel when on holiday in Rome just before taking part in Phase 3 of the study. Looking at the painting in her home on her return reminded her of her visit to the Sistine Chapel a week earlier. Another example is of a participant whose book (see Figure 5.8) cued associations to a recent sighting of the book in a bookstore:

' New cover of Sophie's World at Dymocks [Australian bookstore chain] that we saw on my birthday' [P16]

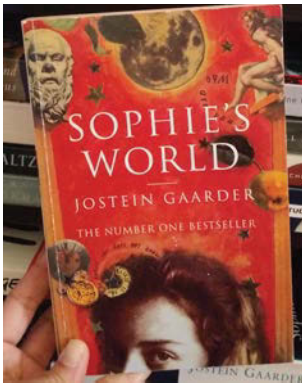


Figure 5.8. Book Sophie's world cuing memories of recent events.

The above examples all involved events that related to the topic represented by the item. In these cases, the item itself stayed the same and in the same place, but a different response was cued.

5.4.2.4 The item was involved in new events

Use of the item, repair, change of location or change in its context (e.g. adding another item next to it) created new memories linked to the item. The red dress (P07) mentioned earlier (see Figure 5.6) is an example of this − the dress reminded the owner of several occasions when she had worn it.

A few participants mentioned repair of their jewellery, such as a golden ring (P06) that was being repaired during Phase 2 of the study and a necklace (P03) that broke just before Phase 1. In both cases, this led to new associations in the next phase. However, the memory of the broken necklace did not become associated right away. In Phase 1 the breakage was not mentioned as a cued memory at all; all the participant mentioned (in two of the contextual questions) was that the chain had broken two weeks previously and could not be worn. In Phase 2 (five months later) the necklace cued the following response:

> *'Moment [necklace] broke and I was really happy I [felt] it break (so I didn't lose it)'. (Phase 2) [P03]*

It is possible that in Phase 1 the event had not yet been consolidated into a memory and that this happened in the interval between Phases 1 and 2 and thus was cued five months later. Three months after Phase 2 this memory was not cued at all; instead other more recent events related to the necklace were cued.

Besides use and repair, we had several items moving location, as was noted in the responses to Question 11. Not every move led to a new associated memory for an item, but in some cases memories related to previous moves or locations were reported. For example, a painting of the Sistine Chapel cued for P02 both a previous position where it had been hung and moving it to her house (Figure 5.9):

> *'The moving from his to my house, the painting could hardly go upstairs, it was that big.' (Phase 1) [P02]*

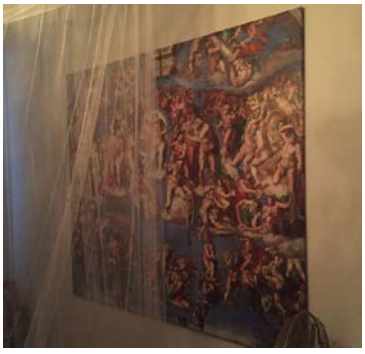


Figure 5.9. Painting of Sistine Chapel changed location.

This was not the only memory associated to the item's (re)location, because in Phase 2 the painting and its owners had moved house again, producing yet another new cued response:

> *'Our last bedroom where it hung on the wall.' (Phase 2) [P02]*

This memory was not mentioned in Phase 3; instead the memory from Phase 1 (carrying it up the staircase) was cued.

5.4.2.5 Thoughts about the person or situation had changed

Often the item related to other people and the owner's (changing) relationship to these people influenced the cued response. Fore example, one item related to a group of friends that was not very active anymore in Phase 2 (P03), another related to concerns about ageing parents who were living overseas (P01). When the relationship to the related subject of the memory changed, it also affected the cuing, as happened with the participant who had many more negative memories related to her husband in Phase 2 than in Phase 1. In Phase 1 the rolling pin (Figure 5.10) related mostly to a holiday in India, and a bit to her husband. About this change she explained:

> *'The anger [and] loneliness in my relationship is more predominant in my mind than India.' (Phase 2) [P23]*

In some cases it was the situation the item related to that was re-evaluated over time, affecting the cued responses to the item. One of the participants (P08) filled in her cards for a photo of herself which had evoked lots of laughter at the time it was taken, and also evoked joyful memories in Phases 1 and 2 of the study. By Phase 3 this had changed; she felt it was a rather stupid photo and it did not remind her of the laughter at the time it was taken.

Figure 5.10. Rolling pin cued an association to a person, towards whom the owner's sentiments were now different.

5.4.2.6 The item revealed other characteristics

When the appearance of an item changed, or the participant looked at it from another angle, the cued responses could differ. In some cases, the participant looked at another detail, which resulted in other associations. For example, one of the participants noticed when looking at a photo in which she and her partner could be seen from the back looking at a mountain view:

> *'I don't have those slippers anymore.' (Phase 2) [P17]*

Another participant, who had kept his clarinet case closed in Phases 1 and 2, decided to open the clarinet case when filling in the cards for Phase 3. This evoked more activity-focused responses, when the owner remembered playing the instrument and the hard work involved.

How an item can change and thus alter cued responses can be illustrated by the following example in which the participant looked at her plant in different ways (Figure 5.11):

> *'During a holiday it did not get any water for 4 weeks, but it just recovers by itself.' (Phase 1) [P11]*

Figure 5.11. Plant showed different aspects of itself.

This memory was cued by specific situations: *'When the leaves hang down, I think of this memory.'* Another response was cued for a similar reason: *'It gets nice purple flowers,'* which was explained by: *'It has little buds at the moment.' (all quotes from Phase 1) [P11]*

When an item was perceived differently, the cued responses could also differ, as in an artwork that slowly reveals different aspects and meanings.

5.4.3 Item properties that facilitate cuing

To understand where the cued responses mentioned in the questionnaire cards came from, we looked at what specifically in the item acted as a cue. In the questionnaire cards we asked participants to indicate in Question 9 what the cue was for each response (see Figure 5.12). We chose to analyse the answers given in Phase 1, because the questionnaire cards for this phase were completed for all items in the study (60 items). Only descriptions of item properties were selected and included. However, the question was not always answered in this way, leading to items without useful descriptions of what the cues were for the mentioned responses. In those cases, we used answers from Phase 2 or Phase 3. We used 45 items from Phase 1 (136 descriptions), nine from Phase 2 (14 descriptions), and two from Phase 3 (two descriptions). In total we based our analysis on 56 items and 152 descriptions (roughly two thirds of all cued responses in Phase 1).

We put the cues into six categories: responses cued by the item as a whole, a specific part of the item (visual/textual/physical), general characteristics of the item (style/colour), tactile/interaction, damage/traces/repair/missing parts, and location/environment. In Table 5.5 we present these cue categories with examples and the percentages of their occurrence among all 152 descriptions.

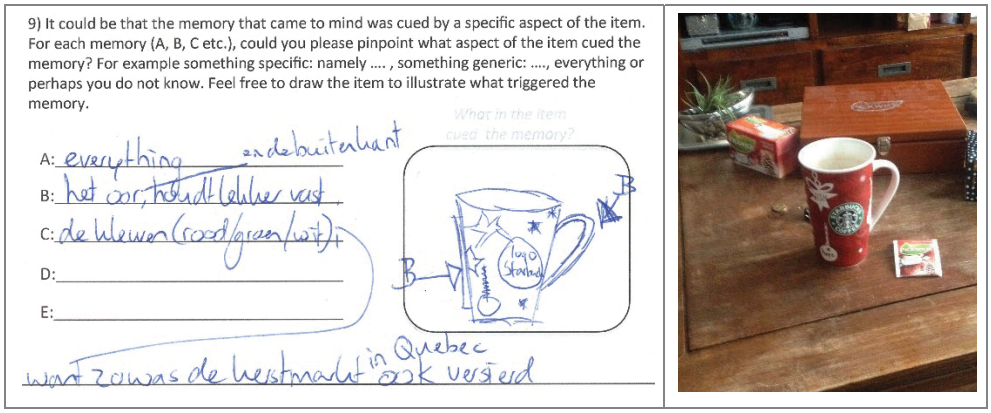


Figure 5.12. Question 9 filled in by P08 for her tea mug (image on the right).
Answers are given mostly in Dutch, translated it reads: B: the ear → and the outside, holds very nicely, C: the colours (red/green/white), → because that's how the Christmas market in Quebec was decorated.

Table 5.5. Item properties that facilitate cuing.

Cue	Examples	%
Item as a whole	A figurine, a set of chairs, a song or cd, a photo, an email	41%
Specific part of the item (visual/textual/physical)	An inscription on the pendant of a necklace, a facial expression on a photo, a word or sentence in an email, a bookmark in a book, a frame around a painting	40%
General characteristic of the item (style/colour)	The colours of a drinking mug, the angle from which a photo was taken, the childish brush strokes on a painting, the floral design of a piece of porcelain	7%
Tactile/interaction	Holding a mug, the rough fabric on the chairs, where a candle can be taken apart, the ivory handle that prevents the kettle from becoming hot	5%
Damage/traces/repair/ missing parts	A case-handle repaired with rope, spots on chair fabric, discolouration at the foot of a lamp, colours that had washed off a rolling pin (bare wood), the lack of cedar smell on a cedar item, a bronze head missing from where it used to be on a chest of drawers	5%
Location/environment	The room where the item was located, a drawer were the item was located, another item was close to the item on the wall	2%

The most prevalent cues were the 'item as a whole' (41%, 31 items) and a 'specific part of the item' (40%, 29 items). The category 'item as a whole' included mentions of 'everything', 'nothing specific' or the name of the item. It meant that there was no specific part of the item responsible for cuing the response. The category 'specific part of the item' consisted of a variety of cues that could be pinpointed on the item. We found visual cues

(e.g. nature in the background of a photo), textual or verbal cues (e.g. words in a book title, parts of the lyrics of a song) and physical cues (e.g. the swing in the sculpture of two people sitting on a swing), all dependent on the type of item.

We also found a category of cues that were characteristics of the item but could not be singled out from the whole item. In this category, the 'general characteristics of the item' (7%, 6 items), the responses were for example cued by style, colours, angle of an image or the design. The 'tactile/interaction' category (5%, 6 items) contained examples of (potential) touching, using or holding the item, or of (potential) movement/operation that cued a response. The 'damage/traces/repair/missing parts' category (5%, 7 items) contained changes and differences in the items over time, such as damage and traces, or aspects that used to be there but were now missing. For example, the lack of a smell, an additional item or paint, evoked the cued response. The last category we identified was the 'location/environment' (2%, 3 items) of the item. In these cases the cuing was facilitated by a nearby item or the item's location.

5.5 Discussion

We explored cuing over time with personal items to gain knowledge on cuing and the development of the item-memories relationship. With a longitudinal study of 60 items and 20 participants in Australia and the Netherlands, we investigated the overlap of cued responses at different moments in time, why cued responses changed over time, and what cues caused the responses. We looked at the relationship between personal items and memories over time in an everyday context, including cognitive aspects and the physical items with which the owners interacted. In the following sections we reflect on the method, the consistency in cued responses over time, the changes in cuing over time, and the item properties that acted as cues.

5.5.1 Reflection on the method: assumptions and limitations

We studied the item-memories relationship over time, with intervals of six and a half and three and a half months. One of our assumptions was that time (the continuation of people's life and natural changes to the item) plays a role in the changes in the item-memories relationship. However, based on this study it could not be established with 100% certainty that time caused any changes. It may be that any other moment (e.g. after five days) would have resulted in some differences among cued responses as well. Yet, some of our findings would not have become apparent without this timeframe, indicating that time does play a role. New events happened in the meantime, items went for repair, and opinions about, for

example, a husband, changed. We may not be able to demonstrate 'forgetting', but we do presume that time is an important aspect in relationship to changes in cuing.

Very few men participated in the study (three out of 20). From the start of recruitment, fewer males volunteered to participate (10 males versus 20 females), and among the drop outs in Phase 1, seven males (versus six females) did not return the cards. The data are therefore biased towards females. Research by Wallendorf & Arnould (1988) has demonstrated that women demonstrate higher attachment to personal items than men. This may explain why more females engaged and committed to completing this research.

Not all questions on the cards were filled in accurately and we asked participants several introspective questions. Timeline questions (Questions 6 to 8) were often left unanswered, and in the follow-up interviews, some participants mentioned they did not feel the answers to the timeline questions were completely reliable. Reflecting on one's own remembering process is hard, and the answers need to be interpreted with care. These questions were used only as a support to interpret what was answered in response to other questions. In addition, the instruction in Phase 2 to return the red envelopes with their content (which contained their answers from the previous Phase for question 1) to the researcher was not always followed. This instruction was given to prevent the participants from seeing their responses (e.g. by putting them up on a pin board) in the period between Phases 2 and 3. We assumed the participants who did not return the red envelopes threw them away and we treated the collected questionnaire cards in the same way as other participants. Another instruction that was not always complied with was that some participants did not look at the item while filling in the questionnaire cards. In their follow-up interview, two participants said that they completed the questionnaire cards at the kitchen table, while the items were in other rooms and not easily visible from where they were sitting. Thus, the method allowed for deviation of the instructions, or misinterpretation of the questions.

We were aware that filling in the questionnaire could influence the normal relationship with the item, also known as the Hawthorne effect (Chiesa & Hobbs 2008). As mentioned in Section 5.3.4.4, for a few participants the item reminded them in Phase 2 of the previous time (Phase 1) they filled in the cards. When asked during follow-up interviews, some participants mentioned that they were trying to think of what they filled in the previous time, but could not remember what they had filled in. Most participants, however, mentioned in the follow-up interviews that they had not treated the items differently because the items were part of the study, except for one participant who mentioned that she would talk differently to the item. Three participants threw their item away or deleted it during the study, which indicates that they were not particularly aware that the item was part of the study.

The order in which the cards were filled in was free, every participant could decide that for themselves. This could mean that the emotions and memories evoked by the previous card and item affected the next. Dutch participants filled in cards with English questions but could answer the questions in Dutch. Not everyone stayed consistent in their language choice. Some participants filled in the Phase 2 cards in English, even if they had filled in the Phase 1 card in Dutch. Memory researchers have found that language can impact remembering (Marian & Neisser 2000), with the language that was spoken in the period the events happened being advantaged compared to another language.

5.5.2 Consistency in cued responses over time

In this chapter, we looked at the content of the memories and thoughts cued by the item, and how they changed or stayed the same over time. The findings indicate that 62% of the responses (content) were cued by the items repeatedly and 76% of all items had at least one response cued in all three phases, 96% in at least two phases. We can thus assume that cuing to some extent stays the same over time (tested for six and a half, three and a half, and 10 months in total). Out of the total set of responses that an item cued each time (we collected up to five cued responses per item in each phase), we found that it was very rare that the same responses were cued (in fact, this was seen for only one item), or to never have the same cued responses (this was seen for only two items). This indicates that cuing by personal items over time is dynamic (the set of cued responses changed over time), but that cuing is not random (often one or two cued responses stayed the same). Of the responses that were cued twice, they were not always cued in successive phases, but sometimes skipped a phase. This may be explained by the fact that the participants had seen their answer (from Phase 1) three and a half months earlier in the red envelope. Another explanation could be that these cued responses were not completely forgotten, but rather not cued at a certain time by the item. When designing for remembering, we may thus expect to some extent a stable response (an item may continuously cue the memory of a certain event, for example), and to some degree an unpredictable, ever-changing outcome.

It is difficult to estimate the impact of an item on cuing (the extent to which it facilitates remembering), compared, for example, to a word cue, such as who, what, where and when descriptions used in other longitudinal memory studies (Linton 1978; Wagenaar 1986; White 2002). This is due to the different set-up of this study, and because the item (the cue) was not new when the study started.

5.5.3 Changes in cued responses over time

We identified six main categories of reasons why new cued responses were evoked, or altered compared to the previous phase. These are summarised in the model in Figure 5.13, pointing to the step to which we believe it relates the most. The categories were:

A) current events on the participant's mind affected what is cued (in Figure 5.13 it relates to *cuing & construction*)
B) emotional state affected the cued response (in Figure 5.13 it relates to *cuing & construction*)
C) new connections to new events which became part of people's memory (in Figure 5.13 it relates to *events*)
D) the item was involved in new events (in Figure 5.13 it relates to both *events* and the *personal possession*)
E) thoughts about the person or situation changed, relating to information available in people's mind (e.g. autobiographical memory) that was different compared to another moment (in Figure 5.13 it relates to *autobiographical memory*), and
F) the item revealed other characteristics (in Figure 5.13 it relates to *personal possession*).

These findings were based on participants' explanations and the researchers' observations and interpretations of the questionnaire cards.

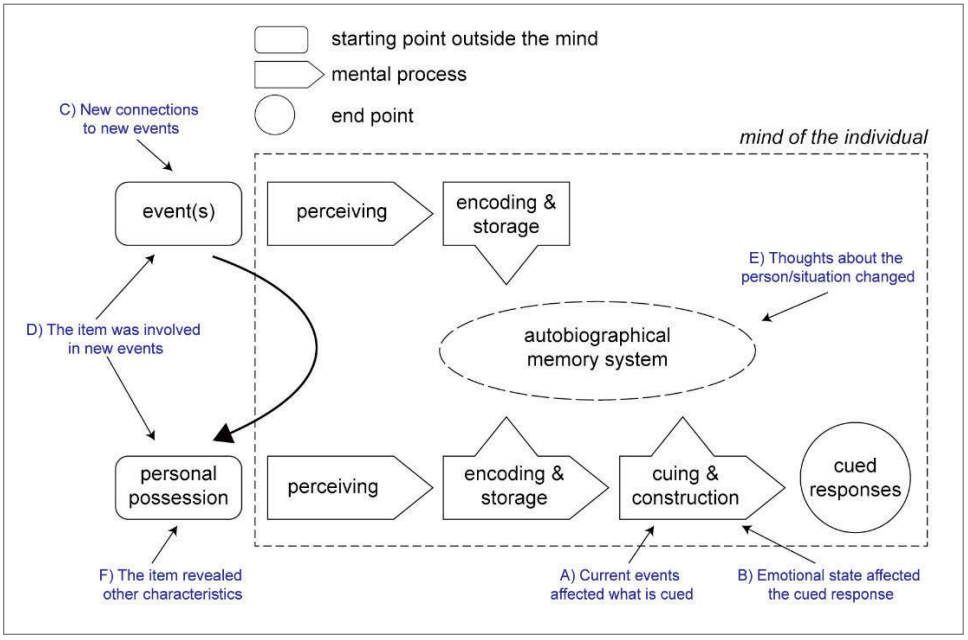


Figure 5.13. Summary of the reasons for changes in cuing over time.

Some of the findings are in line with what is known about remembering. For example, the finding that events currently on people's mind (A), such as things they had done in the past few weeks or would do in the near future, could affect the cued response (see Section 5.4.2.1). In memory research this may be explained by current goals affecting retrieval (Conway 2005; Conway & Loveday 2015) and priming, the phenomenon where exposure to one stimulus (an upcoming event) unconsciously influences a response to another stimulus (the item) (Tulving & Schacter 1990). These thoughts on the mind provide additional context to the physical cues, and guide retrieval of related memories when the items are seen.

It is not only events in people's everyday lives that affect cued responses but also people's emotional state (B) (see Section 5.3.2.2). This is in line with findings in memory research that being in a negative mood brings negative events to mind (mood congruence), while having the same mood as when the event was experienced facilitates the retrieval (mood dependence) (Lewis & Critchley 2003).

The finding that events that had not occurred in the previous phase (recent events) (C) were being cued (see Section 5.4.2.3) indicates that items can gain new associations to memories, without the item being present. The new connections do not always stay over time; recent memories cued in Phase 2 did not always appear in Phase 3 three and a half months later. We may speculate that the memory was not important enough to be integrated into autobiographical memory (Conway 2009), or that these memories were in the first place cued by priming (Tulving & Schacter 1990), meaning that another current or recent event influenced remembrance of a similar topic (the recency effect) (Ebbinghaus 1885 (translated in 1913); Murdock & Bennet 1962), in which recent events are remembered more easily.

The finding that memories were formed because the item was involved in events (D) (see Section 5.4.2.4) indicates that the item's biography (Kopytoff 1986) marks memories as well, similar to remembering the milestones of one's child or another loved one.

The finding that cuing changes because the thoughts about the person or situation of the cued response change (E) (see Section 5.4.2.5) is in line with the 'self-memory system' in which the 'conceptual self' influences the construction of autobiographical memories (Conway & Loveday 2015).

In the last category, it was the items' characteristics that altered (F) and caused different cued responses (see Section 5.4.2.6). This implies that memory cues that change by themselves over time, or where the owner may perceive different cues every time (s)he sees it, can evoke different responses. There are many ways in which items change naturally, such as by ageing (e.g. patina) and traces of use (Rognoli & Karana 2013), or by the owners themselves, such as adornment (Ahde 2007).

We noticed that very actual events, that were quite unique, did not cue right away, but did become a cued response in the next phase (five or three months later). We mentioned a necklace that was broken at the moment when the participant was filling in the cards for Phase 1. The breakage was not mentioned as a cued response, until five months later. A similar situation happened to a Christmas crib. At the time of filling in the cards it was Christmas time, and Christmas as a period or celebration did not come to mind until five months later. A possible explanation is that the connection between item-memory was not made right away (it may not have been a memory yet), but that the memory needed to be consolidated (integrated into memory) (Squire 1986), before it could become a connection to the item.

Our findings in Section 5.4.2 on why cuing changed over time can be divided roughly into three groups: factors related to 'the item' (item revealed other characteristics, or the item was involved in new events), 'new or altered memories' (new connections to recent events, or thoughts about the subject changed), and 'the current state of mind' (current events affecting what is cued, or emotional state affecting the cued response). Factors related to new or altered memories and 'the current state of mind' may be hard to influence for a designer who wants to design for remembering, but 'item' factors can be manipulated by designers. Thus, depending on the goal of the designer, items could for example be designed for (un)changing appearances, or allowing (im)mobility to increase or decrease changes in cuing. Although not everything can be attributed to the item, it may be expected that cuing memories can be partly influenced by a designer.

5.5.4 Item properties as cues

We found that the cues that generated the responses (according to the participants) could be almost any property of the item, even aspects that were lacking (categorised under damage/repair/missing parts, which was 5% of the cues). The majority of the cues however, were the item as a whole (41%) and specific parts of the item such as visual, textual and physical features of the item (40%). These cues may be features a designer would normally not purposely influence when designing for remembering, as any item may be there 'as a whole' and consists of specific parts. However, a bedside chair or table covered with laundry, for example, may imply that the owner does not perceive all its features, and thus the cues the item displays are different. The findings suggest that details in an item do matter for cuing. Other design aspects, such as style and colour (7%), turned out to function as cues, as did characteristics, such as damage and traces that developed over time. These are investigated in more depth in Chapter 6.

5.6 Conclusion

We aimed to explore what cuing is and how cuing occurs by investigating the item-memories relationship over time. Previous research indicated that this item-memories relationship is dynamic (Chapter 4) (Kleine & Baker 2004), which is to be expected, as neither a person's mind nor items are static. Based on 20 participants who filled in questionnaire cards for three personal possessions three times over the course of 10 months on average, it was confirmed that cuing is indeed dynamic and responses cued by personal items do differ at different points in time, which suggests that the item-memories relationship changes over time.

Participants were asked to record a maximum of five cued responses per personal item, and of these cued responses, 62% overlapped in two or three phases. These were memories or thoughts that were cued by the item repeatedly (after six and a half months and/or three and a half months after that).

Six main categories of reasons were found for why cued responses changed (new or altered) compared to the previous test phase. These were:

A) current events on the participant's mind affected what is cued

B) emotional state affected the cued response

C) new connections to recent events

D) the item was involved in new events

E) thoughts about the person/situation changed, and

F) the item revealed other characteristics.

We also investigated what cued the memories or thoughts that they reported as responses, and put these triggers in six categories. The participants reported most often that 'the item as a whole' was the cue for their responses. Following that, a 'specific part of the item' (40%) was mentioned. Some of these specific parts where visual cues, such as nature in the background of a photo; others were textual or verbal cues, such as parts of the lyrics of a song, and physical cues, such as a bookmark in a book. Other categories were the 'general characteristics of the item' (7%), such as its colour, 'tactile/interaction' (5%), such as holding the item, 'damage/traces/repair/missing parts' (5%), and the 'location/environment' (2%), such as a drawer in which the item was located.

We can conclude from this study that personal items can cue similar responses consistently over 10 months. We can also conclude that other responses can be cued because of (recent) past events (with or without the item). Besides the person's current state of mind (emotionally, past and future events, activities and goals, thoughts about the subject in the

cued response), the item itself can influence what is cued. Thus, changes in cuing by personal items depend on (new) events, the owner's state of mind and the item (including what cues are revealed) itself. Besides the item as a whole, specific parts of the item are often responsible for cued responses, and thus these also need to be considered when designing for remembering.

6 EXPLORING THE MEANING OF MATERIAL TRACES ON PERSONAL ITEMS

Abstract

In this chapter, we present findings of a study that focused on the relationship between memories and the material traces of ageing and use on personal items, and the effects of repair on this relationship. We interviewed five professionals at their workplace who worked as restorers or repairers of personal items, such as furniture, porcelain and clocks, and five owners of a repaired or restored personal item. We found five different categories of traces among the owners' objects: traces of use, traces of ageing, traces of repair, traces of accidents and intentional alterations. Major motivations for repairing objects were the state of the object, followed by wanting to pass it on to a new owner, knowing someone in their circle of friends who could repair it or a desire to display and maintain the object. Almost all personal items gained more meaning after the repair, because of their aesthetic improvement or because of a better understanding of their history. Not all traces or damage were repaired; sometimes they were kept for aesthetic reasons, sometimes as memory cues. Sometimes the costs did not outweigh the benefit or improvement, and sometimes it was because that was the state the owner felt it should be in and had been in in the past. Traces can cue associations to the past use of items and to their history. The findings in this chapter indicate that repair can enhance the cuing of memories.

This chapter is partly based on:

Zijlema, A., Van den Hoven, E. & Eggen, B. 2017, 'Preserving objects, preserving memories: Repair professionals and object owners on the relation between traces on personal possessions and memories', *Proceedings of the Product Lifetimes And The Environment Conference (PLATE 2017)*, pp. 453-7.

6.1 Introduction

The characteristics of an item play a role in cuing memories. For example, in Chapter 3 we described an item-owner relationship called the companion, in which the item carries marks and material traces that relate to past events. In Chapter 4 we saw that different types of cued responses were found with different item characteristics; for example, the items that cued 'reflection' responses were often visual and were sometimes composites of multiple memory cues. In Chapter 5 we described how perceiving different details or aspects of an item could cue different responses. In the current chapter we investigate this topic further by focusing on a specific type of item characteristics, the material traces of ageing and use. We present findings of a study that focused on the relationship between material traces on personal (physical) items that had undergone repair and memories. An understanding of the role of material traces of ageing and use will contribute to our knowledge of how cuing memories by personal items can be facilitated through those items' material properties. We often use the term 'object' in this chapter, to refer to a personal item in physical form, and not any digital personal items, such as digital photos.

Several studies have indicated that a major reason for attachment to objects that have been owned for a long time is the memories they evoke (Niinimäki & Armstrong 2013; Page 2014; Schifferstein & Zwartkruis-Pelgrim 2008). In contrast, these studies suggest that most prominent factors in attachment to newer objects is the enjoyment and pleasure they give. Schifferstein & Zwartkruis-Pelgrim (2008, p. 8) recommended that designers 'facilitate the formation of associations between products and people, places or events (memories)'. They proposed that designers could use material that allow graceful ageing, or accrue other physical signs associated to past events, to facilitate the connection of memories to personal items. This may not only enhance the product aesthetically but also its ability to cue memories. Page (2014) found that '[p]roducts that had aged with dignity, showing the general wear and tear of use were often connected with fond stories and experiences'. These findings indicate that traces and ageing can facilitate the ability of an object to serve as a memory cue.

Personal possessions can go through many material changes over time, such as ageing, breakage, usage and maintenance. During their lifetime possessions often collect marks and traces or have undergone modifications and these references to times past are known to increase owners' attachment to them (Belk, Wallendorf & Sherry 1989; Kopytoff 1986).

Not every trace of ageing and use is valued and the materials from which objects are made can play an important role in how ageing manifests itself. Rognoli & Karana (2013) make a distinction between degrading and maturing of materials. Natural materials such as wood and leather may improve over time and are often perceived as 'maturing'. Designers have sought to apply ageing, traces and patina to their products. However, most often ageing

devalues objects (Chapman 2015) and deliberately influencing the ageing of objects to increase attachment has little to no guarantee of being successful. As Chapman noted, 'If the presence of patina draws too much attention to itself, consumers will perceive the resulting experience as pre-programmed and inauthentic, ramming a colossal wedge between subject and object' (Chapman 2015). Besides the appearance, it is suggested that utility, enjoyment and memories play a role in attachment (Mugge, Schifferstein & Schoormans 2010; Mugge, Schifferstein & Schoormans 2008; Schifferstein & Zwartkruis-Pelgrim 2008; Wallendorf & Arnould 1988).

The people who deal with material traces on personal items on a daily basis, masking them as well as protecting them, are repair professionals. This group includes renovators, restorers, conservators and repairers of personal items, such as furniture, ceramics, and art work. Practices differ among these professions as well as by discipline and individual. For example, restorers often use the same material available when the original item was made (e.g. using the glue available at the time of the making of the item) and intend to return the item to its original state (Bjorneberg 2016). However, in the 18th and 19th century, this principle of returning an item to its original state as much as possible was often not lived by, and some paintings underwent radical transformations to contemporary style based on the preference of the owner (Hoeniger 2009). Nowadays, professionals may have different stances and opinions towards repair and traces, based on their training and practice methods, and the particular profession they practice. The type of repair the professional identifies with, be it renovation, restoration or conservation, may predict their general perspective towards repair. A renovator will try to 'make an object look like new' (Bjorneberg 2016, para. 2), a restorer will try to bring the object back to its appearance in a previous period (Bjorneberg 2016), and a conservator will try to keep the original material as unaltered as possible, try not to make any changes that are irreversible and protect the object from 'climate and chemical deterioration' (Bjorneberg 2016; The Australian Institute for the Conservation of Cultural Material, para. 1). In this chapter, we refer to 'repair professionals' as a whole group, regardless of the particular repair tendencies they may have.

This chapter presents the findings of a study that focused on the relationship between material traces on personal (physical) items and memories. Earlier research indicated that traces and ageing play a role in remembering. By investigating object characteristics such as traces, we intended to increase our understanding of cued remembering by traces. Our assumption, which was based on existing research and our studies presented earlier in this thesis, was that there is a link between traces and memories. However, we preferred to keep open the option that this was not the case for the study participants, and studied the meaning, which may include memories, of the object. The research focused on the following research questions:

- What do objects mean to the owners and why was it decided to repair/restore/renovate?
- What properties of the object contribute to the meaning of the object?
- What role do material traces of ageing and use play in the meaning to the owner, and how do repair professionals deal with traces of ageing and use?

Before looking into this research, we discuss existing research on repair.

6.2 Literature on repair of personal possessions

Since this study focused on repaired objects, we undertook a review of the small body of literature that exists on the topic of repair, often aimed at improving sustainability and with a particular interest in repair of electronic appliances. The literature is discussed below in the sections ‘Repair communities’, ‘Repair attitudes and behaviour of owners' and ‘Repair of non-electronics’.

6.2.1 Repair communities

Dant (2010) argues that in the 20th century, companies designed objects to be thrown away, and not repaired or they discouraged repair. This was to encourage the customer to buy a new product of the same brand. To reduce the need for resources and energy, the 21st century is shifting towards repair and recycling. In recent years, repair communities such as repair cafes, fixer collectives and makerspaces have arisen in many Western countries, and several researchers have focused on the collaboration and repair activities in these venues (Houston et al. 2016; Kannengießer 2017; Rosner & Ames 2014; Rosner & Turner 2015). Here, people who wish to repair their objects and those with the requisite knowledge and willingness to help voluntarily meet. Other ethnographic studies focused on repair and maintenance practices in rural areas in Africa (Houston et al. 2016; Jackson, Pompe & Krieshok 2011; Rosner & Ames 2014), where replacement of electronics and other products is not as self-evident as in Western countries.

6.2.2 Repair attitudes and behaviour of owners

Most research into repair has studied electronic objects (e.g. computers, vacuum cleaners and kitchen appliances). According to a recent study conducted in Spain, 9.6% of the surveyed consumers repaired their electronic household items, especially vacuum cleaners, toasters, and juicers (Bovea, Pérez-Belis & Quemades-Beltrán 2017). The research, which surveyed consumers, repair centres, and second-hand shops, found three main reasons why people did not have their electronic objects repaired. The most common reason among

consumers and repair centres was that people did not find it worthwhile to have the item repaired, considering the price of a new one, which was sometimes less than the cost of repair. Other reasons cited by consumers were not knowing 'where to take them to be repaired' or that taking the item to a place where it could be repaired was inconvenient (Bovea, Pérez-Belis & Quemades-Beltrán 2017, p. 96).

Other research that looked into the factors that played a role in repair behaviour found that people who saw 'the value and potential in material possessions' (stewardship), and were able to find 'new and different uses for existing products' (innovativeness) were more likely to repair their items (Scott & Weaver 2015, p. 25). This survey was undertaken via the crowdsourcing website MTurk (with participants whom the researchers labelled as having an average propensity to have items repaired) and the self-repair site IFixit (whom the researchers labelled as having a high propensity to have items repaired), the latter of which offers free repair guides and spare parts for sale. They found that for people with an average propensity (MTurk users), the replacement costs of the item and the initial items costs were the major motivations for repair. For people with a high propensity (IFixit users), attachment to the item was the main motivation for repair. Research also showed that repairability and understandable and accessible repair information positively correlated with a future purchase of the same brand and likelihood of recommendation to others (Sabbaghi et al. 2016). This was found after the researchers surveyed 8403 consumers of IFixit on the impact of their product repair experiences.

6.2.3 Repair of non-electronics

Two studies focused on the repair of non-electronics, both using an ethnography-oriented research method. During a fieldwork study by Rosner & Taylor (2011) of seven bookbinding workshops (in which the first author participated) and 13 interviews with stakeholders (five professional binders, five hobbyist binders and three customers), the researcher observed that restorers balanced two goals: 'preserving uniqueness' (the qualities that made the item a sentimental object) and 'increasing longevity'. Individual pages and hand prints on the cover of a book, for example, could trigger memories. Mottled pages in a music book showed which pieces had been practiced a lot. These material traces on the books, including the bookbinding repair itself, represented a personal history of the owner with the item. The balance between preserving uniqueness and increasing longevity was a negotiation between customer and bookbinder.

Observations of another ethnographic study indicated that repair and maintenance activities can rekindle the owner's relationship with an item (Gregson, Metcalfe & Crewe 2009). The researchers, who studied three object stories (a dining room table, a tv/video cabinet and a cream leather three-piece suite) in the north east of England, identified two different types of repair. These were a craft type of repair (restoring and preserving) and a 'quick fix' using

additional products such as glue or fillers. The latter often devalued the object in the eyes of the owner. The researchers found that people had different competencies regarding maintenance and this had consequences for how an item was maintained and replaced (e.g. the next item should be a black one so that it shows less dirt). Following these findings, they argued that failure in maintenance practices led to more consumption.

6.3 Study on the meaning of traces on repaired possessions

In the previous sections, we learned that prior research found that material traces can increase attachment and may act as a cue to past experiences. Research also suggested that repair can have a positive effect on an owner's relationship with a personal item. Overall, however, existing research on objects of sentimental value and the meaning of material traces was scarce. In the following sections, we discuss the design of the study we conducted among repair professionals and owners of repaired objects into the meaning of material traces. We explain the study method, describe our participant sample and how they were recruited, the analysis method and the procedure and data collection.

6.3.1 Method

For the current study, we approached repair professionals, as we assumed they were experts on the topic of traces of use and ageing. We also interviewed owners of repaired or repurposed objects with traces of ageing and use. Repurposed objects are objects that are remade into a new functional or decorative object while still retaining the material and characteristics of the old object, for example, a front door turned into a table surface or broken porcelain into a decorative mosaic. As with repaired objects, owners of repurposed objects had to make decisions on what characteristics and traces should be preserved; they were therefore included in the target recruitment group.

The research commenced after ethics approval from the university had been obtained, and a pilot study with a repair professional (furniture maker) had been conducted. We interviewed five professionals who worked in the field of repair, restoration, renovation, or conservation, and five owners of a repaired or repurposed possession (who did not work in this field). The owners were not necessarily customers of any of the professionals interviewed; in fact, only one object owner was recruited via a participating professional. The professions included in this study were a furniture maker, a clock maker, a doll and bear repairer, a silver, gold and metalware restorer, and a ceramics restorer.

The interview method used is known as ‘contextual inquiry’, which combines elements of ethnographic field research and participatory design (Holtzblatt & Jones 1993; Raven & Flanders 1996). Interviewing the participants in their workplace allowed them to illustrate what they said with the materials and objects they worked with. The professionals were asked to share their knowledge and experience based on the many repaired pieces they had seen, and were encouraged to provide specific examples. In the interviews with the item owners, one or two objects chosen by the owners were discussed in depth. The interviews were semi-structured, and sometimes adjusted to the type of object or participant. An outline of the questions can be found in Appendix 5.

6.3.2 Participants and recruitment

The five repair professionals we interviewed worked in Sydney, Australia, and had long-standing experience in their profession of at least 25 years. Their age ranged from 43 to 69 (average 58); four were male and one was female. The object owners also lived in Sydney, were aged between 41 and 62 (average 52), and three were female and two male. One object owner worked as a pastry chef, and four object owners worked in higher education as lecturers and research managers. Two object owners each discussed two objects, thus seven objects in total were discussed.

The recruitment of the professionals took place mostly through direct invitation via email and sometimes via phone contact. The owners of the repaired objects were recruited via posters and flyers at community boards, via the intranet noticeboard of the university and one via a repair professional. People who had repaired or repurposed objects themselves could also participate. The main criteria were that the object had traces of ageing and use and was repaired or repurposed.

In this chapter, we always refer to the participants who had their objects repaired as ‘object owners’, even though not all participants were official owners of the object at the time the interview. One object (a chest of drawers) was given to the interviewee’s mother after restoration, and another set of objects (a baby cot and changing table) was given to the interviewee’s daughter for use. The interviews took place between August 2016 and February 2017.

6.3.3 Procedure and data collection

The interviews with repair professionals took on average approximately one hour, varying from 22 to 98 minutes (excluding the introduction to the study, signing the consent forms and closure). During the interview photos were taken of objects that were pointed out or shown as examples while questions were being answered. In one case, the repair

professional was limited in time and the interview was therefore adapted accordingly. This meant that only a selection of the prepared questions, covering as much of the main topics as possible, was used. After that interview, a colleague of the professional guided the interviewer through the workplace and explained their practices further; this was not recorded with a digital voice recorder. All interviews took place on a weekday during opening hours, and brief interruptions by phone calls, visiting customers or colleagues were common.

The interview questions for the repair professionals covered topics such as the objects and the reparations or restorations they carried out, the meaning of the objects, and the role of traces of ageing and use. Table 6.1 presents which objects the professionals covered and the types of traces of ageing and use that these objects exposed, as reported by the participants.

Table 6.1. Professions of the participating repair professionals and their objects and traces.

Participant #	Profession	Objects	Examples of traces
RP1	Clockmaker	Clocks, watches, and music boxes (all pre-1960s)	Damage to the surface (lacquer, paint) and mechanical wear
RP2	Furniture restorer	Wooden furniture, sometimes statues	Broken parts, stained or damaged surfaces, moving parts that do not function well (e.g. hinges of drawers or doors, parts that can open and close)
RP4	Doll and bear repairer	Dolls, (teddy) bears, prams, wheel toys and other toys	Paint, breakages, missing pieces (e.g. eyes, hair or body parts), missing filling and fabric
RP7	Metalware renovator	Silver and gold ware, copper and brass, cutlery, candlesticks, trophies, ornaments, religious objects	Patina, metal fatigue, breakages, cracking and splitting, surface wear and tear, damage from over-cleaning, tarnishing
RP9	Ceramic restorer	Ceramic or porcelain objects such as ornaments, statues, china, lamps, vases, figurines, plates, cups, religious objects	Breakages, cracks, chips, missing pieces, stains (e.g. from food or rust), earlier repairs (glue, staples)

The owners of the repaired possessions were interviewed either at the professional's workplace (1x), in a meeting room at the university (3x) or over the phone (1x). These interviews averaged 37 minutes, varying between 32 and 46 minutes, and were recorded with a digital voice recorder. The participants were asked to bring or email photos of the object(s) for use during the interview, to clarify or illustrate their answers. The collection of objects in this study include a cabinet, a chest of drawers, an antique desk, a baby cot and changing table, a porcelain bowl, a porcelain doll and a necklace (see Table 6.2). Two objects (from P5a and P10) were self-repaired or repurposed.

The questions asked to object owners covered topics about the history of the object, their meaningful properties for the owners, the traces of ageing and use on the object and the repair, and the meaning and memories the object evoked. The object owners were asked to send or bring a photo of the object to the interview if possible. In one case, where the interviewer met the object owner at the repair professional's workshop, the interview was carried out without a photo of the object. This interview involved fewer questions on the material properties of the object, because the interview was held in the workplace and therefore we kept it as short as possible. All interviews were conducted in English.

Table 6.2. Repaired objects from the participating object owners.

Participant #	Object	Who repaired	Reason for repair	Current traces on the object
P3	Chest of drawers	A befriended furniture maker	Deteriorated, looked old and worn	Mark on the top where grandmother used to put the vase with flowers, shiny handles that did not belong to it, but were put on because grandmother liked them shiny (the original handles were of wood)
P5a	Porcelain bowl	Self-repaired by participant	Broken when the cat jumped on it	Crack from breakage, crazing of the porcelain
P5b	Antique desk	Furniture maker	Joints became wobbly and it eventually fell apart	Ink stains, scratches, wear of the wood
P6	Cabinet	Furniture maker	Surface was scratched and looked worn	Veneer repair where colour did not match, parts of the brand label sanded away during repair, wear inside the drawers
P8a	Necklace	Jewellery maker who sent it to specialist	String with beads broke (does not remember what happened)	Stiff compared to before repair, some scratches and perhaps a dent, little piece of string sticking out, it caught when you tried to slide it
P8b	Porcelain doll	Conservator	Maintenance to preserve it and display it at home	Missing foot of doll, discolouration of the dress (yellowing), tiny holes in the fabric of the shawl
P10	Baby cot and changing table made from parents' chair	Handmade by participant for grandchildren	Chair disassembled after clearing parental home and pieces of wood repurposed for when first grandchild was born	Chips off the wood

6.3.4 Analysis and results

The interviews were transcribed and the data was analysed qualitatively using open coding, following the bottom-up coding approach from thematic analysis (Braun & Clarke 2006, 2012). The interviews with the repair professionals were coded separately from those of the object owners to allow for different perspectives to emerge, as these groups had different relationships with the objects. The initial coding first took place by hand, after which three main themes were selected for more in-depth coding with the data analysis software NVivo (QSR International Pty Ltd 2012). The topics that were selected for the more in-depth coding for both the repair professionals and the object owners were the motivations for repair and the meaning for object owners, the item properties and alterations, and the role of traces and ageing. These topics were chosen because they were deemed relevant to our research questions. We then went through all the transcripts and selected the excerpts relevant to these themes. The coding process was inductive (bottom-up). The following example (Figure 6.1) shows how a piece of text was coded in NVivo:

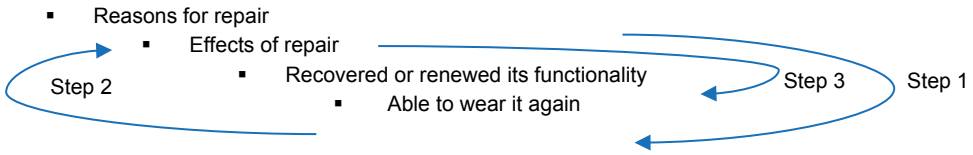


Figure 6.1. Example of coding.

The interview excerpt coded was from the transcript of one of the object owners. After coding by hand, it was decided that the 'reasons for repair' (under the broader topic 'role of traces and ageing') was a topic to look into. The transcripts were read for pieces that revealed information on this topic and the interview excerpts selected were then coded bottom-up. In this case, an excerpt of three sentences was coded as 'able to wear it again' (Step 1). This was categorised under the heading 'effects of repair' (Step 2). When all the interviews were coded for this topic, the 'effects of repair' category was reviewed again. The initial codes in step 1 were grouped in three different sub-themes under 'effects of repair', one of them being 'recovered or renewed its functionality' (Step 3). Together with four other initial codes from the interviews, the code 'able to wear it again' was categorised under this sub-theme. A similar process of coding, categorising, renaming and sometimes merging themes took place for all other interview excerpts.

Table 6.3. Summary of findings.

	Repair professionals	Object owners
	Motivations for repair and meaning of the objects to owners	
Motivations for repair	• The state of the object *(5x: RP1, RP2, RP4, RP7, RP9)* • Passing on ownership *(3x: RP2, RP7, RP9)*	• The state of the object *(6x: P3, P5a, P5b, P6, P8a, P10)* • Knowing someone who could repair *(2x: P3, P6)* • Desire to display and maintain the object *(2x: P8b, P10)*
Meaning of the objects	• Sentimental value (including memories) *(4x: RP1, RP2, RP4, RP9)* • Appreciation for the object itself *(3x: RP1, RP2, RP9)* • Monetary value and status *(1x: RP2)*	• Memories *(6x: P3, P5b, P6, P8a, P8b, P10)* • Appreciation for the aesthetics and history of the object *(5x: P5a, P5b, P6, P8a, P8b)*
Future of the objects		• Uncertain or negative prospective *(3x: P3, P5a, P5b)* • Pass on *(3x: P8a, P8b, P10)* • Care for it by themselves *(2x: P6, P8a)*
	Item properties and alterations	
Properties contributing to meaning		• Aesthetics and material qualities (*6x: P5a, P5b, P6, P8a, P8b, P10*) • Ageing and preciousness (*4x: P5a, P5b, P8a, P8b*) • Craft and care (*4x: P3, P5a, P5b, P10*) • Connection to other objects and people (*3x: P5a, P8a, P8b*)
Acceptable changes to the object	• Restore the shape *(2x: RP2, RP7)* • Change colour *(2x: RP2, RP9)* • Repurpose *(1x: RP2)*	
Effects of repair		• Additional or stronger meaning (*6x: P3, P5a, P5b, P6, P8b, P10*) • Recovered or renewed its functionality (*3x: P3, P8a, P10*) • Lost qualities (*2x: P6, P8a*)
	Role of traces and ageing	
Reasons for not repairing traces	• Reminder of the past (*4x: RP2, RP4, RP7, RP9*) • Improvements do not outweigh costs or effort *(4x: RP1, RP2,*	• Improvements do not outweigh costs or effort (*4x: P3, P5b, P6, P8b*) • Ageing or damage is aesthetically appreciated (*3x: P5b, P6, P10*)

	RP4, RP9) • Ageing or damage is aesthetically appreciated *(2x: RP7, RP9)*	• It is how the object is remembered (*2x: P3, P8b*)
Role of traces		• Memories of personal use or family (*2x: P3, P10*) • Objects history aside from owner's history (*2x: P5a, P5b*) • Annoying (*2x: P8a, P8b*) • Reference to values of self-realisation (*1x: P6*)

During the bottom-up coding process, a few topics specific to either repair professionals or object owners, but not both, were also coded, when they seemed to be relevant to this research. In the same process as provided in the example above, the initial codes were clustered and merged under themes. The photos that were taken were not coded but consulted to help understand the transcripts. The results of the coding can be found in Table 6.3. This analysis is at the basis of the findings presented in Section 6.4. Quotes from the coded excerpts were selected to illustrate and explain the findings.

6.4 Findings: meaning of traces and use for remembering

In the following sections we discuss the meaning of the objects for the owners and the reasons for repair, the properties contributing to the meaning and the role of traces and ageing in the object. For each of these topics we present the findings from the perspective of both the owners and the professionals.

6.4.1 Types of traces

The object owners reported a variety of traces that were present on their items after repair (see Table 6.4). The majority were traces of use and of ageing. An interesting category of traces we observed were traces caused by the repair itself, as in the case of a repaired cabinet, the new veneer of which did not always match the rest of the wood and the original label of the cabinet had been partly sanded away (see Figure 6.2):

'You can actually see, he, in most cases he added the new veneer really really well. There is one whole section where actually the colour of the wood doesn't really match. […] he said he was really sorry that he did […], he accidentally sanded a little bit of the label. You can see kind of where he tried to sand around it, and slightly missed it.' [P6]

Figure 6.2. Label of the cabinet partly sanded away by the repair professional

Other instances of traces caused by the repair were when the repair or restoration did not come out as desired, for example, a doll's dress that remained yellower than the previous time when the owner washed the doll's dress herself. Less frequently there were traces of accidents (two times, e.g. breakage) and traces of intentional alterations (e.g. one instance of handles being replaced for aesthetic reasons).

Table 6.4. Types of traces after repair of the seven objects in this study.

Traces of use (6x)	Traces of ageing (4x)	Traces of repair (3x)	Traces of accidents (2x)	Intentional alteration (1x)
• Mark on the top of a chest where grandmother used to put the vase with flowers • Wear inside the drawers • Scratches/dents on the wood • Chips off the wood • Ink stains on desktop • Scratches on desktop	• Crazing of the porcelain • Discolouration/ yellowing of the dress • Tiny holes in the fabric of the shawl • Wear of the wood	• Veneer repair where colour does not match • Parts of the brand label sanded away during repair • Stiff compared to before repair	• Crack of porcelain from breakage • Missing foot of doll (unclear where it is now)	• Shiny handles that did not belong on the chest, but were put on because grandmother liked them shiny (the original handles were made of wood)

6.4.2 Motivations for repair and meaning of the objects

In this section, we present our findings on the motivations for repair, what the objects meant to the owners and what they thought would happen in the future. The motivations for repair and the future prospects of the items tell us more about what prompted the repair and

at what point in time. The meaning of the object tells us more about the cued responses of the repaired objects.

6.4.2.1 Motivations for repair

The professionals mentioned two categories of motivation for bringing an item for repair: one related to 'the state of the object' and the other related to 'passing on ownership'. The object owners mentioned three different motivations, 'the state of the object', 'knowing someone who could repair it' and 'a desire to display and maintain the object'.

The motivation to repair the object mentioned by both the repair professionals and object owners was the state of the object, such as breakage or objects that were not functioning, such as a clock that had stopped working or a necklace that had broken and could no longer be worn. Another reason was that the object had aesthetically deteriorated, for example, if the object's surface was damaged, or *'because the lustre of it is gone'* [P2]. Sometimes the object still looked good but was brought in for maintenance.

Repair professionals also mentioned that intentions to 'pass on ownership' prompted the owner to have the object repaired. This 'passing on' could be to a person with whom the owner had a close relationship, such as when a grown up child moved out of the house. It was also mentioned that owners restored objects that they wanted to sell, a 'passing on' that was in fact disposing of the object.

Knowing somebody in their personal circle who could do the repair was a motivation solely for owners to have an object repaired. Talking to the repair professional reminded them that they themselves had an object that needed repair or restoration. For example, one of the object owners met a repair professional through a date, another had a friend who was a repair professional. The importance of the trust relationship was also expressed by the worry that owners said they felt during the repair process (would it come back?).

The last reason, a 'desire to display or maintain the object', came from owners who had objects that were stored away and needed repurposing, for example, turning loose pieces of wood from an old chair into baby furniture, or getting a display box for a porcelain doll to make sure it could be displayed safely.

The reason mentioned by professionals to 'pass on' an object to a new owner did not appear explicitly as a reason in the conversations among the sample of object owners, although one of the owners had repurposed his parents' chair as baby furniture as a gift to his daughter. This turned out to be a set of objects that would probably become heirlooms in the future.

6.4.2.2 Meaning of the objects

The meanings of the items coded from the interviews of the repair professionals were categorised in three sub-themes: 'sentimental value (including memories)', 'appreciation for the object itself' and 'monetary value of the object for status'. The meanings of items found among the object owners overlapped with what the professionals mentioned. Two sub-themes came forth, namely, 'memories' and 'aesthetics and history'.

The professionals said that the meaning of an object related in most cases to its sentimental value to the owner, including the memories attached. They cited several examples of objects relating to certain periods in their owners' lifetime, such as a figurine that related to a dancing career, furniture used when the owner was a university student, or objects made or given by loved ones or acquired as an heirloom. These examples of memories, mentioned by the repair professionals, covered a longer period of time or marked a new period (e.g. they (the customer) bought it after getting married). Other reasons that were mentioned were the 'appreciation for the object itself', such as loving the object aesthetically or collecting a certain style or type of items, and the 'monetary value', as with antiques.

From the owners' perspective, the meaning of the objects was a mixture of associations with memories and with the object's aesthetics and history. Similar to what the professionals said, the objects had sentimental value and had memories attached. Several objects reminded their owners of how it was used (if it was a use object) or how they took care of it (e.g. polishing handles on a chest of drawers at their grandparents' house). Other times it reminded them of a person, of an emotional state such as 'personal independence' and 'moving forward', or because it was bought with their current partner during their honeymoon. Although almost everybody said that the objects were associated with memories, it was also mentioned that the memories were not vivid, and were often of repeated events. Some associations were closely related to the repair or the reason for repair. A memory of how the object was broken (when a cat jumped on the porcelain bowl) or an association to how the item was better before it broke (a necklace) or looked better now.

Independent of the repair, owners mentioned associations with what the objects evoked aesthetically, such as their style or period, associations with the history of the object or its imagined use in the past and in what context.

6.4.2.3 Future of the objects

We asked the object owners what they thought would happen to the objects in the future. Most answers related to the object's prospects when they, as owner or carer of the object, would not be there anymore, suggesting that they wanted to keep the object for as long as

possible. In half of the cases, the object owners were pessimistic about the object's prospects: the object might end up in the Salvation Army (Salvos) shop or be thrown away, as other family members did not value the object as much as they did themselves.

> *'My daughter will probably give them all to Salvos... […] Salvos will probably throw it away. […]She [participant's daughter] is more into minimalism, and you know, that Japanese, throwing away the things not giving you joy. So, I don't know. […] And this one, because it is broken, it might be thrown away.' [P5a]*

In the other cases, the owners expected a family member would be interested in it and it would be passed on. Also, 'near future' expectations were mentioned, such as intending to match other furniture with the repaired cabinet, or getting the necklace repaired again because of dissatisfaction with the last repair.

6.4.3 Item properties and alterations

In the previous section, we presented what meaning, according to the repair professionals and the owners, the objects had. In the next sections we present our findings about the properties that contributed to the meaning, based on what the object owners told us and on the material properties the repair professionals found acceptable to alter when they carried out repairs.

6.4.3.1 Properties contributing to meaning according to object owners

When asked about the properties contributing to meaning, the object owners' answers fitted in four subthemes: 'aesthetics and material qualities', 'ageing', 'craft and care' and 'connection to other objects and people'.

Many object owners said that the aesthetics and material qualities contributed to the meaning of objects for them. If asked what in the object cued the associations they mentioned, they listed such aspects as the general look of it, the prettiness, the painted image, the fineness in the making, its natural look, the varnish, the material it was made of, or the carvings in the wood. Mostly these were visual qualities, although in one case the tactile qualities of a necklace made of jet, a black lightweight gemstone, were also explicitly mentioned.

The ageing of the item contributed to its meaning, including its 'preciousness', such as the fact that it was old and had survived over time, that it had a history and that it was unique. The owners also mentioned another aspect: the craft and care that had gone into creating the object. Part of this aspect was visible; part of this was also the 'knowing it'. For example, participants valued the craftsmanship of the maker, the fact that other people had taken care

of it, or that they had put energy into the object, having made it themselves or polished it as a child.

In a few cases, participants also mentioned that the item was connected to other objects and people, which contributed additionally to its meaning. This aspect of value derived for example from the object being part of a small selection of items that had originally come on a sailing ship when the participant's grandparents migrated from the UK to New Zealand, or from being part of a collection of other porcelain objects of the same brand, or simply the fact that the item (a necklace) went well with her black clothes.

6.4.3.2 Changing material properties by professionals

The repair professionals mentioned that what was done and what was altered was the result of negotiation with the customer. Most repair professionals said that they preferred to alter as little as possible, and sometimes experienced discrepancies between what they believed was best and what the customer wanted. For example:

> *'I don't always agree with what people want done. […]When you work with craftsmanship, and want to preserve it, and keep it as is, where a person might want a detail removed from that. […] People can really not care, like having this 17th century piece of silver, asking for it to be gold plated, while it has never been gold plated. It is just wrong.' [RP7]*

We asked what repair professionals found acceptable, and the scope of what they considered acceptable to change or repair varied among them. They said they would restore or protect the shape of an object, such as adding missing pieces to a piece of furniture to restore the lines and in rare cases even make exceptions to regular conventions in the discipline (such as not putting lead onto silver) to repair and keep the shape of a piece of silverware. Changing the colour of a surface (other than cleaning and polishing) was common for the furniture repair professional − often the customer wanted the surface of the wood in a natural finish, even though the current piece was painted in a different colour or stained. The look of furniture often changed over time due to contemporary fashions and owners' preferences. Sometimes the furniture maker repurposed an item into a new functional object, an example being an old sheep shearing table for wool grading, which had been in the family for a long time. As the current owners did not have a farm, the furniture maker transformed the shearing table into a dining table (a glass plate was put on top of the wooden beams, and new wood pieces were added where they were previously missing). For the other professions, radical changes were less common. The porcelain repair professional very rarely changed the colour (but it did happen) and for the clock maker it was important that the item kept its integrity, and the aesthetic preferences of the customer were less at play.

> *'The nature of what you restore and how you restore, is entirely governed by the piece itself.' [RP1]*

Earlier in the conversation he explained:

> *'If people rather not restore it holistically, we rather not do it.' [RP1].*

For this repair professional the perspective of the object, rather than the owners' preferences, dictated how it was repaired. However, all professionals said that after they had provided expert advice and listed the options for repair, the customer was the person who decided in the end what happened. The properties of the objects that were saved, restored and altered were thus the result of negotiating the customers' wishes, the ethics and conventions of the individual repair professional and his or her discipline.

6.4.3.3 Effects of repair on the meaning of the object

We asked object owners if the meaning of the objects changed after repair. Interestingly, all but one object (the necklace) gained additional or stronger meaning after the repair. The aesthetic improvements made by the professional gave stronger associations to its style, or a higher appreciation of the object. For example, an antique desk (see Figure 6.3) gained historical meaning because the participant learnt about the history of the item. The participant explained:

> *'I didn't realise quite what the desk would have been used for. And now I see it, you know, as a money desk, […] it has given me a little window into history that I didn't have.' [P5b]*

Figure 6.3. Owner learnt that the compartments in the antique desk were used to store money.

Besides the personal meaning, participants also mentioned the item regained its functionality (adding meaning), including preserving it for the future and being able to use the object again. In a few cases, the repair also caused the loss of some qualities it had had before. For example, the repair of the necklace caused a stiffness it did not have before the breakage.

6.4.4 Role of material traces and ageing

We explored what the material traces on objects meant to owners. We first present our findings on the reasons for not repairing or removing material traces. We then discuss the role of the traces according to repair professionals and object owners.

6.4.4.1 Not repairing material traces

There was an overlap among the reasons that repair professionals and object owners listed for deciding not to repair traces of ageing and use. Repair professionals mentioned 'reminder of the past', 'improvements do not outweigh costs or efforts' and 'ageing or damage is aesthetically appreciated' as reasons for not repairing or removing material traces. Object owners similarly said 'improvements do not outweigh costs or effort', 'ageing or damage is aesthetically appreciated' and 'it is how the object is remembered'.

When repair professionals and object owners mentioned that repair did not outweigh costs or effort, they explained situations where it was very difficult or costly to repair, or when the damage could easily be hidden. Both groups also said that traces of ageing and use were aesthetically appreciated. Repair professionals said that most owners did not want their object to look like new and traces or damage were usually appreciated when they did not stand out. Traces show the age of the piece and make it more original. An example given by the ceramic restorer was that in the old days, people mended their porcelain with staples. Depending on the preference of the owner, these staples are sometimes kept, rather than taken out and the holes and breakage repaired.

The professionals also said that besides the appreciation of ageing, traces were kept because they reminded the owner of their past. During the interviews, professionals mentioned many examples where traces acted as a reminder of the past and were a reason for keeping the traces; they often related to events or activities that had caused the traces and the person involved. Examples included a grandmother who caused a burn mark on the table with a hot iron, a layer of scale in a kettle due to the use of clay water from the area where the family lived, or a children's Beatrix Potter bowl where the rubbing of the surface was a reminder of its use when the children were little.

An interesting reason for not repairing the traces mentioned by some object owners was that the damage or traces had always been there and it was how they remembered the item. Regarding the porcelain doll with the missing foot (see Figure 6.4), the owner said that among other reasons for not repairing it, she had never known the object with both feet and thus did not need to have the missing foot replaced. For the owner:

Figure 6.4. Porcelain doll with a missing foot.

> *'[…] it has never had it like that' [P8b].*

Another participant explained that his grandfather had removed the original handles on a chest of drawers, because his grandmother liked shiny things.

> *'My grandfather put them on. I just remember I was polishing them. […] I wouldn't change it for the world.' [P3]*

Although not originally part of the object, the handles were kept because they related to his childhood memories of polishing the handles on Sunday mornings.

6.4.4.2 Role of material traces

We categorised the roles the material traces played for the object owners according to four sub-themes: 'memories of personal use or family', 'object's history aside from owner's history', 'annoying' and 'reference to values of self-realisation'.

For some object owners, the still visible traces (after repair) played a role in their remembering how they or their family members had used the object. Examples include the mark on the surface of a chest of drawers where grandmother put the vase with flowers and the scratches on the wood where the participant and his siblings, contrary to the wishes of their parents, would sit with their shoes with buckles when they were little. In one case the traces symbolised the participant's independence, as the object itself and the traces referred to life events that marked autonomy, such as moving house and the end of a relationship. Traces also referred to the object's past with which the owner was not involved. Such traces evoked awareness of the long life of the object, that it had been part of other people's lives (and been cared for) and its purpose in the past. In only one instance did the traces have a negative connotation: the scratches and changes on a necklace were simply 'annoying'. Although the owner would never swap the necklace for a new one, the scratches did not fit the piece and the participant tried to prevent it from getting more scratches.

6.5 Discussion

We have explored the area of material traces of ageing and use on cherished and repaired objects, to learn more about the role of material traces in cued remembering. Based on a small sample of repair professionals and object owners, we looked at the meaning of objects and traces and the effects of traces and repair. In the sections below we reflect on the motivation to preserve the object, the memories triggered by the object and by the material traces, the 'pastness' evoked by the ageing and evidence of craft and care on the object, and on preserving material traces and the effects of repair.

6.5.1 Motivation to preserve an object

Our research found that the state of the object, such as breakage and deterioration, was the main reason for repair. However, encounters and events also triggered the decision to repair, such as passing on the object (sometimes to sell), knowing someone who could repair it and the desire to display and maintain the object. These motivations differ from the motivations found by Scott & Weaver (2015), who found that replacement costs, initial item costs and attachment to the item were the main motivations. In Scott's (2015) research, the motivations apply to electronic items that were repaired by the owners and explain why the object was repaired instead of replaced. The decision to repair in our study was made because the owners loved the object and they considered it in some way unique, rather than repairing and keeping it for its functionality.

Other observations in our study indicated that this participant group would go further to save their object than participants from other studies would go with electronic objects. For example, one of the object owners repurposed his parents' chair into new objects for his grandchildren, because the original, large size chair, could not easily be shipped overseas to his home in Australia and would have been an obstacle if put in their house. Instead, pieces of the chair (the wood) were taken as luggage on the owner's return flight and repurposed at home. Another participant said that if she could not have mended the broken porcelain bowl, she would have repurposed the image on the bowl, because it was the painting on the porcelain and the craft involved that she appreciated most and she would have liked to use it in a different way. There may be potential in taking parts of the objects apart and thereby preserving the most appreciated memories.

The strong attachment to an object may also explain why the repair itself was a cause of concern for object owners, even if the object was in pieces at the time. Owners felt worried when the object was away or when it was being repurposed, asking themselves 'Am I going to get it back?', 'Will the object get lost when the jeweller sends it to the professional?' or,

in the case of an object repurposed by the owner himself, ‘Is this going to look nice?’ Having the object under repair caused a bit of anxiety.

6.5.2 Memories related to objects versus memories related to material traces

Our research revealed that the meanings of the objects tended to be broad, in that they reminded the owner of a person, a period or repeated activity, rather than specific events. In Chapter 4, we discussed four different cued responses: ‘no-memory’ responses, ‘knowledge’ responses, ‘reflection’ responses, and ‘episodic memory’ responses. Almost all responses mentioned by the owners and repair professionals can be categorised as ‘knowledge’ responses, and one instance can be labelled as a ‘reflection’ response. Some participants mentioned that what came to mind when seeing the object was not very vivid. In addition, one participant could not remember the details of the moment when the object was acquired, which is in contrast to the findings in Chapter 4 (see Section 4.4.7). We may speculate that the cued responses have these characteristics because the objects are generally older objects, and may therefore refer to memories covering a longer period of time, or multiple memories that have faded or blended over time.

Some of the objects’ main cued responses related to their breakage or repair. This is in line with the findings in Chapter 5, where it was found that one of the reasons for new cued responses were recent events involving the item, such as repair of the object. In cases where the cued response referred to the object’s breakage or repair, the responses were more related to aesthetics (it looked better than before, or its design) and in one case an ‘episodic memory’ response was cued by traces from the breakage of the porcelain bowl when the cat jumped on it. The breakage and/or repair became part of the object’s biography, as a significant event in its lifetime (Kopytoff 1986).

If we look at the responses that the traces cued (as opposed to the object as a whole), they referred more to the use of the object in the past, either for personal memories or imaginative use. The majority of material traces and their meaning mentioned by object owners, as well as the examples given by repair professionals, were reminders of repeated events, such as the mark on the table where grandmother used to put the flowers, which we refer to as ‘knowledge’ responses. However, more than the examples mentioned for the object as a whole, some examples also referred to incidents, such as the burning mark caused by the grandmother leaving a hot iron on the table, which we would categorise as an ‘episodic memory’ response. Some repair professionals also mentioned that damage through ‘misuse’ of the object was often something to be repaired, as people do not want to be reminded of this. Sentiments about these types of traces may differ depending on who

caused the damage. As the furniture restorer explained about the burn mark, it was a reference to the great-grandmother, not to the action itself:

> *'It is the attachment to the person. It's not the fact they did something stupid and burned the table, it is just that she used to iron on the table.' [RP2]*

The association is positive, although the great-grandmother may have thought otherwise and would perhaps have removed the burn mark if she could. Similarly, the object owner who saw how the porcelain bowl flew through the air after her cat jumped on it had no guilt associated with the breakage − it was a comical sight.

6.5.3 'Pastness': ageing, craft and care

Participants mentioned that aesthetics and ageing (mentioned by both repair professionals and object owners), functionality (stated only by repair professionals), the craft and care that had gone into the objects and the connection to other objects or people (stated only by object owners) contributed to the meaning of an object. In addition, material traces sometimes referred to the history of the object before it came into the possession of the current owner. Some participants realised that the object was old (often older than themselves) and acknowledged the energy that had been put in to making and preserving the object (past); in addition, the material traces evoked a preciousness, care and responsibility for the object (present – future). The traces that evoked associations to the object's past were not necessarily personal memories. Some cued responses were imagined, for example, how it may have been used by previous owners and the role it had played in society or by ancestors. Sometimes the traces evoked personal memories involving the object (e.g. 'how I used to polish the copper handles when visiting my grandparents'). These material traces can be seen as cuing 'pastness', irrespective of whether the owner was remembering or imagining it.

The characteristics that contributed to meaning show similarities with the theories on product attachment, in which aesthetics and utility (as well as memories) play an important role in the individual relationship between owners and objects (Mugge, Schifferstein & Schoormans 2010; Mugge, Schifferstein & Schoormans 2008; Page 2014). Most of these aspects relate to specific material and aesthetic qualities, such as ageing, craft and care. These are aspects that designers can influence and have an impact on the meaning that owners attach to the object.

6.5.4 Preserving material traces and the effects of repair

Several people said that they wanted to preserve certain damage or traces because that was how they remembered the object. Consequently, the porcelain doll did not get a new foot (in the owner's memory, she never had it), and the chest of drawers kept its copper handles, even though they were not an original part of the object. Our findings also showed that the repair professionals were happy to meet the customer's preferences, within the limits of their professional and personal values. These findings are in line with research by Rosner & Taylor (2011), who found that material traces on books could trigger memories and were for that reason preserved by bookbinders, amateur bookbinders, or the owners of the books.

Our study found that in most cases, the objects had a stronger meaning after repair. Gregson, Metcalfe & Crewe (2009), who found similar findings in an ethnographic study, referred to this effect as 'rekindle the object'. 'The object stories show how restorative acts generally rekindle consumer objects' (Gregson, Metcalfe & Crewe 2009, p. 248). A difference between our study and the study by Gregson et al. is that in their study all objects were self-repaired, whereas in our study only two out of seven objects were self-repaired or repurposed. Nevertheless, the same effect, that is, the increase in meaning, was observed.

6.5.5 Limitations

This study explored the role of traces among repair professionals and object owners, carried out with a small sample size. The results do not show a complete picture, and should not be generalised; however, they do provide qualitative insights into what is at play with repair and material traces on objects. The study was carried out with repair professionals and object owners who mostly reflected on older, often antique, objects, which differ from many other memory-objects such as photos and souvenirs (which we investigated in previous chapters), let alone digital objects. The same bias accounts for the participants who volunteered, the object owners in particular; they probably had an above-average appreciation of old objects, since having an object repaired, rather than ignored, disposed or replaced, was a prerequisite to participation in the study. Since this may have caused a greater acceptance and appreciation of material traces in our findings, the study is therefore less indicative of people's general opinion and attitude towards material traces and repair. However, it was valuable for gaining an understanding of the potential effects of material traces and repair on cued remembering.

6.6 Conclusion

The study presented in this chapter set out to investigate the role of traces in remembering. We interviewed two groups of people whom we considered as experts on this topic, five

repair professionals and five object owners who had repaired or repurposed an object that (still) contained material traces. Based on the seven objects we discussed with participants, we could identify five categories of traces: traces of use, traces of ageing, traces of repair, traces of accidents and intentional alterations. The main reason for repairing objects was the state of the object (breakage and deterioration), followed by wanting to pass it on to a new owner, knowing someone in their circle of friends who could repair it, or out of a desire to display and maintain the object.

The findings indicate that while traces may not always cue personal memories, they do cue associations to the past, of the object and the (imagined) history of the object. The traces almost always related to the object's use in the past, whereas the object in general also related to people, life time periods (e.g. a holiday) and repeated activities (e.g. cleaning the object). Besides the memories, the objects also carried meaning because of their associations to their aesthetics or the craft put into them. Objects that did not function, or had damage that was distracting to the owner, may have hampered the cuing of desired associations and memories. Almost all participants mentioned that their objects gained meaning after they had been repaired.

Damage or traces are not always repaired or removed by the repair professional, as people sometimes appreciate the traces from an aesthetical point of view, the traces may serve as a reminder. Alternatively, it may simply be that the improvements do not outweigh the costs. In addition, how an object is remembered by the current owner plays a role; participants often wanted to restore the object to the state in which they remembered it, even if that was not how the object was originally made.

Several properties, such as aesthetics and material qualities, ageing and characteristics of 'preciousness', the evidence of craft and care put into the object, and the object's connection to other objects and people (e.g. a collection), contributed to the object's meaning. These are aspects that may make a difference when preserving or restoring an object. In this research, almost all objects (six out of seven) increased in meaning after repair, brought about by the aesthetic improvements or the additional information about the object provided by the repair professional.

7 DESIGN CONSIDERATIONS FOR CUED REMEMBERING

Abstract

In this chapter, we present design considerations for those who aim to design products and systems for cued autobiographical remembering. Based on the research that is presented in the previous chapters of this thesis, we answer the question, what do the findings imply for designing products that are intended to cue memories? We begin the chapter by placing 'cued remembering by personal items' in the context of the remembering experience. We then discuss 10 considerations, for which we provide arguments from our research, and suggest design choices that can be made to apply those considerations. We present considerations that cover the following three topics: 1) influencing the dynamic nature of cuing, focusing on establishing associations to memories, 2) designing for use and behaviour that facilitate the possibility that the item can cue, and 3) considerations that aid the designer to steer towards the desired cued response. The 10 considerations may guide designs in relation to cued autobiographical remembering.

7.1 Introduction

In this chapter, we translate the knowledge gained from our research on cued remembering and the item-memories relationship to design considerations. These considerations could be applied to increase (or decrease) the ability of a design to cue memories. In the previous chapters, we presented our knowledge about the interplay between possessions, both digital and physical, and our memories. In particular, we gained knowledge about the *individual* item-memories relationship, in contrast to cuing in a social context (e.g., storytelling). In this chapter, we focus on those cuing aspects that can be manipulated through design, such as the behaviour that the item affords, the contextual aspects and the item's physical properties. Different design choices may have different consequences, and by being aware of the potential consequences, the designer can steer towards the desired outcome.

A first point for designers who design for cuing memories is that they can design for two different levels of cuing. One level is designing *containers* for memory cues; these could include digital or physical frames to hold the photos or pictures that act as the memory cues, designing a *device* that can present personally significant audio fragments from the past, or designing systems that can deposit and present memory cues. The other level is designing a *single item* as a memory cue in its own right, for example a souvenir, a decorative object or objects of use. We include design considerations on both these levels.

A second point of interest is that designers may not be designing for cued remembering on purpose, but that their item or device may facilitate this nevertheless. In such cases, it may be helpful for designers to be aware of the consequences of their design choices, because they may support an association with memories, or restrain it. In this thesis, we came across a wide variety of items, all of which cued memories. Furniture makers, communication and game app developers and fashion designers are among those who also design items or systems that can cue memories, even though that may not be their intention.

An example of a type of object where associations with memories can be advantageous as well as disadvantageous, are objects of use, which covered many items we discussed with participants in this thesis. Because attachment to items is increased when positive memories are associated with the items, item designs that easily become memory cues may have positive consequences for their use and longevity (Mugge, Schifferstein & Schoormans 2008; Wallendorf & Arnould 1988). In contrast, items that are intended for passing on to other users, e.g. items that are used short-term such as crutches, baby furniture or beginners sport equipment, may not benefit from characteristics that increase cued remembering and attachment, as owners may find it hard to part with the item. Thus, it may be equally important for designers to understand how to design for non-cuing. The considerations in this chapter could therefore be read in the opposite way, that is, how to restrain items from becoming memory cues.

Before we present our design considerations for cued remembering, we discuss 'designing for the remembering experience', because 'cued remembering' is part of the remembering experience. We will then present design considerations based on the knowledge we acquired in this thesis. We have seen in our research that we can identify tendencies for cuing memories, such as 'A is often seen with B but not always.' The design considerations in this chapter should thus be understood not as ingredients that guarantee a certain outcome, but are intended to inspire, and to inform about possible consequences and guide the design of items in a desired direction.

7.2 Designing for the remembering experience[2]

In the human-computer interaction (HCI) and interaction design disciplines, designers of products and systems predominantly aim to design for a positive user experience, as discussed in Chapter 2 (Section 2.6.2). The meaning of 'user experience' is debated and thus the definitions of this concept vary (Roto et al. 2011); generally, however, 'user experience' points to the effects of how people interact with a product, with particular emphasis on the emotional aspects of the experience, such as pleasure and satisfaction (Forlizzi & Ford 2000; Hassenzahl 2010; Hekkert 2006; McCarthy & Wright 2004). Research and discussions on this concept has accentuated that the outcome of the interaction with a product is not influenced only by the material product itself, but also by the user's mental state and the environment. We see this in the following definition of user experience by Hassenzahl & Tractinsky (2006, p. 95):

> *'[User experience] is a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.).'*

In Chapter 2, we described the concept 'remembering experience', which shows some overlap with the concept of user experience, but has a different focus. The concept of remembering experience focuses on the experience of externally-cued remembering, and includes the anticipation of the act of remembering, the experience of interacting with the

[2] The content of this section was partly shaped by the collective thoughts and ideas that were discussed in workshops with members of the Materialising Memories team since 2013 on the 'remembering experience'. It is also partly based on a manuscript in preparation: Van den Hoven, E., Eggen, B., Zijlema, A., Van Gennip, D., Mols, I., Broekhuijsen, M. & Markopoulos, P. manuscript in preparation, 'RX: the Remembering Experience'.

item acting as a memory cue, or the device presenting the memory cues, and the lingering effect of the cued remembering. The focus of remembering experience is thus on remembering, while the product and context experience themselves are secondary. Conversely, user experience has its focus on the person's interaction with the item, and while the cognitive outcome is important, memory plays a minor role. When designing for remembering, designers will probably focus on the remembering experience; this is a passing experience but can last for a while. For example, it would include the surprise of finding a long-forgotten box of photos in the attic, taking them to the living room to flick through, holding photos up to a partner and telling stories, and the lingering of the memories and emotions after the box has been put away. A remembering experience can consist of multiple emotions, memories, actions, physical responses and so on.

To design for a remembering experience, one needs to facilitate cued remembering, a process that is described in this thesis, and discussed in the design considerations of this chapter. The outcome of cuing by a personal item is a cued response, and the remembering experience may include multiple cued responses. As opposed to a remembering experience, the process of cuing and the cued response are immediate and require a cue, for example, in the form of an item or part of an item, as this thesis has discussed.

The series of experiential moments that are part of the remembering experience constitute the context of the process of cued autobiographical remembering. Based on the findings in this thesis, which are summarised in the considerations in the next section, the outcome of cuing, that is, the cued response, can be affected by aspects of the remembering experience. Such aspects can include, for example, the physical context (e.g. the attic, the items surrounding the box, see also Consideration 3), the actions (e.g. flicking through, storytelling, see also Consideration 9), the social context (e.g. the partner listening to the stories, see also Consideration 5), the mental state the person is in (e.g. relaxed mood on Sunday afternoon, see also Consideration 10). The design choices made for cued remembering thus also shape the remembering experience, and possibly vice versa. For example, choices made for a remembering experience in a social setting, can affect what is cued, and choices made for a particular cued response will affect the remembering experience.

7.3 Considerations

A designer can weigh different options in the design and technology that will influence an item's effects on the user, such as the interaction with the item, the location of use, and the user experience. Below we discuss points for considerations that lay out these options and factors.

7.3.1 The item-memories relationship dynamics

The item-memories relationship is personal and can vary; not all memories that are cued today are cued later on. Items' characteristics and locations can change, which may cause their owners to see them in a different way. Owners themselves grow and change, resulting in different values and attitudes. More recent experiences may be cued while others have been forgotten, or moved to the background. There are thus many variables (e.g. item characteristics, more life experience of the owner) in the item-memories relationship that makes cued autobiographical remembering by personal items dynamic, rather than static.

This dynamic relationship was demonstrated in Chapter 5, where cued responses were investigated over time. Many cued memories and thoughts stayed the same over time, but not all. The topics of 62% of cued responses came to mind repeatedly during three data collection occasions conducted over a period of 10 months. The cued responses not only varied in topic, but also in nuance, such as the emotions connected to an event, or the details told. The reasons given for the dynamic item-memories relationship changes in what was cued were the following:

a) current events
b) emotional state
c) new connections to recent events
d) the item had become involved in new events
e) thoughts about the subjects had changed, and
f) the item revealed other characteristics.

We also saw in Chapter 3 (Section 3.5) that companions, mundane objects that travelled with the owner, could acquire cues (e.g. material traces and marks) and memories over time.

A designer may therefore choose to design for specific memories, or try to stimulate a dynamic relationship. For example, a designer can play with how much the object or image resembles a specific memory (e.g. a veracious photo versus an abstract representation), to allow more or fewer opportunities to cue memories of other events or thoughts (see also the encoding specificity principle (Tulving & Thomson 1973) as described in Chapters 1 and 4 (Sections 1.3.1 and 4.2.2)). Chances of multiple memories being associated with the item and a dynamic item-memories relationship may also be increased when the item is involved in new events, since this was one of the reasons for a change in cued responses. Allowing for marks and traces of different experiences, which could encourage the previously-mentioned companion relationship with items, would give designers opportunities to design for items that cue memories of additional and more recent experiences. Designers may also encourage a variety in cued responses by allowing changes to the appearance of the item. Examples include objects whose memory cues could be covered and uncovered, the shape

of an item could change, or, through interaction with the item or device, the cues themselves could vary. An example that demonstrates such a covering and uncovering of memory cues is the concept Photo Switch, a photo display containing two photos and a sliding door, always covering one of them (Taylor, Swan & Durrant 2007).

7.3.2 First item encounter often becomes a memory

When people talk about friendships and romantic relationships, they often remember the moment they first met. Similarly, people's first encounter with personal items, often when they became owner of the object, was a prominent cued memory in our research. This was most apparent with items bought on holiday, as described in Chapter 4, where people described not only the location and experience prior to purchase, but also the moment of purchasing, such as the aisle in the store where they found the item, selecting the nicest colour and their conversations with other customers.

For designers wanting to design for a specific memory, this can be a restraint as well as an opportunity. How and where the item is acquired may overshadow later item-memories relationships. At the same time, there are also opportunities to make the design suitable for gift giving, or actively using or personalising during a specific activity, to connect the item with such memories. An example of a prototype that applies this principle is the 'data-souvenir', which captures the individual museum experience of a visitor (Petrelli et al. 2017). The authors suggested enabling 'visitors to contribute' to the data-souvenir, which may increase the strength of the association (Petrelli et al. 2017, p. 281).

7.3.3 Changes to the item or its environment can create associations to memories

Intended as well as unintended changes to an item, or changes to an item's environment, can cause new memories to be associated with it (see Chapter 5). This applies to the appearance of an object, such as traces and marks, to a repair, or to moving the item temporarily or permanently to a different place. The effect of such changes, both to the item and/or its environment, was demonstrated in Chapter 5, where it was seen that the reason that the responses cued by items changed was because the item was involved in new events, such as moving it to a new location, repair of the item, it staying with or being lent to a friend, or because the owner perceived different characteristics, such as damage reminding of its role at a party, or a new figurine was placed next to the item. In Chapter 6 we saw that traces could cue memories, and in the exploration of companions in Chapter 3 (Section 3.5) we proposed to use material that allows for the development of marks and traces to facilitate a companion relationship.

Designers can manipulate cued remembering by facilitating or preventing changes to the item and its environment. For example, cued remembering may be facilitated by using material that allows for graceful ageing, allowing marks and traces resulting from interactions with the item, or by adornments. Another example would be to design objects that need some degree of care (e.g. because of its delicacy), which may facilitate more experiences with the item that in turn may become memories, such as repair, keeping it safe and sound, involving other people or even other items to increase engagement and memory formation with the item.

7.3.4 Possessions of various types can act as memory cues

While souvenirs and photos are typically kept as cues for remembering, we saw that a great variety of personal possessions can act as memory cue (see Chapters 3 and 5). These were often objects of use, such as clothes and kitchen utensils. To provide some specific examples, a lip balm, a handbag, a camera, a set of chairs, a handkerchief and bottles of alcohol were all selected by participants in our research and acted as memory cues. Similar conclusions have been drawn by other researchers, such as Csikszentmihalyi & Rochberg-Halton (1981), who found that people's favourite objects (not necessarily because of the memories associated with them) spanned a wide variety of item types, and were often objects of use.

To design for cued remembering, designers thus do not need to focus necessarily on photos or souvenirs. This implies that it is challenging to design items that are unlikely to become imbued with memories, or that would not cue memories. Examples of item categories that were not intended as memory cues, but for many people are, are lamps and furniture (see Chapters 5 and 6, and the biggest category of special possessions in: Csikszentmihalyi & Rochberg-Halton 1981), underlining the fact that while the main purpose of these objects are for use, they can also act as memory cues.

7.3.5 Current use and exposure of the item influences cued remembering

Personal items have different functions and exposure in the home, ranging from, for example, a decoration seen every day on the wall, a use object in the kitchen, or an archived item for reminiscence hidden under other documents in a drawer. In Chapter 3, we saw how participants reported that the more an item was exposed (e.g. being permanently on display) the less did it lead to remembering; conversely, items rarely seen cued an 'episodic memory' response more often. Thus the *frequency* with which the object was seen, or with

which the owner interacted with the object and its meaning may have influenced the extent to which an item can cue (if at all) and the type of responses it may cue.

Chapter 3 also shows a variety of behaviour associated with items and tensions around their use; examples are items being hidden because of the owner's embarrassment if visitors were to see them, or considering whether to discard an object out of use, such as an empty bottle, when its meaning and function changed. These *behaviours* can affect whether an item can cue; a change in an object's role or potential role (use object versus waste) can also affect what is cued. In Chapter 6 we saw that the objects discussed there, often antiques on display in the home, mostly cued a 'knowledge' response (a factual response on an abstract level, e.g. to a person).

For designers who aim to design items for remembering, it may be useful to be aware of the effects of exposure and use on cuing, as well as the consequences of tensions with and changed meaning of the items. For example, designers may want to manipulate the *exposure* of memory cues, and facilitate serendipitous encounters instead of permanent exposure. When designing an item for use and for remembering, the utilitarian meaning may be an advantage for preserving the object (because it is functional) but at the same time this may distract from cuing memories, and cue other thoughts instead. Peculiar objects may be appreciated more by the owner than general ones and create a special item relationship; however, this may cue feelings of embarrassment when other people see the item (see Section 3.4.4). Designers can choose to prioritise aspects of use and exposure, or find a balance to minimise the effects. An example in which this principle is applied is the prototype 'Photobox', an oak chest in the home that randomly prints four or five times a month photos from the owner's online photo collection (Odom, Selby, et al. 2012; Odom et al. 2014).

7.3.6 Items acting as memory cues can undergo role change and serve multiple purposes

The role of items in the home may differ over time, even with the same owner and in the same home. In Chapter 3 we saw many examples of role change. The pattern most often observed was from object of use to souvenir, sometimes displayed with other items in small shrines. Personal items often changed from being in use or on display to not being used at all or even hidden, such as jewellery that was used less, or books that were covered by a pile of other books. Digital items often had parallel uses, as they could be used on multiple platforms at the same time, such as photos posted on social media, a desktop image and placed in a photo album, all at the same time. We also observed acts to prevent role change, for example, not using a bottle with liquid content as it would not feel right to keep the object once it was empty. Participants also mentioned that they would like to reuse or

repurpose items in the near future. In Chapter 6 we saw an example of a chair repurposed into a baby cot and changing table, likely to be used by future generations. Other items were less appreciated by the next generation, as not all heirs valued old and used items.

For designers, these different roles may be opportunities to design for an item's multiple roles or life stages. For example, one can design for a use item, such as a bottle or clothes that can be transformed into a decorative item. Perhaps pieces of the object can be taken off (e.g. a label from a bottle of wine, parts from the fabric of the cloth) and used elsewhere, or perhaps the item can be used for multiple purposes from the beginning. The finding from Chapter 6 that the heirs did not like antique items, because they prefer a different style (e.g. minimalism) in their home, also offers a design challenge. Would it be possible to design objects that could be adapted easily to different times, styles and fashions? Or could decorative objects (or parts of them) be easily transformed into objects of use? If designers could design for an item's lifetime beyond its original purpose, the item may then serve as a valuable memory cue over an extended period. We suspect there are, but we currently do not know of any products that purposefully apply this principle. Transforming an object into something new is a common practice among crafts, to reuse or repurpose sentimental possessions, especially in relation to separation (e.g. death, divorce). For example, bereavement or memory quilts are made of clothes from deceased loved ones (their aim being to aid the grief recovery process) (Gebel 1995), and jewellers transform wedding rings after a divorce or death into new jewellery. The research project 'object therapy' experimented with 'transformative repair', in which broken objects were transformed by artists into different objects (Keulemans, Rubenis & Marks 2017).

7.3.7 Changes in aesthetics, ageing and damage of the object over time influences the cuing of memories

In Chapter 6 we saw that the repair of an item had a positive effect on the owner's perceived meaning of the item compared to before the repair. In Chapter 3 we saw that people were hesitant to use an item's content, as they would then look at it differently. Aesthetically pleasing and graceful ageing contributes to the cuing of memories. By contrast, damaged and non-functioning items may possibly hamper the cuing of memories. Marks and traces can also cue memories to a specific memory.

Compared to the item as a whole, marks and traces referred more to the past use or the people who used it, or to an 'accident' that caused marks or traces, while the item itself referred more often to lifetime periods, such as childhood (see Chapter 6). Traces that were not caused by the current owner or their family, but were present when purchased, can cue feelings of 'pastness' and facilitate the association of an imagined past of the item. In that way, traces can take people back in time, which may cue other memories. In addition, not

all traces are valued. Often traces of regular use are valued, while other traces (e.g. traces of misuse) are disliked.

The consideration is that not all traces are appreciated, but when they are, they can facilitate the cuing of memories. Designers can use this knowledge by using material that allow traces to be repaired if not valued, or to be exaggerated or highlighted, if valued. A good example of an item that facilitates traces is the 'Underfull' tablecloth, which is a tablecloth whose patterns become visible when people spill. The patterns disappear when the tablecloth is washed (Bjaadal 2009).

7.3.8 Different cued responses are possible and can be influenced by the design of the item

When people look at their personal items, different mental representations (called 'cued responses' in this thesis) can come to mind. We saw four types of cued responses in Chapter 4, in which studied items related to a holiday:

A) 'no-memory' responses, those are responses not related to a memory, but instead evoked practical thoughts related to the item, or the participants felt the holiday item cued nothing
B) 'know' responses, mainly evoking semantic knowledge regarding the associated events
C) 'reflection' responses, such as thoughts, feelings, judgments or reflections, based on a memory, and
D) 'episodic memory' responses, e.g. where a past experience is relived.

We also saw that certain item types or characteristics occurred more often among certain cued response categories. For example, 'no-memory' responses were often generated by items that had been used during or after the holiday, such as clothes and food items. Many items in the 'know' responses group were looked at a lot after the holiday, including some typical souvenirs on display. Items in the 'reflection' responses had predominantly visual qualities, and a part of these items consisted of multiple cues in themselves (e.g. photo collages). The 'episodic memory' responses contained a large variety of item types, including almost all the digital photos, and some of the clothes, fridge magnets and city guides. Most of these items were acquired during the holiday, but were not always intended as a souvenir.

A designer could strive to design an item that evokes one of these four cued responses. For example, when aiming for an 'episodic memory' response, a design that presents a visual image of a past event is more likely to achieve that goal (see Chapter 4 and Dewhurst & Conway 1994; Karlsson, Sikström & Willander 2013; Willander, Sikström & Karlsson

2015). If a ‘reflection’ response is preferred, compositions of past experiences to encourage this type of cued response could be designed.

7.3.9 Different aspects of the same item can influence the cued responses

An item has different aspects or characteristics, such as details, patterns, traces, styles, and colours. In Chapter 5 we saw that the responses were cued by the item as a whole, as well as by many different aspects of the item. These specific aspects could be a particular part of the item (e.g. an inscription, or a frame), general characteristics such as style and colour, tactile or interaction aspects, damage, traces, visible repairs or missing parts, as well as its location and environment. We also saw in Chapter 5 that when an item revealed other characteristics, for example if it was opened, or a plant began to bloom, different responses were cued.

For a designer, this consideration means that if different aspects of an item are highlighted (e.g. changed once or twice a week), different responses may be cued. If this is desired, a designer could also design items with aspects that may not be noticeable at first glance, but can be seen when the item is looked at in more detail, such as inscriptions and traces. The ability to reveal alternating cues may keep the item interesting, and a more stable item may keep its association with one particular event longer lasting, albeit subject to subtle changes of memory as well. An example that applies this principle is a mosaic photo (e.g. www.EasyMoza.com). It is a mosaic image (e.g. a person’s face) that is constituted of small squares of photos from people’s own collection. When seen from a distance a single image is seen; when looked at more closely, the individual photos are revealed.

7.3.10 Events, emotional state, and attitudes can affect the cued responses

People have short and long-term goals and concerns, which influences what they perceive and what is cued by a personal item. Imagine getting ready early in the morning for work, and having mainly attention for personal items that are related to that goal, such as the bag you take with you and the keys of the front door. A family member who is ill may be at the back of your mind while being at work or performing other tasks, affecting what you think and remember. In addition, one’s emotional state, that is, being happy or sad, may affect how and what we remember and what is cued. Besides our current state, also our thoughts about the subject of the memories may change over time. Thoughts about a person may change, for example, after a person got divorced or a group of friends fell apart.

In Chapter 5 we saw six reasons for changes in the cuing by personal items over time. Half of those changes related to people's current context, such as current events (e.g., going to an event where the item was worn before) or the participant's emotional state (e.g., mood after death of friend versus just coming back from holiday). These stimulated the retrieval of other cued responses, and thoughts about the cued person or situation changed, resulting in other associated memories coming to mind (e.g. negative rather than positive memories related to the person or vice versa).

For a designer wishing to design for remembering, this consideration means that not everything can be influenced through the design itself. The response cued by an item will additionally be affected by people's current context, including events, their emotional state and their opinions about the remembered experiences. The intended cued response may thus vary due to a person's circumstances. However, designers could design systems that attempt to present memory cues that correspond with what may currently be on someone's mind. 'Smart objects', which are 'autonomous physical/digital objects augmented with sensing, processing, and network capabilities' (Kortuem et al. 2010, p. 44), may be able to understand what events or people are currently relevant. A photo device may present photos of a previous Christmas when it's close to another Christmas, and photos of a family member may show up on the day of that person's birthday. An example of a concept of a smart digital photo frame is 'Cherish', the aim of which was to display photos of the people who visited the home (Kim & Zimmerman 2006).

7.4 Conclusion

In the previous four chapters of this thesis, we presented the findings of qualitative empirical research on the process of cuing by personal items, with an emphasis on cued remembering. We investigated the effects of use of personal possessions on cuing, the variety of cued responses, how cuing changes over time, and the effects of material traces on remembering. The focus of these chapters was on understanding cued remembering by personal items. In this current chapter, we aimed to interpret the findings and look at the implications of our findings for the design of items, devices or systems. We have collated our insights into 10 considerations to aid the design of personal items for cued remembering.

Cuing and cued responses are part of *the remembering experience*. To design for the remembering experience, one can also design for cuing, to achieve the goal of remembering with the aid of personal items or systems. Design decisions made to influence the user or remembering experience may also affect the cuing process.

Several design considerations stressed the *dynamic nature of the item-memories relationship*. Items can cue multiple memories and the composition of these memories can

vary. Certain memories seem to be connected more often, such as the first encounter with the item and the changes made to the item (e.g. repair, moving home). A designer may decide to design an item in such a way that it invites certain behaviour that facilitates the coming and going of associations to memories, for example by designing for gift giving (first encounter with the item) or allowing changes to be made to the item, by graceful ageing or adornments.

Other considerations focused on facilitating *the possibility that the item will cue*. An item may not always cue memories, and what people do with personal items in the home affects the item's potential to cue memories. Items that were seen and used a lot tended to cue less or cue shallower responses (e.g. knowing where it comes from, without a specific memory coming to mind). Although serendipitous finds of personal items can lead to more remembering (an episodic memory came more easily to mind), neglecting or discarding personal items that are associated with valuable memories will diminish the potential for cuing. Designers can facilitate various roles for an item during its lifetime, for example by enabling different uses (role change) over time. In addition, allowing an item to age gracefully and the ability to repair unwanted traces may be a way to increase the appreciation and durability of personal items that can act as or evolve into memory cues.

We also discussed design considerations about *influencing the outcome of cuing by personal items*. Different cued responses are possible, and designers may make design choices to accommodate certain outcomes. A personal item may itself consist of multiple cues, associated to different memories, and traces and marks can cue the use of the item in the past.

Not everything can be designed for. Cued remembering is also affected by people's emotional state, their current concerns or their opinion about remembered events. An understanding of cuing, of what can be influenced and knowing the factors that can be controlled to a lesser extent, may guide the design of personal items and the expectations of what can be achieved.

The 10 considerations in this chapter show what our research findings may imply at an applied level. While these considerations need to be seen as indications, they may nevertheless guide design in relation to cued autobiographical remembering.

8 CONCLUSIONS

Abstract

In this chapter, our main findings are discussed based on the research presented in this thesis. Through three qualitative studies, we gained knowledge into cued autobiographical remembering by personal possessions. We found that different uses of personal possessions influenced their potential to cue memories, and that tensions in the owners' relationship with their personal possessions affected their cuing. Cuing with personal possessions can result in a variety of outcomes, which were not always episodic memories. In addition, over time, cued responses can change (although the majority stayed the same) and we gained an understanding of what caused these changes. Features of the items used as cues, such as details or traces, can also act as cues. Particular types of traces, such as those resulting from age and use, were found to relate to episodic memories and to an item's imagined history. We also discuss our findings on why new or different responses can be cued. Our main findings are then presented, and we suggest future directions for research. We close this chapter with a conclusion.

8.1 Introduction

In the previous chapter, we saw what the research findings in this thesis imply for designers whose intention is to design personal possessions or systems that cue memories. In this chapter, we present other conclusions derived from the research in this thesis.

This thesis focused on cued autobiographical remembering by personal possessions in the home environment. These possessions included photos of past experiences, souvenirs from holidays, and objects of use that played an important role in the owner's past. As discussed in the first two chapters of this thesis, autobiographical memories, which are personal experiences of one's life, are important for a sense of self-identity (Conway, Singer & Tagini 2004). Personal possessions may cue these autobiographical memories. We aimed to gain understanding of cued autobiographical remembering for the purpose of designing items intended for cuing memories.

We conducted our research from a human-computer interaction (HCI) and interaction design perspective, following a research for design approach (Downton 2003). At the same time, we used and built on knowledge from other disciplines, such as cognitive psychology, consumer research and HCI/interaction design. We used qualitative methods that we applied to people's own possessions, often in their home environment, in line with an ecological approach to memory research (Neisser 1976).

We conducted three studies, focusing on the items and the features of items that acted as cues, the possible outcomes of cuing, and the changes in cuing over time. To summarise our studies:

- Study 1 focused on the effects of use of the possession on their role as memory cue (see Chapter 3), and the possible outcomes of cuing (cued responses, see Chapter 4), using a home-tour interview method.
- Study 2 focused on the changes that happen in cuing by items over a period of several months, using a longitudinal study with questionnaire cards (see Chapter 5).
- Study 3 focused on the role that traces on personal items played in cuing memories, based on interviews with item owners and repair professionals (see Chapter 6).

The nature of these studies was explorative, looking at what and why things were happening between owners and personal items. In the following sections, we discuss our main research conclusions from this thesis, our contributions to the disciplines this research rested on or borrowed from, reflect on our findings and methods and discuss possible future directions.

8.2 Overview and discussion of main findings

In the following sections, we present our main insights based on the empirical research presented in this thesis. We begin by summarising the findings related to the behaviour and bonding with a personal item, as this is part of the context to cuing memories by possessions in daily life. This will be followed by what we learned about the possible outcomes of cuing. Hereafter we discuss the changes in reported cued responses over time and why new or different responses are cued over time. Lastly, we discuss what items and what features of the items acted as cues. Where appropriate, we supplement our conclusions by relating to previous literature and explaining the contributions to related research areas.

8.2.1 People's behaviour with personal possessions

As all personal possessions can potentially cue memories, it was relevant to investigate what people do with personal possessions, and what this means for their perception of these items.

One insight gained regarding people's behaviour towards personal possessions was the cued remembering prerequisite that the possession had to be available, if it was to act as a memory cue. We noticed that this could not be taken for granted. The frequency an owner uses and interacts with possessions affect the potential that an item is perceived. This insight is supported by several findings from our research, the main finding coming from the home-tour study, which disclosed information about people's behaviour with items (see Chapter 3).

In the home-tour study, we observed many variations in the use of an item and in its context over time; these changes affected the setting in which and the frequency with which the item is perceived and hence the likelihood of it being able to cue memories. Examples included repeated use, change in use or location, exposure (e.g. limited exposure may lower the frequency of cuing, but not necessarily harm the cue effectiveness, as we discuss in Section 8.2.2), items not used because of the owner's discomfort if others can see it, and postponed use to prevent the item degrading aesthetically or functionally. Some of these caused tensions in the owner, such as liking the item (e.g. a piece of clothing) but feeling embarrassed when wearing it in public, which prohibited the owner from using the item in the way he or she wanted. A more radical behaviour affecting the availability of the memory cue was that personal possessions were intentionally thrown away, as seen a few times in our longitudinal study (see Chapter 5), thus making them permanently unavailable as an external memory cue. A challenge is thus that items should be kept (e.g. through use), an area which product attachment literature has addressed. Based on earlier work, it is known that cuing memories positively affects the bonding with a possession (Mugge,

Schifferstein & Schoormans 2008; Niinimäki & Armstrong 2013; Page 2014; Schifferstein & Zwartkruis-Pelgrim 2008), resulting in possessions more often being kept and repaired. In combination with the above results, we can conclude that bonding with a personal possession is an enabler as well as a result of cuing memories. The findings imply that digital possessions stored on computers and hard drives, such as photos, may not act to their full potential as memory cues due to little exposure and use (Nunes, Greenberg & Neustaedter 2008; Petrelli & Whittaker 2010), unless people would use devices (e.g. digital photo frames) or social media platforms (e.g. Facebook's 'On this day' function, see Konrad 2017) that increase the use and encounter of digital possessions.

The second insight regarding owners' behaviour was that, based on observations in our study with holiday items, some items become 'companions' (see Chapter 3). Those were personal items that had accrued meaning by travelling with the owner, and often carried marks and traces from such events. Interestingly, we did not find any digital items that matched this concept. The companion is an example of an attachment relationship and resonates with Kleine & Baker (2004, p. 1), who wrote that 'attachment requires a personal history between person and possession' that can be built up through use, display and other forms of active and passive use. It also resonates with earlier research that showed that material traces contribute to increased attachment (Belk, Wallendorf & Sherry 1989; Kopytoff 1986). Although for attachment random traces of ageing and use are of interest, more specific marks and traces, that is, traces that can be related to the times these traces were obtained, are preferred as memory cues.

Bonding and use are thus enablers in preserving an item and allowing it to cue. Frequent use and awareness of the item would be advantageous for an item to become a memory cue. However, our findings also indicate that serendipitous encounters with an item are more likely to cue a sensory-rich memory. These two findings affect different steps in the *Model of cued autobiographical remembering by personal possessions*, described in Figure 1.1 (Chapter 1). Frequent use not only impacts cued remembering, but also the process of events being perceived (linked to the item), encoded and stored into the autobiographical memory system (at the top of the model). The cuing of a sensory-rich memory mainly applies to the process of cued remembering (at the bottom of the model). The results can also be explained in terms of stages in the relationship with possessions. Research by (Niinimäki & Armstrong 2013) showed that use, beauty, and functionality are more prevalent in the earlier stages of the owner's relationship with their object, and memories come into play at later stages. This 'maturing' process may apply for memory cues as well; when the attachment relationship is established, the item's memory cue function may become more prevalent.

8.2.2 The outcomes of cuing

The research in this thesis revealed what possible outcomes cuing by personal possessions may have, in terms of the mental responses that come to mind (which were verbally reported by the participants). We found that not all outcomes were memories. Our main insights are based partly on home-tour interviews, in which we discussed, among other topics, what came to mind when the owner was looking at the item (see Chapter 4), and partly from our longitudinal study on cued remembering over time (see Chapter 5).

One of our insights was that different response types can be cued. We identified four such categories: 'no-memory' responses, evoking either thoughts (e.g. practical thoughts about use) not related to an associated memory or nothing at all, 'knowledge' responses, mainly evoking semantic knowledge regarding the associated events, 'reflection' responses, such as thoughts, feelings, judgments or reflections, based on a memory, and 'episodic memory' responses, where an event or moment is remembered in detail. Strictly speaking, cued autobiographical remembering should include an episodic memory response, as this type of memory is an essential part of a specific autobiographical memory (Conway & Loveday 2015). However, we widened our scope and also looked at other types of cued responses in this thesis.

A second insight is that cued responses by personal possessions are not limited to one single response, but can cue multiple responses (see Chapter 4). This may be facilitated by the fact that personal items often consist of multiple features that could act as cues (e.g. specific parts, traces or a picture frame with multiple photos), and each part may cue different responses (see Chapters 4 and 5). Digital cues, such as photos or files, currently lack many of these features. For example, an email of ten years old will open in the email program you use today, instead of the one with the layout from the past.

Another insight was that while the content of the cued responses could vary over time, in most cases, there was at least one response that over a period of 10 months was cued repeatedly (see Chapter 5). In relation to this, we saw that the content of the cued response often related to an event close to when the item was acquired (see Chapter 4), such as the store where the item was bought, and the conversations with sales people and customers in that store.

The knowledge we gained adds to the existing literature on human memory research and the meaning of personal possessions, including product attachment. To date, we are not aware of any other research that has studied the types of responses (mental representations) that personal possessions can cue, nor the changes in cuing by personal possessions over an extended period of time. The contribution to cognitive psychology lies in the observed overlap and differences between responses in a lab setting and cuing in everyday life. Our insights indicate that research on remembering cued by people's possessions can be

differentiated from remembering aided by non-subjective cues (e.g. cue-words or phrases). Personal possessions as cues do not always result in a memory, and the environment and even the main cue (possession) itself is prone to change, possibly affecting the memory-item relation. In the field of consumer behaviour (in particular product attachment), it is known that memories are one of the determinants for product attachment (Mugge, Schifferstein & Schoormans 2008). We contribute to this by having identified four categories of cued responses. Our work also adds to the work on meanings of personal possessions, such as the influential work by Csikszentmihalyi & Rochberg-Halton (1981). They developed 37 categories of meanings grouped into 11 meaning classes that explain why personal possessions are valued (the symbolic meaning), of which the most frequently-mentioned classes were the 'self' (e.g. the items relate to something the owner does or likes) and 'experiences' (e.g. the item relates to a hobby and is valued for the enjoyment it gives). Adding to this, the reported cued responses described in the current thesis tell us something about the immediate effects of encountering personal possessions on an everyday basis by the owners in their home environment.

8.2.3 Changes in cued responses

Our research showed that changes in the cued responses by personal possessions over time occurred for a number of reasons. We base our insight on the findings from our longitudinal study, from which we gained more knowledge on cuing over time (see Chapter 5).

Our findings indicated that cued responses can be different from those of a previous cuing because of factors relating to the item, to the memories and/or to the owner's emotional state. The categories of changes we found are the following:

A) current events on the owner's mind
B) the owner's emotional state affecting the cued responses
C) new connections to recent events
D) the item was involved in new events, which generated new memories
E) thoughts about a person or situation changed, resulting in other associated memories coming to mind, and
F) the item revealed other characteristics (owner perceived different item features), and these cued other memories.

Based on these findings, we now understand that new, recent events can be associated to the item, either with the item involved, as in D (this was also the case with some of the items related to holidays in Chapter 4) or without the item being explicitly involved, as in C. We now also understand that cuing depends on the present: on the current goals and activities on people's minds (which is in line with the influence of current goals in autobiographical remembering, see Conway 2005), as in A, and their emotional state, as in

B, as well as thoughts about the cued person or situation, as in E. The findings also showed that the items themselves might be perceived differently and therefore cue different responses, as in F. Devices facilitating remembering may be able to influence the owner's emotional state (B), for example by influencing the user or remembering experience (see Section 7.2 in Chapter 7).

8.2.4 The (features of) possessions that act as cues

In this thesis, we found that the items as a whole and their specific features could act as cues, with different outcomes. Our insights are based on findings from all three studies, such as the response categories that were cued by items with particular characteristics in the home-tour study (see Chapter 4), the features that acted as cues revealed in the longitudinal study (see Chapter 5), and the findings specifically on the role of traces of ageing and use from our interviews on repaired possessions (see Chapter 6).

Our first insight was that some item characteristics seemed to relate with a specific category of cued responses (see Chapter 4). We found that the 'no-memory' responses were often cued by personal items that were used, such as a skirt, a wallet and food. 'Knowledge' responses were often cued by items that were seen a lot, such as a fridge magnet, a background photo on a desktop, or shopping bags. They included typical souvenirs, with an image or name of a destination on them, and thus the owner would know where the item came from. The 'reflection' responses related with items that had visual qualities and several items were composites of multiple images or consisted in other ways of multiple cues. The 'episodic memory' responses related with all types of items, such as books, wearables, decorative objects and many digital photos. Although we cannot consider these as hard facts, they may have indicative value. These findings also indicate that digital possessions (e.g. photos) are effective cues for episodic memories, despite digital possessions being perceived as less valuable than physical possessions (Petrelli & Whittaker 2010).

Our second insight was that cues could come from five categories of features, besides the item as a whole (see Chapter 5). These feature categories were: specific parts of the item (visual/textual/physical), general characteristics, tactile/interaction, damage/traces/repair/missing parts and location/environment. To give an example, we saw that cuing could be generated by the whole item (e.g. an entire book), or by specific features of the item, such as a book mark in a book, the cover of a book, or a specific trace or damage on the book. Most often the item as a whole (41%) and specific parts of the item (40%) acted as cues in our study. Traces of ageing and use were further investigated through interviews with repair professionals and with owners of an item with traces (see Chapter 6).

Our third insight was that traces of ageing and use on possessions cued different types of responses than did the item as a whole, and thus contributed to cuing in a different way. In our study on repaired items with item owners and repair professionals, we found that whole items tended to relate to people, lifetime periods and repeated activities, while traces of ageing and use often related to the item's use in the past. However, besides relating to personal memories (e.g. a family member using the item), they also cued associations to the imagined past (e.g. how it would have been used 100 years ago). These associations with memories were one of the reasons why repair professionals did not always repair or remove traces of ageing and use.

With these insights, we contribute to the design field that has focused on graceful ageing for aesthetic reasons, for example, to increase product longevity (Chapman 2015; Rognoli & Karana 2013). We have added knowledge to the relationship between material traces and memories, which may also contribute to attachment and product longevity.

8.3 Interdisciplinary research contributions

In this thesis we drew from different research disciplines and used it to set up our own research and in turn, our research may give something back to these disciplines. We mostly used knowledge from the HCI/interaction design, cognitive psychology and consumer behaviour disciplines (see Chapter 1 Section 1.6). In Table 8.1 we have listed the main three disciplines our research has used and built on and explained how our research contributes to three of the main concepts or models in each of those disciplines.

Table 8.1. Contributions of the research

	Thesis contribution
Interaction design / HCI	
Designing systems that facilitate remembering (Van den Hoven 2014; Van den Hoven, Sas & Whittaker 2012)	We have added knowledge on cued remembering with digital and physical objects, which can aid further research in HCI on the design of systems and prototypes for remembering. We have summarised and translated our findings into design considerations in Chapter 7.
User experience / remembering experience (Van den Hoven 2014)	We have provided a deeper understanding of the 'remembering experience' by describing the process of cued remembering. For example, our findings included factors that influenced cued remembering, and therefore also influence the remembering experience (see Section 7.2).
Material qualities	We have added knowledge about the effects (positive and negative) of material traces, and what they contribute to remembering (see Section 8.2.4). In relation to digital versus material qualities, earlier research

(e.g. Odom, Zimmerman & Forlizzi 2014; Petrelli & Whittaker 2010)	found that digital items such as digital photos, identified as valuable memory items less often and harder to access (Golsteijn et al. 2012; Petrelli & Whittaker 2010; Whittaker, Bergman & Clough 2010). This research has added a positive nuance to this, confirming that digital photos seem to have a strong ability to cue episodic memories (see Chapter 4).
Cognitive psychology	
Autobiographical memory / self-memory system (Conway & Loveday 2015)	Our research findings often confirmed the self-memory system (Conway & Loveday 2015; Conway & Pleydell-Pearce 2000), One example is the influence of the goal system and the conceptual self (which are elements of the self-memory system), on cued remembering (see Section 5.5.3). We have added knowledge on what occurs surrounding this model (which describes the mental process) in relation to external cues (possessions).
Memory specificity levels (Conway & Pleydell-Pearce 2000)	Our thesis findings have partly confirmed existing levels of specificity, e.g. lifetime periods and general events, but have also showed that thoughts and reflections can result from cuing. As discussed in Chapter 4 (Section 4.5.2), some of these reflections resembled the by episodic memories supported process of 'imagining', as described in the Remembering-Imagining System (Conway & Loveday 2015).
Cued remembering with naturalistic cues (e.g. Karlsson, Sikström & Willander 2013; Willander, Sikström & Karlsson 2015)	Our research confirmed findings on naturalistic cues, such as the effectiveness of photo cues, but our added a nuance to those findings, namely that what is cued depends partly on the perception of the external memory cue, even when the cue stays the same (see Section 5.5.3).
Consumer behaviour	
Determinants of product attachment (e.g. Mugge, Schifferstein & Schoormans 2008)	Our findings have contributed to a deeper understanding of the memory-possession relationship, which is one of the determinants for product attachment (Mugge, Schifferstein & Schoormans 2008). For example, our research revealed factors that affect how memories get associated with items (see Section 4.4.7). Also, our findings add nuance to the correlation between detaching from objects associated with negative memories, and increased attachment to objects associated with positive memories (Kleine, Kleine III & Allen 1995). It became clear from our research that objects are associated with multiple memories, and that the associated memories can change over time.
Stages in the person-product relationship (e.g. Dazarola et al. 2012; Niinimäki & Armstrong 2013)	Our findings related to use and cuing memories have added to the knowledge about the relationship stages over time. Our observation that fewer encounters and less use seems to lead to more remembering, may also explain the changing role of memories at different stages. The research by (Niinimäki & Armstrong 2013) found that memories play a more prominent role in the attachment relation in later stages of the relationship (see Section 2.4.2).

Material change, e.g. graceful ageing (e.g. Chapman 2015)	The thesis findings about material traces (in particular Chapter 6) have added to knowledge on the role of material change and increased attachment. Our findings reveal the meaning of material traces' and their connection to memories.

The HCI/interaction design discipline has studied how remembering can be facilitated or improved using technology (see Chapter 2), often in in a qualitative manner, and our research has added to existing knowledge. Part of this can be used to further study and improve the user/remembering experience and the experience with materials, including the challenges of the experience with digital items.

The cognitive psychology discipline has studied remembering and memories, often using quantitative methods. We used this research to interpret our findings and to some extent we confirmed the research. Our research was conducted qualitatively and in a home context, and therefore had a broader variety of responses and influencing factors than would have occurred in controlled research. We thus add to this discipline an understanding of how remembering is affected by non-stable environmental and perceptual factors (e.g. possessions). It has been long known in consumer research that memories, together with other factors, are a factor contributing to attachment, which may then lead to people keeping and caring for a product for longer. Our research contributed to this understanding with more in-depth knowledge of the memory factor. Besides attachment and the long-term relationship with possessions, we also contributed to the research area on graceful ageing by studying material traces and their relation to memories. This research area overlaps with research on material qualities in interaction design/HCI, but whereas the latter focuses on (user) experience, the consumer behaviour research is focused on (increasing) attachment.

8.4 Reflections on findings and methods

In conducting our research, we collected findings that sometimes seemed contradictory, and gained experience with research methods of which we learned more about their advantages and disadvantages. In the following sections, we reflect on some of our findings and experiences with the methods.

8.4.1 Reflections on findings

Some findings seem to oppose each other. The finding that items that were encountered less frequently were more likely to result in an episodic memory response (see Chapter 4), may sound problematic in relation to our finding that frequent use is advantageous for an item to be preserved and remain available as a memory cue, perhaps even being a companion (see

Chapter 3). It implies that loved possessions that are frequently used, will cue not, or less often, an 'episodic memory' response, but a 'knowledge' response instead. Some of the findings in Chapter 4 seemed to indicate that the episodic memories were not lost or forgotten, but that habituation had taken place. Taking into account that a possession goes through a range of different life stages (see Section 2.4) and also changes role and location in the house, as described in Chapter 3, the different life stages may also be linked to other cued responses. For example, a much used musical instrument during one part of someone's life and cuing 'no-memory' responses or 'knowledge' responses, may after a while be stored away and be seen only once a year, cuing 'episodic memory' responses. This is in line with (Niinimäki & Armstrong 2013), who studied the life stages and people's attachment to clothing. Her research showed that use, beauty, and functionality are more prevalent in the earlier stages of the owner's relationship with their object, and memories come into play at later stages. Further research would have to confirm if this is also the case for other possessions, and whether other types of responses are indeed connected to the stages in which objects are used and on display, while later becoming a souvenir and evoking a memory response.

It was found in this thesis that most digital photos evoked 'episodic memory' responses (Chapter 4). It is known from earlier studies that a relation exists between favourite objects and memories and increased attachment and memories (Csikszentmihalyi & Rochberg-Halton 1981; Golsteijn et al. 2012; Mugge, Schifferstein & Schoormans 2008; Wallendorf & Arnould 1988). Based on this, one would expect digital photos to be possessions that are highly valued, but earlier research found the contrary. It was found that digital items were 'initially perceived as less valuable' (Petrelli & Whittaker 2010, p. 153), although they later realised that they were sentimentally attached to their digital items as well. Golsteijn et al. (2012) found that physical items were talked about in a positive light and were related to the participant's identity, but digital objects were mostly talked about in relation to their usefulness. However, Golsteijn et al. (2012) also found that items that can exist both digital and physical, such as photos, their physical properties did not seem to matter. In fact, often the digital version was preferred. Petrelli & Whittaker (2010) suggested that a lack of accessibility of digital items could be the reason for participant's initial perception that their digital items were less valuable. In the studies in this thesis too, participants selected few digital items, and often they were digital photos. Based on our findings on the strong effectiveness of digital photos as cues and the limited numbers participants selected digital items, we agree that storage and accessibility may be the main problem for people, and less the value as memory cue.

In our research we found several occasions where a memory did not come to mind. In Chapter 4 we found 'no-memory' responses, where no memory came to mind but something else, for example a thought. In Chapter 5, we found that some cued responses

were not repeated in the next phases of the longitudinal study. This could indicate autobiographical forgetting, as opposed to autobiographical remembering (Harris, Sutton & Barnier 2010). An association between a memory and the possession was once there, but the memory is not cued anymore. In the case of 'no-memory' responses (Chapter 4), it is not always clear whether there has been a connection between the possession and a memory, and therefore whether it could be considered autobiographical forgetting. For example, if a strong connection between the possession and a memory had existed once, but had now been too weak to cue a memory, it would be autobiographical forgetting. It is also possible that a memory has never been associated with the possession. Thus, a memory was and is absent, and could therefore not be remembered or forgotten.

Our findings may have looked different if we had focused on a particular type of memory. A very specific type of memory is for example the memory of a deceased one (bereavement), for which other types of designs are desired (Moncur et al. 2015; Odom et al. 2010) than memory cues for a holiday memory, like in our home tour study. Remembering a memory of a holiday in detail will probably a joyful experience. Memories that are partly, or entirely, negative or painful, may not be preferred to be relived. Instead, just a glow of the memory may be appreciated. Our findings may have had more emphasis on the emotional component of cued responses, and a longitudinal study as described in Chapter 5, may have been affected by the bereavement process. The studies in this thesis covered a wide variety of objects (holiday objects in Chapter 3 and 4, any home possessions in Chapter 5, and objects with material traces in Chapter 6), and focusing on a specific type of memory may reveal more insights on designing for this type of memory.

8.4.2 Reflections on the methods and research

During the process of conducting this research, we gained more knowledge on how to conduct this type of memory research and what to be aware of. One of these insights was that there is a distinction between what comes to mind (the cued response) when an item is encountered, and the memory or story told when asked about the item, for example when a question is asked by the researcher. This became most apparent during the home tour study (see Section 4.5.1). The first response coming to mind may be a particular smell and image, while the story told may start with the location and a description of the event. The psychology researcher Brewer (1986) noted that slight changes in the instructions given (participants were given word-cues), could lead to different types of memories being reported. Our research confirmed the effect the question asked has on the response reported. For conducting memory research or evaluating systems that facilitate remembering, it may be useful to consider what kind of response or behaviour one would like to investigate. For example, personal items that cue a 'no-memory' response (Chapter 4), may still be effective

as a conversation starter in a social setting, and should thus be judged for the role they are intended to play.

An underlying assumption to this research is that cued remembering can be influenced by a designer. The findings in this research revealed many factors affecting the cuing that are not related to the item, but instead are related to the person's mind or state of mind. However, cuing itself, and possibly the type of outcome, the way memories get attached, and creating the environment and mood for remembering, can be influenced by the designer. We may not be able to determine exactly the content that is cued and with what emotions, but our findings indicate that we can steer cuing to some extent, which future research may shed light upon.

An observation regarding the methods we used is that our longitudinal study, which lasted approximately 10 months and used questionnaire cards, is that quite a number (13 participants) did not complete the whole study. The participants who did complete, did not always respond right away and were often reminded before returning their cards. In the two other studies this was not the case, because the main method used were interviews and data could be collected immediately after meeting the participant. Although the method of questionnaire cards had its advantages, such as being able to include participants living further away and answers were given in a private setting (as opposed to having a researcher as audience), based on our experience, interviews would be preferred for a longitudinal research like this to increase commitment.

8.5 Future directions

We gained knowledge on cued remembering, but still have many questions that could be further investigated. We discuss three areas for possible further investigation in the sections below.

8.5.1 Establishing connections between items and memories

Based on the research in this thesis, we gained some knowledge about how memories are connected to items, as discussed in this chapter in Section 8.2.3. It is a topic relevant to designing for cuing, as an improved understanding could guide designers in connecting experiences with items. The moment of acquiring a holiday item seems to be a memory that is often connected to the item. Does this apply to other types of items, or do the unique locations where holiday items often are acquired play a role here? Would it also apply to digital items, in particular items that are not photos? All items in our studies were already personal possessions, and most had an existing connection with memories at the time of our investigation, and therefore we cannot yet draw conclusions on how this item-memories

relationship evolves from the start. As described in Section 8.2.3, we saw some changes in the set of memories connected to an item. It is not yet clear how new possessions, other than holiday items, gain their connections from the beginning, or when and what memories get connected.

8.5.2 Designing for memory cuing to achieve longevity

Understanding how the cuing of memories occurs and how the association of memories to items takes place is useful for the design of personal items that could cue. This understanding may also contribute to design for longevity, to encourage people to keep products longer and to repair rather than replace them. One direction of interest could be to investigate the memory content of the cued responses of possessions to which people are strongly attached, topics such as people, events or achievements. In that way, we gain knowledge of what memories to target, and thereby contribute to the owner's attachment to the item and to the longevity of the item itself. We may also want to investigate the duration of the item-memory relationship. We saw that some responses were cued only once, while other responses were cued at every one of the three times we tested over the 10 months (see Chapter 5). Understanding why these memories were more consistent than others may guide designing for remembering. What may play a role, for example, are the item properties, or its use, or the time between acquiring the item and the targeted memory. It would also be useful to know what type of cued responses tend to be associated with long-lasting possessions, for example, a 'knowledge' response versus an 'episodic memory' response.

8.5.3 The uses of cued remembering

Cued responses may be sought in a variety of settings. Whittaker et al. (2012, p. 57) identified three uses of mementos:

A) for 'facilitating social narratives and sharing of experience'
B) for 'acting as reminders in frequently used everyday objects', and
C) for 'private immersion in rich collections of emotionally evocative objects'.

It was not in the scope of this thesis to investigate in what setting the item could best act as a cue, but it is nevertheless of relevance when designing for cued remembering. In social interactions (e.g. A in Whittaker et al.'s uses of mementos), other factors may be at play, such as people's self-images (external identity, as opposed to internal identity) which they would like to share with others, and item characteristics that invite visitors to ask about the memory. A direction of interest could be the features that facilitate the sharing of memories, which may be different from individual cuing, such as enhancing cross-cuing

and storytelling. Memories that people prefer not to share (private memories), but would like to be reminded of in rooms that are public for visitors, such as the living room, may rather be connected with items that do not attract attention by visitors and act as conversation starter.

8.5.4 Cuing by digital possessions

Many adults spend more than half their days using digital devices (according to research this is 9 hours and 22 minutes, of which 8 hours are for personal use, see Sheikh 2017). People may thus for a large part of the day be exposed to digital cues. Several researchers have investigated remembering with digital possessions (Odom, Zimmerman & Forlizzi 2014; Petrelli & Whittaker 2010) and items other than photos, such as avatars, may provide opportunities for memory cues (Denegri-Knott, Watkins & Wood 2012). Many of the influences on cuing that we discussed in this thesis, such as usage, traces, and role change, do not have a digital counterpart (see the 'companion' in Chapter 3). At the same time, the qualities of digital items also open many new opportunities, as noted by Odom, Zimmerman & Forlizzi (2014). A research direction could be to investigate what is needed to make digital items effective memory cues. In our current research, the digital items were mostly photos, music, books and other files. Future research may include studies into what other digital files are suitable for cued remembering (e.g. information about what people worked on and which applications, the contacts they have spent time with), and what role would suit these items when they are no longer in use (e.g. from object of use to souvenir). As there are many opportunities to manipulate digital material, such as photos, another direction could be to investigate what style would be most appropriate for memories at different levels of specificity (e.g. a specific moment versus a lifetime), and of different ages. Perhaps older memories fit better with a painting-like adaptation of a photo, for example to coincide with ageing memories that lose their detail.

8.6 Conclusion

In this thesis, we set out to gain an understanding of cued autobiographical remembering by personal possessions. An understanding of this process could facilitate the design of personal items or applications for cuing memories, and could also provide pointers to evaluating these items and systems, for example as part of evaluating the remembering experience. The three studies we conducted investigated cuing by people's personal possessions in their own homes and provided insights into this everyday phenomenon in the real world. The research has shown what cued remembering entails and how it is affected

by factors that relate to the item and its context, as well as to the person's mental state and events in her/his daily life.

We investigated people's behaviour with personal possessions. Our research showed that an essential enabler for cued remembering was the availability of the personal possession, since, self-evidently, if the possession had been mislaid for quite some time, cuing was severely restricted. Interaction with, and the location of, the personal possessions affected the potential for them to cue. These aspects are subject to changes over time and thus also their cuing potential.

We then focused on cued remembering itself, in particular the outcomes of cuing by personal possessions. Our findings revealed that personal possessions can cue a variety of responses, which are often, but not always, episodic memories. We found several other cued responses, such as responses not related to memories ('no-memory' responses), responses containing mainly abstract or factual information ('knowledge' responses), and thoughts or feelings related to a memory ('reflection' responses). We found that different item characteristics affected the outcome. For example, a close resemblance of the item to the original event (e.g. a photo), or the presence of traces of ageing and use, led more often to episodic memories than did items without these characteristics.

Our research also revealed evidence of the dynamic nature of the item-memories relationship: What the personal possession cues today will not necessarily be the same 10 months later. Nor were the cued responses by personal possessions completely random: in most cases, there was at least one of the multiple responses that seemed to cue consistently (tested three times) over the 10 months (76%). We identified various reasons for these changes in cued responses. Summarised, they were: factors related to the *item* (e.g. other item characteristics were perceived, or the item was recently involved in new events), factors related to *the retrieval of other or altered memories* (e.g. new connections to recent events, current events on people's minds affecting what was cued, or the thoughts about the remembered events or people changed) and people's *current emotional state* (e.g. mood affecting what was cued and with what emotions it came to mind).

Our research has contributed to an increased understanding of cued remembering, especially the dynamic nature of the item-memories relationship, and the ways in which cuing can be facilitated or hampered. This knowledge can be used for designs of systems and personal possessions that facilitate desired cued remembering.

APPENDICES

APPENDIX 1 QUESTIONNAIRE CARDS AND INSTRUCTIONS PHASE 1

Your name: ..... Item title: ..... Current date: DD – MM – YYYY

1) Can you describe what came to mind when you selected the item? You may have jotted this down on a piece of paper when you selected the items. Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind (a minimum of 2 memories are required for the item to be included in the study). Start each new memory at a different letter.

A:

B:

C:

D:

E:

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

2) Do you think there is a reason why they came to mind in this order? If so, could you explain?

3) Sometimes a memory pops up that is not cued by the item, but cued by the previous memory. If you look at the memories you described, are all the memories cued by the item? Or are some cued by the previous memory? Please circle your answer for each memory:

A: item / memory / do not know
B: item / memory / do not know
C: item / memory / do not know
D: item / memory / do not know
E: item / memory / do not know

4) Some memories may involve more mental effort than others to be retrieved. How easy do the memories you just described come to mind? Please indicate with a letter (corresponding to the memory in question 1) on the scale where each memory is placed. If they are all the same, please write the letters on top of each other.

low effort — high effort

5) How specific was the memory that came to mind? Please write down the letter from question 1 at the description where it fits best. Pick one description for each memory. It is ok if multiple memories (or all) fit in the same description. *What I wrote down refers to...*

- One specific moment or a particular time: (A, B, C, etc.)
- A repeated activity or a category of similar events without the specification of a particular time: (A, B, C, etc.)
- An extended period of time which lasted longer than a day: (A, B, C, etc.)
- A person, animal or thing without remembering a specific moment or a particular time: (A, B, C, etc.)
- A feeling, thought or reflection based on a memory: (A, B, C, etc.)
- None of the above fit for what I wrote down: (A, B, C, etc.)

6) Below you will find a timeline. Could you please point on the timeline when the remembered event took place? You can use the letters from question 1 and use the upper row to fill them in. If the memory is not from an event (for example to a person) or you do not know when it took place, you can leave out the letter.

7) We are interested in when the item started cuing this memory. Do you have any idea when this connection was established? If so, please fill in the letters in the second row.

8) Did any other relevant events happen related to the item/remembered events? If so, please fill them in in the third row.

6) remembered events (A, B, C, etc.)

7) item began to cue the memories (A, B, C, etc.)

8) relevant events related to the item/events

..... **(please fill in)** **now**

Check: did you fill in a point of time at the start of the timeline? For example, year 2002 till now.

9) It could be that the memory that came to mind was cued by a specific aspect of the item. For each memory (A, B, C etc.), could you please pinpoint what aspect of the item cued the memory? For example something specific: namely .... , something generic: ...., everything or perhaps you do not know. Feel free to draw the item to illustrate what triggered the memory.

A:_____

B:_____

C:_____

D:_____

E:_____

What in the item cued 'the memory'?

10) Can you give a (short) description of the item?

_____

_____

11) Could you describe the place where the item normally is located? If the item does not have a fixed location, or the location has changed recently, I would also be glad to hear more about that.

_____

_____

12) Can you describe what you normally do with this item? For example, how often do you encounter it, in what activities is it involved, is it a private item or available for anyone else to see, etc.

_____

_____

Please continue interacting with the item as if the item was not part of this study.

13) Could you please take a photo of the item on its original location? Take the photo from a little distance, so the environment of the item is in the picture too.
You can email it to me on annemarie.f.zijlema@student.uts.edu.au.
If the item is already digital and you can copy the original, you do not need to take a photo. Include a print screen of the folder location if possible.

Thank you very much, you completed all the questions for this item! You can now continue with the next item. If you are done, you can put the cards in the envelope and return it to us.

Instructions selecting three items for the research project: memories cued by personal items

How do you select the right items? We have a couple of requirements for items you can include in this study. Please read the requirements on this page first. On the back of this page you will find a short instruction on how to get started.

A) Pick something from your personal environment
You can pick any type of item currently present in your home or carried with you. We are studying memory cuing in people's personal environment, where they come across items every day that potentially evoke memories. For this study we would like you to select items that are located in your personal space. For example in your own home, garage etc, or your handbag. They do not necessarily need to be your own items; perhaps they belong to a family member. The item is suitable as long as it evokes memories to you, and if it is likely the item will still be around after a year.

B) Select 3 items, and at least 1 digital and 1 physical
The items you select can be a variety of things. For example utensils, souvenirs, self-made items, gifts, photos, documents, clothes, electronics, books etc. We would prefer to have one digital item and one physical. A digital item could be anything currently on an electronic format, such as digital photos, videos, documents, presentations, emails, e-books etc. Physical items are the general things around us, such as printed photos, mugs, diplomas etc. The number of items to include is three and preferably they refer to different events (not all referring to your high school period, or all referring to the same holiday).

C) Select items that evoke multiple memories
The three items you select should currently evoke more than one memory. You may have never thought about items in this way, but it is probably easier than you think. We will ask you to look at an item (and depending on the object perhaps you want to hold it, listen to it, smell it etc.) for 5 to 10 seconds and observe what comes to mind. Two or more memories? Then it is suitable for this study. One or even zero memories? Then try another item.
You can discern one memory from the other if they happen at another *time* (e.g. another day) and/or at another *location*. For example, "it reminds me of the castle and the tour we did. We also had lunch at the café there" (castle, tour, and lunch is 1 memory). "It also reminds me of the time we went to see the movie Dracula. The children found the movie a bit scary" (another memory). In this case, both time and location differed.
The previous examples are very specific memories about singular events. But a more general memory, "it reminds me of my grandma", is also fine, as well as longer periods such as "my time at university" and repeated events, such as "going to pub x after class". They all count as separate memories.

D) Select a singular item rather than a composite
We prefer to have one singular item at a time. For example, a single photo rather than an album full of photos. It is not a problem if the photo is part of a collection, as long as you are able to identify the photo another time in the research again. The same counts for other objects you have more than one of, like fridge magnets, or clothes. If a photo frame contains two or three photos, it is ok to take the whole photo frame as one item, or a charm bracelet that contains of different charms as one item. But in the case of collections (e.g. albums) we prefer you to select one item.

Ethics approval for this study has been granted by the UTS Human Research Ethics Committee (no. 2015000581)

Instructions on how to select suitable items for this study

Have you read the information on the other side? Than you are ready to begin!

1. Pick an item that (potentially) evokes a memory for you. You can look at shelves, look in boxes, drawers, cupboards, and walk into different rooms (for inspiration of items and places, see A and B)
2. Look at it for 5-10 seconds. Depending on the object, you may also want to hold it, smell it, listen to it, browse through it, etc.
3. What comes to mind? Quickly jot it down on a piece of paper (not on the cards yet!).
4. Look at what you just wrote down, did the item evoke 2 or more memories? (see C) No? Pick another item and try again.
5. Is it one singular item? (see D) If yes, you found a suitable item!

Repeat this until you have 3 items. At least 1 needs to be digital and 1 needs to be physical (see D).

You can now proceed with filling out the cards for each selected item. Please include what you wrote down at question 3 on the card in the same order it came to mind. If more memories have come to mind in the meanwhile, you can fill them in too. Any doubts or questions? Feel free to send a text message, call us, or email us:

Ethics approval for this study has been granted by the UTS Human Research Ethics Committee (no. 2015000581)

Rationale behind the questions and tasks on the questionnaire cards

Question 1 to 5 contain questions about the cued responses and the cuing process. The first question asks what comes to mind when they saw the item. This was a major question for this study and was asked to collect data on cued responses and to be able to compare them over time. Question 3 asked whether the response was cued by the item, the previous memory (cued response) or whether they did not know. We were interested in this because we may understand more about the cuing process if we gained knowledge on the patterns of external cues (the items) and internal cues (the previous cued response) when being cued by the item. Question 5 asked how specific the memories were. Four of the multiple choice answers are taken from Raes et al. (2007), that overlap with the cued response type 'knowledge' response and 'episodic memory' response (see Chapter 4). The four answers taken from Raes et al. describe the definitions of specific memory (one specific moment or a particular time), categoric memory (a repeated activity or a category of similar events without the specification of a particular time), and extended memory (an extended period of time which lasted longer than a day), and semantic associate (a person, animal or thing without remembering a specific moment or a particular time). These options were complemented with a category found in the research described in Chapter 4, a feeling, thought, or reflection based on a memory, and with 'none of the above fit for what I wrote down'. We asked this question because it would be interesting to see if certain types of cued responses are more persistent over time, and the type of cued response would be hard to judge from the limited text in question 1. Other questions (question 2 and 4) were asked to collect information about the cuing process and may explain how the cuing happened.

Question 6 to 8 were asked to place the cued events (if the cued responses were about remembered events) in a context, by asking the participants to fill in a timeline. For example when the events happened (question 1), when it started cuing (question 7), and whether any other related events happened (question 8). We realised that question 7 may be difficult to answer, but nevertheless we were interested in what participants thought was the moment it started cuing the particular cued response.

Question 9 to 13 were asked to collect data on the item and its location. Question 9 was asked to gain an understanding of what in the item cued the response. Question 10 differed among the three phases. In phase 1 question 10 asked for a description of the item. This would allow the researcher to interpret other answers in the questionnaire. It was not necessary to ask this question again in phase 2 and 3, and therefore this question was replaced by a new question. In phase 2 and 3, question 10 asked participants to open a red (phase 2) or green envelope (phase 3) and to compare their answers in question 1 with the answers they gave in the previous phase. They were asked if there were any differences and

if they could explain why the cued responses had changed. Question 11 and 12 asked the participant about the current location and behaviour of the item. In the phase 2 and 3 the answers from the previous phase were prefilled, and the participants were asked if the situation was still the same. In all phases the participants were asked to take and send a photo of the item (question 13). This question was repeated for all phases to observe any differences, even if the participant had not mentioned any changes.

APPENDIX 2 QUESTIONNAIRE CARDS AND INSTRUCTIONS PHASE 2

Your name: Mark Darcy Item title: Christmas reindeer sweater Current date: DD – MM – YYYY

1) Please find the item that you see on the top of this card, 'after item title'. Can you describe what comes to mind when you see the item? Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind. If it is only one memory that comes to mind, that is fine too. Start each new memory at a different letter.

A:

B:

C:

D:

E:

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

Phase 2

2) Do you think there is a reason why they came to mind in this order? If so, could you explain?

3) Sometimes a memory pops up that is not cued by the item, but cued by the previous memory. If you look at the memories you described, are all the memories cued by the item? Or are some cued by the previous memory? Please circle your answer for each memory:

A: item / memory / do not know D: item / memory / do not know
B: item / memory / do not know E: item / memory / do not know
C: item / memory / do not know

4) Some memories may involve more mental effort than others to be retrieved. How easy do the memories you just described come to mind? Please indicate with a letter (corresponding to the memory in question 1) on the scale where each memory is placed. If they are all the same, please write the letters on top of each other.

low effort high effort

5) How specific was the memory that came to mind? Please write down the letter from question 1 at the description where it fits best. Pick one description for each memory. It is ok if multiple memories (or all) fit in the same description. *What I wrote down refers to...*

- One specific moment or a particular time: _____ (A, B, C, etc.)
- A repeated activity or a category of similar events without the specification of a particular time: _____ (A, B, C, etc.)
- An extended period of time which lasted longer than a day: _____ (A, B, C, etc.)
- A person, animal or thing without remembering a specific moment or a particular time: _____ (A, B, C, etc.)
- A feeling, thought or reflection based on a memory: _____ (A, B, C, etc.)
- None of the above fit for what I wrote down: _____ (A, B, C, etc.)

6) Below you will find a timeline. Could you please point on the timeline when the remembered event took place? You can use the letters from question 1 and use the upper row to fill them in. If the memory is not from an event (for example to a person) or you do not know when it took place, you can leave out the letter.

7) We are interested in when the item started cuing this memory. Do you have any idea when this connection was established? If so, please fill in the letters in the second row.

8) Did any other relevant events happen related to the item/remembered events? If so, please fill them in in the third row.

6) remembered events (A, B, C, etc.)

7) item began to cue the memories (A, B, C, etc.)

8) relevant events related to the item/events

..... **(please fill in)** **now**

Check: did you fill in a point of time at the start of the timeline? For example, year 2002 till now.

9) It could be that the memory that came to mind was cued by a specific aspect of the item. For each memory (A, B, C etc.), could you please pinpoint what aspect of the item cued the memory? For example something specific: namely …. , something generic: …., everything or perhaps you do not know. Feel free to draw the item to illustrate what triggered the memory.

A:_____

B:_____

C:_____

D:_____

E:_____

What in the item cued the memory?

After you have completed the first 9 questions, you can open the red envelope with the name of this item on it and compare your memories from 5 months ago to your current memories in question 1.
It could be that you gave exactly the same answers as the previous time. It could also be that the memories changed, or the order of the memories changed. Both situations are ok.

10) Do you see any changes in your memories compared to the previous session? Can you think of anything that could explain the difference? If you do not know, that is ok too.

_____

_____

_____

11) Five months ago you said this was the location of the item: *"In my wardrobe."* Is the location still the same for this item? If the location has changed in the mean time, we would be glad to hear more about that.

_____

_____

12) Five months ago you told us that this is what you normally do with this item: *"I sometimes see it when looking for something in the wardrobe. I wear it once a year, at Christmas."* Is this still the case? If not, please explain what has changed.

_____

_____

13) The previous time you sent us a photo of the item on its original location. We would like to ask you to do this again. Also if the item did not change in its appearance and it is still at the same location. So, could you please take a photo of the item on its original location? Take the photo from a little distance, so the environment of the item is in the picture too. You can email it to me on (annemarie.f.zijlema@student.uts.edu.au). If the item is digital, please include a print screen, a photo, or a description of the folder location if possible.

Folder location:_____

Please continue interacting with the item as if the item was not part of this study.

Thank you very much, you completed all the questions for this item! You can now continue with the next item. If you are done, you can put the cards and the piece of paper with your memory description from the previous session in the envelope, and return it to us.

TU/e Technische Universiteit Eindhoven University of Technology

UNIVERSITY OF TECHNOLOGY SYDNEY

Sydney, April 2016

Subject: Study 'memories cued by personal items' (UTS HREC approval reference 2015000581)

Dear [name],

Approximately five months ago you participated in the study **'memories cued by personal items'** and returned the three cards for the first session. We would now like to invite you for the second session.

In this envelope you will find the following documents:

- 3 cards with questions and tasks
- 3 red envelopes with the name of the item (do not open the envelope until you have answered question 9)
- A return envelope (addressed to the University of Technology Sydney)

We would like to ask you to fill in the cards for the same items as you did the previous time. On each card, you will find your name and the title of the item. Have you forgotten which item it was? No problem. Contact Annemarie Zijlema and tell her the title of the item. She will provide more information from your previous session to help you to identify the item.

The deadline for returning the cards is two weeks after you receive the cards. Please also include the envelopes and their content. You can use the return envelope for returning the material. If you can no longer find the return envelope, you can send the material to the following address:

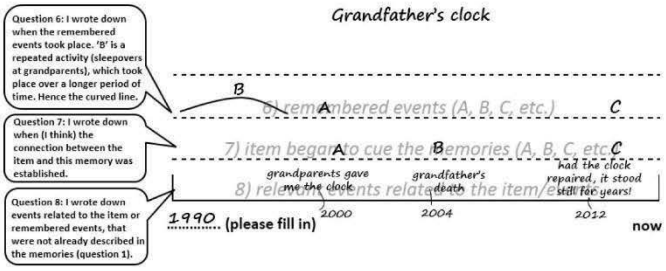
University of Technology Sydney
Faculty of Engineering and Information Technology (FEIT)
School of Software
Attn: Prof Elise van den Hoven
CB11.07.212
PO box 123
Broadway NSW 2007

This time we will not have a meeting to go through the questions, as we did for the first session, so instead there are a few things I would like to draw to your attention:

Question 1: In this question we ask you to write down the memories that come to mind when you see the item. Please write a description of what comes to mind, for example in a few sentences (rather than a few keywords).

Question 5: We ask how specific the memory is that came to mind. You can select for each memory one category. The specificity is leading when choosing a category. For example, if the memory describes a specific moment and involves a person, then choose the first category (not the fourth). The same applies if the memory involves feelings (not necessarily the fifth category).

Question 6, 7, and 8: The timeline questions. We would like to mention that the questions apply to the whole period you have memories related to this item, so not just the last five months. The timeline may be hard to interpret. I have therefore pasted an example below with additional explanation in the callouts:



It may be that question 6 is hard to answer, for example because the memory is broad and not from a specific time. Feel free to estimate the time with curves or dotted lines. If a memory did not happen at a certain time (e.g. remembering a person you have known your whole life), you can leave the letter out.

It might be that some questions come to mind while filling in the questions, or some questions on the cards are not clear to you. You can always, at any time of the day, contact us. You can contact us via the following channels: email annemarie.f.zijlema@student.uts.edu.au (I can also call you back), text or telephone + for Whatsapp. The main researcher (Annemarie Zijlema) will respond to this as soon as possible.

We wish you all the best and hope you will enjoy participating in this study!

With kind regards,

Production Note:
Signature removed prior to publication.

Annemarie Zijlema MLISc.
PhD candidate at the University of Technology Sydney
& PhD candidate at the Eindhoven University of Technology (joint PhD)

APPENDIX 3 QUESTIONNAIRE CARDS AND INSTRUCTIONS PHASE 3

Your name: Amélie Poulain Item title: Father's garden gnome Current date: DD – MM – YYYY

1) Please find the item that you see on the top of this card, 'after item title'. Can you describe what comes to mind when you see the item? Please write down all the memories that are being cued by the item. Also write them in the order that they came to mind. If it is only one memory that comes to mind, that is fine too. Start each new memory at a different letter.

A:

B:

C:

D:

E:

Perhaps some memories will come to mind after you have completed question 1. It is perhaps tempting to fill them in, but please do not include them. We are exclusively interested in the memories this item cued right away.

Phase 3

2) Do you think there is a reason why they came to mind in this order? If so, could you explain?

3) Sometimes a memory pops up that is not cued by the item, but cued by the previous memory. If you look at the memories you described, are all the memories cued by the item? Or are some cued by the previous memory? Please circle your answer for each memory:

A: item / memory / do not know D: item / memory / do not know
B: item / memory / do not know E: item / memory / do not know
C: item / memory / do not know

4) Some memories may involve more mental effort than others to be retrieved. How easy do the memories you just described come to mind? Please indicate with a letter (corresponding to the memory in question 1) on the scale where each memory is placed. If they are all the same, please write the letters on top of each other.

low effort high effort

5) How specific was the memory that came to mind? Please write down the letter from question 1 at the description where it fits best. Pick one description for each memory. It is ok if multiple memories (or all) fit in the same description. *What I wrote down refers to...*

- One specific moment or a particular time: (A, B, C, etc.)
- A repeated activity or a category of similar events without the specification of a particular time: (A, B, C, etc.)
- An extended period of time which lasted longer than a day: (A, B, C, etc.)
- A person, animal or thing without remembering a specific moment or a particular time: (A, B, C, etc.)
- A feeling, thought or reflection based on a memory: (A, B, C, etc.)
- None of the above fit for what I wrote down: (A, B, C, etc.)

6) Below you will find a timeline. Could you please point on the timeline when the remembered event took place? You can use the letters from question 1 and use the upper row to fill them in. If the memory is not from an event (for example to a person) or you do not know when it took place, you can leave out the letter.

7) We are interested in when the item started cuing this memory. Do you have any idea when this connection was established? If so, please fill in the letters in the second row.

8) Did any other relevant events happen related to the item/remembered events? If so, please fill them in in the third row.

6) remembered events (A, B, C, etc.)

7) item began to cue the memories (A, B, C, etc.)

8) relevant events related to the item/events

..... (please fill in) **now**

Check: did you fill in a point of time at the start of the timeline? For example, year 2002 till now.

9) It could be that the memory that came to mind was cued by a specific aspect of the item. For each memory (A, B, C etc.), could you please pinpoint what aspect of the item cued the memory? For example something specific: namely .... , something generic: ...., everything or perhaps you do not know. Feel free to draw the item to illustrate what triggered the memory.

A:_____

B:_____

C:_____

D:_____

E:_____

What in the item cued the memory?

After you have completed the first 9 questions, you can open the green envelope with the name of this item on it and compare your memories from 5 months ago to your current memories in question 1.
It could be that you gave exactly the same answers as the previous time. It could also be that the memories changed, or the order of the memories changed. Both situations are ok.

10) Do you see any changes in your memories compared to the previous session? Can you think of anything that could explain the difference? If you do not know, that is ok too.

_____

_____

_____

11) Two and a half months ago you said or confirmed this was the location of the item: *"it is normally located my father's garden, although sometimes it travels over the world."* Is the location still the same for this item? If the location has changed in the mean time, we would be glad to hear more about that.

_____

_____

12) Two and a half months ago you told or confirmed us that this is what you normally do with this item: *"I see it once a week when I visit my father."* Is this still the case? If not, please explain what has changed.

_____

_____

13) The previous time you sent us a photo of the item on its original location. We would like to ask you to do this again. Also if the item did not change in its appearance and it is still at the same location. So, could you please take a photo of the item on its original location? Take the photo from a little distance, so the environment of the item is in the picture too. You can email it to me on (annemarie.f.zijlema@student.uts.edu.au). If the item is digital, please include a print screen, a photo, or a description of the folder location if possible.

Folder location:_____

Please continue interacting with the item as if the item was not part of this study.

Thank you very much, you completed all the questions for this item! You can now continue with the next item. If you are done, you can put the cards and the piece of paper with your memory description from the previous session in the envelope, and return it to us.

TU/e Technische Universiteit Eindhoven University of Technology

UNIVERSITY OF TECHNOLOGY SYDNEY

Sydney, July 2016

Subject: Study 'memories cued by personal items' (UTS HREC approval reference 2015000581)

Dear [name],

Approximately two and a half months ago you returned the cards for the second session of the study **'memories cued by personal items'**. Thank you very much for your response. We would now like to invite you for the third, and last, session.

The content of this envelope is very similar to the previous session. In this envelope you will find the following documents:

- 3 cards with questions and tasks
- 3 green envelopes with the name of the item (do not open the envelope until you have answered question 9)
- A return envelope (addressed to the University of Technology Sydney)

Just as the previous time, if your first language is Dutch, you can answer the questions in Dutch. If you have doubts about which item it was that is printed on the card, you can contact Annemarie Zijlema, and she will help you to identify the item. If the item is not available anymore, you do not need to fill in the card. At the back of this letter, you find some additional information that might be helpful to you when filling in the cards.

The deadline for returning the cards is two weeks after you receive the cards. You can use the return envelope for returning the material. If you can no longer find the return envelope, you can send the material to the following address:

University of Technology Sydney (UTS)
Faculty of Engineering and Information Technology (FEIT) - School of Software
Attn: Prof Elise van den Hoven
CB11.07.212
PO box 123 Broadway NSW 2007

If you have any questions or anything is unclear to you, you can contact us via the following channels: email annemarie.f.zijlema@student.uts.edu.au (I can also call you back), text or telephone +61416363626 or +31621938263 for Whatsapp. The main researcher (Annemarie Zijlema) will respond to this as soon as possible.

After returning the material, we will write to you one more time, to thank you for your participation and give you a small token of appreciation. We wish you all the best and hope you will enjoy participating in this study!

With kind regards,

Production Note:
Signature removed prior to publication.

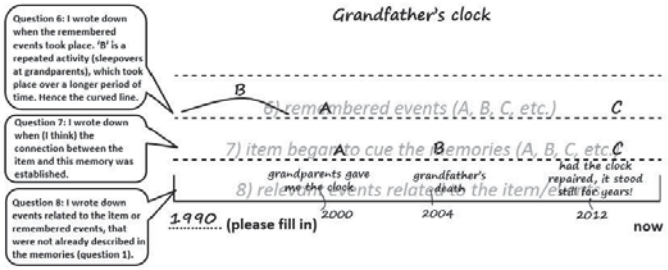
Annemarie Zijlema MLISc.
PhD candidate at the University of Technology Sydney
& PhD candidate at the Eindhoven University of Technology (joint PhD)

Additional explanation of some of the questions on the cards

Question 1: In this question, we ask you to write down the memories that come to mind when you see the item. Please write a description of what comes to mind, for example in a few sentences (rather than a few keywords).

Question 5: We ask how specific the memory is that came to mind. You can select for each memory one category. The specificity is leading when choosing a category. For example, if the memory describes a specific moment and involves a person, then choose the first category (not the fourth). The same applies if the memory involves feelings (not necessarily the fifth category).

Question 6, 7, and 8: The timeline questions. We would like to mention that the questions apply to the whole period you have memories related to this item, so not just the last five months. The timeline may be hard to interpret. I have therefore pasted an example below with additional explanation in the callouts:



It may be that question 6 is hard to answer, for example because the memory is broad and not from a specific time. Feel free to estimate the time with curves or dotted lines. If a memory did not happen at a certain time (e.g. remembering a person you have known your whole life), you can leave the letter out.

APPENDIX 4 COMPLETION TIME FOR THE LONGITUDINAL STUDY

participant #	months between phase 1 and 2	months between phase 2 and 3	total completion time*
P01	6	3	9
P02	6	2 ½	9*
P03	6 ½	4	10 ½
P04	7	4	11
P05	10 ½	4	14 ½
P06	5 ½	3 ½	9 ½*
P07	5 ½	3	9*
P08	5 ½	3 ½	9
P09	4 ½	3	7 ½
P10	7	5	12
P11	5 ½	3 ½	8 ½*
P12	6	2 ½	8 ½
P13	5 ½	3	8 ½
P14	5 ½	3	8*
P15	6 ½	2 ½	9
P16	5	5 ½	10 ½
P17	7 ½	5	12 ½
P18	8	3 ½	12*
P19	7	4 ½	11*
P20	6	5	11
AVERAGE	6 ½	3 ½	10

* Total completion time was calculated by subtracting the fill in date of phase 1 from phase 3 (number of days divided by 30.42), not by adding up the second and third last columns. In some cases (e.g. P02 and P06) the rounding off results in different numbers than the previous two columns combined.

APPENDIX 5 SEMI-STRUCTURED INTERVIEW QUESTIONS FOR REPAIRED OBJECTS AND TRACES STUDY

All interviews started with an introduction to the research, the interview, and the code of conduct. A consent form was signed before the start of the interview. The interviews were semi-structured, and the interviews were flexibly adjusted towards the profession or object and the time available.

Questions for the interview with the repair professional

Introduction to their profession

- Can you explain what you do in your work?
- How did you came to start working in this profession?
- For how many years have you been working as a renovator/restorer/ … professional?

Objects

- What are the objects you repair or restore? Can you tell me about them?
- As I explained to you in the introduction, I am interested in traces of use and ageing. In what way do you notice that the objects you work with are not new anymore? What kind of traces can be seen?

Motivation/meaning of the objects

- When someone asks you to repair an object, what is the motivation for customers to bring the object?
- In these cases, what makes the object important for the customer?

The relationship with the object

- When a customer asks you to renovate an object, what do you normally discuss with the owner, if they come with an object for the first time? What would you say is most important to find out?
- What kind of traces of ageing and use, or damage of the objects do you restore?
- Do you sometimes keep the traces? Why do you do this? Why would the customer prefer this?

- Do you have examples of situations in which traces had a special meaning for the owner? Cases in which the damage was important for them?
- What is acceptable to change to an object? For example, is it acceptable to change material? Or colour? Where is the limit?
- Do you think the owners have memories attached to the objects? Can you give me examples?
- Do you think traces play a role in remembering? Would it matter if you would remove the traces entirely?
- Has it ever happened that a customer was disappointed by the result after renovation? Why?
- Can you tell me something about your best succeeded reparation? Why was this?
- We are almost done with the main questions. Is there a question I forgot to ask you? Something that you think is relevant for me to hear about?
- [Do you think some of your customers would be willing to participate in this research?]

Closure

- Are there any photos I have taken which you do not want me to use?
- Thanks a lot for your participation.

Questions for the interview with the owner of the repaired object

Introduction

- Can you tell me about this object and its history?
- Where is it from?
- Where is it normally located in your house? Has this always been the location?
- How has it been used?

Cuing and object properties

- What comes to mind if you look at this item?
- What in the object cues these memories or associations?
- What are the object properties that you value in this item?
- What are the object properties you do not value in this item?
- Do you normally touch it? Why do you (not) touch it?
- Does the item smell or make a sound? Can you describe it?

- What modalities, visual, auditory, tactile, olfactory, perhaps gustatory or kinaesthetic (e.g. movement), are most important to you in relation to the memories and associations you have with the item? Can you explain why?
- Does the item have meaning for other people as well? If so, who?

Traces and use

- Why was it brought for repair? / Why was it repurposed?
- Often objects have traces of ageing and use. Does your object have any?
- What do the traces on the object mean to you?
- What did you decide to repair/ reuse?
- Did you keep anything as it is? Can you tell me why?
- What are acceptable changes to you?
- Has the meaning of the object changed to you, after repair? How?
- What do you think will happen with this object in the future?

Closure

- Are there any photos I have taken which you do not want me to use? / do you mind if I use your photo for research purposes?
- Thanks a lot for your participation.

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PUBLICATIONS BY ANNEMARIE ZIJLEMA

Related to this thesis

Journal publication

Zijlema, A., Van den Hoven, E. & Eggen, B. 2017, 'A qualitative exploration of memory cuing by personal items in the home', *Memory Studies,* ahead of print, pp. 1-21.

Conference publications

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The above mentioned paper with Kloosterboer and De Groot was also published as a book chapter:

Kloosterboer P., De Groot, G. & **Zijlema, A.** 2015, 'Toekomst ontsluiten, verleden insluiten'. *Adviseren vanuit het geheel: De vitale waarde van intern advies.* Vakmedianet, pp. 227-258.

BIOGRAPHY

Annemarie Zijlema was born on 17 January 1983 in Hoogezand-Sappemeer, the Netherlands. In 2004 she completed her bachelor in Information Services and Management at the Hanzehogeschool Groningen, the Netherlands. As part of her bachelor program, she spent a semester at the faculty of Information Studies at the University of Sheffield, United Kingdom. Annemarie obtained a two-year international master degree from the Royal School of Library and Information Science in Copenhagen, Denmark (now University of Copenhagen). She graduated with a thesis on the topic of users' search behaviour from a cognitive perspective. After completing her studies, she worked five years in the field of communication and information, first as a trainee at the European Commission, and later at the ministry of the Interior and Kingdom Relations in the Netherlands. Next to her job, she studied psychology at the Open University, which she ended to start her PhD. In 2013 she began her degree in Australia in the joint PhD program of Materialising Memories at the University of Technology Sydney (UTS), Australia (until April 2016 at the school of Design and from April 2016 onward at the school of Software) and Eindhoven University of Technology (TU/e), the Netherlands (faculty of Industrial Design). Also, she was involved in education at UTS as tutor, supervisor, and curriculum developer during her PhD. This thesis is the result of her PhD research on the topic of personal possessions as cues for autobiographical remembering.