The Palgrave Encyclopedia of Memory Studies

Human-Computer Interaction Research on Memory Technologies

A. Author's name and details (affiliation, city, country with e-mail address).

Prof Dr Elise van den Hoven MTD [1,2,3] - Professor of Human-Computer Interaction - *corresponding author*

1. Interaction Design Discipline and Visualisation Institute, Faculty of Engineering and IT, University of Technology Sydney, Sydney, Australia, elise.vandenhoven@uts.edu.au
2. Department of Industrial Design, Eindhoven University of Technology, Eindhoven, the Netherlands, e.v.d.hoven@tue.nl
3. Duncan of Jordanstone College of Art and Design, University of Dundee, Dundee, UK, evandenhoven@dundee.ac.uk - *honorary professor*

Prof Dr Corina Sas - Professor in Human-Computer Interaction and Digital Health[1]

1. School of Computing and Communications, Lancaster University, Lancaster, UK

B. Synonyms (Like Keywords)

Human-Computer Interaction, Interaction Design, Memory Technologies, User Experience, Design Research

C. Abstract

Many remembering activities nowadays include technology, such as a phone used to take and view photos, a laptop with a file structure or search engine to help find documents, and a social media app to post and share messages to represent someone's identity. In Human-Computer Interaction and related fields more and more research goes into learning how to design for remembering. This chapter will be divided into two parts, the first will focus on motivations to study design for remembering (the WHY), where the second part will focus on how design for remembering using memory technologies can support people (the HOW).

D. Introduction

The field of Human-Computer Interaction (HCI) studies people interacting with technology and how to translate this knowledge into good design. This multidisciplinary field combines, amongst others, computer science, behavioral sciences, and design. Human memory has been studied from early in the history of HCI, first through the lens of human factors and cognitive ergonomics (Bannon, 1991), which meant a specific focus on analyzing human behavior and cognitive abilities. e.g., one of the ten usability heuristics for user-interface design (Nielsen, 1994) recommends to reduce a user's cognitive load by designing systems to support recognition instead of recall, thereby focusing on the function of memory, especially the unburdening of working and short-term memory.

With HCI research developing over time into three waves from usability and groupwork to user experience (Bødker 2006, 2015, Harrison et al. 2007, 2011), human memory also became of interest to HCI from a user experience perspective. This research focuses on individuals' experiences with technology, not only people's responses to a system, but also providing input (e.g., through user research, co-design and participatory design or evaluations) into newly designed prototypes of systems that aim to support people's remembering practices. These systems often focus on the activity and/or practice of remembering of episodic and autobiographical memories.

In this entry memory technologies are physical devices with embedded electronics that respond to people's actions (*interactivity)*, which are designed to support people's memory and/or remembering practices, or memory supporting applications to be used on generic devices, such as phones and laptops. This chapter will also provide some illustrative examples.

E. The Why and How of Designing Memory Technologies

The term memory in this chapter refers to human memory, unless explained otherwise autobiographical and episodic memory (see Entry Autobiographical Memory), and we distinguish both internal and external remembering (van den Hoven, 2014) as different parts of the human remembering experience. The distinction between the two is that *internal* remembering occurs without any influences from outside the brain, while *external* remembering can include components such as physical objects and devices, people, and places. Sutton et al. (2010) call the latter distributed-scaffolding cognition (see Entry Distributed Memory). Finley et al. (2018) make a slightly different and more straightforward distinction between internal and external memory, where their *internal* refers to information stored inside a person's brain and *external* is information outside of the brain. While these distinctions have been made on several occasions, the boundaries are quite fluid and in one remembering process one can easily experience both.

Any technology used in relation to memory and remembering has the potential to serve as external memory and support for external remembering, for example, seeing the icon for a calendar app on an interactive device can make someone remember a conversation that ended in agreeing to meet up, and the app reminded them of the need to add this into their calendar. This is called *cued* remembering, and the remembering process that HCI research has often focused on by involving *external* memory cues, which are "physical or digital cues in a tangible embodiment with an internal effect" (van den Hoven & Eggen, 2014). This internal effect caused by a cue in a certain environment can bring to consciousness a memory (Tulving and Thomson, 1973).

Before going into more detail on how to design for memory cuing, first let us investigate the motivations for researching memory technologies.

The Why: Motivations for designing memory technologies

For autobiographical memory (see Entry Autobiographical Memory) its functions are quite well understood and have to do with the self, social, directives (Bluck & Alea, 2002; Bluck et al., 2005) and adaptive functions (Pasupathi & Carstensen, 2003; Williams et al., 2008). HCI is a people-focused field, and the motivations for designing technologies are those that benefit the people who - now or in future - might use such memory technologies. In that context, often the 5R's are listed to summarize the value of memory for people (Sellen & Whittaker, 2010): Recollecting, Reminiscing, Retrieving, Reflecting and Remembering intentions.

In the following sections we present three motivation categories that include these functions and values 1 - functional process support; 2 - memory performance augmentation; and 3 - emotional experience facilitation. Each of these motivations will be illustrated with a set of interactive memory technologies, aimed to show the different approaches, albeit not exhaustive. We also note that some of these technologies can be used across motivations, for example with different use groups and in new settings.

1. Functional process support

An important motivation to study memory technologies is to understand and support the functional retrieval process of information from memory through a process involving technology now or in the future. With the move from predominantly physical memory media to digital, we need technology to create, access, edit, retrieve, or re-experience our memory media. By memory media we mean any type of medium that is user created or accrued and is relevant to their personal memories, e.g. photos (see Entry Photography), documents, souvenirs, videos, concert tickets, social media posts, heirlooms, streaming media histories, location or health tracking information and more. Different manners in which these personal possessions can relate to personal memories have been identified (van den Hoven et al., 2021), which is relevant for memory technology design.

HCI research includes studies to understand people's experiences with remembering practices and memory technologies in everyday life (when research aims to inform design practice, this is called research for design, or RfD, Frayling, 1993), where other studies aim to lead to a new or improved design of memory technologies (when design action is used in research, this is called research through design, or RtD, Frayling, 1993). Examples of research for design into people's remembering experiences include the study of different memory media, such as photos (e.g. Broekhuijsen et al., 2017; Petrelli et al., 2014), physical artefacts (e.g. Kirk & Sellen, 2010;

Petrelli et al., 2008, Zijlema et al., 2017), sounds (e.g. Dib et al., 2010) and personal quantified data (e.g. Elsden et al., 2015). Other RfD studies focus on specific remembering activities, such as reminiscing (van Gennip et al., 2015), the use of physical and digital mementos (Petrelli & Whittaker, 2010) or for specific purposes, such as recording memories for posterity (Lindley, 2012) and for finding out which memories become valuable (Mols et al., 2014). Research *through* design includes studies that use design or designing as part of the research process, such as studies looking into how everyday life remembering can be supported through newly designed systems, such as text-based Pensieve (Cosley et al., 2012), physical artefact-focused Living Memory Box (Stevens et al., 2003), sound-based FM Radio (Petrelli et al., 2010) and photo-based (e.g. the Audio Photo Desk: Frohlich & Fennell, 2007; 4Photos: O'Hara et al., 2012; and Digital Photo Browser, van den Hoven & Eggen, 2008). RtD can also include research participants' designs, such as a study into family-created time capsules to study what future technology should support (Petrelli et al., 2009).

To summarize, a substantial body of work in memory technologies in HCI aims to support people's existing remembering processes and capacities, focusing on improving or redesigning either memory media or remembering activities.

2. Memory performance augmentation

Aside from memory technologies supporting the remembering process, a popular motivation to study memory technologies has been to improve people's memories, from reducing cognitive load, as mentioned earlier, to supporting people with health-related memory challenges, to compensating for human memory's perceived imperfections. Most people are aware that their memories are fallible, and they assume that this needs fixing, for example by aiming to prevent forgetting.

The research into memory augmentation goes all the way back to Bush (1945), who proposed the Memex, a device that looked like a desk and could contain lots of records and communications to supplement personal memory. Early work on lifelogging (for an overview, see O'Hara et al., 2008) was inspired by technological possibilities and had been based on the assumption that recording as much as possible would enhance human memory by avoiding forgetting. This problematic assumption led to the critique that lifelogging research needs to focus on understanding human memory first (Sellen & Whittaker, 2010). Since then, more considerate lifelogging work has been published in HCI (e.g. Elsden et al., 2015; O'Hara et al., 2008), for example one memory technology that does not assume that recording improves memory is Ritual Camera: a device that automatically photographs dinner table settings every evening for a 14-day period. These photos are then used to create digital media in the form of visualizations that highlight the differences to support everyday life reflection and remembering (Mols et al., 2016). Based on empirical observations of people using memory technologies four design principles have been identified for new types of lifelogging systems that better support human memory (Whittaker et al., 2012). These principles relate to selection, embodiment, reminiscence and reflection and synergy not substitution.

Before-mentioned example studies were all aimed at people with healthy memories, but a lot of research has been done to support those with memory challenges (see Entry Dementia). For example, certain applications of lifelogging turned out to be beneficial to people living with dementia (PLWD) and their carers (Crete-Nishihata et al., 2012, van Rijen et al., 2020).

After many decades of memory technologies being developed based on incorrect assumptions of how human memory works, recently this has seen a shift.

3. Emotional experience facilitation

This third motivation is a more recent trend and not aimed at improving human memory, instead the focus is on the emotional and experiential side of remembering (see Entry Emotions) and how to facilitate these experiences using memory technologies.

This includes a wide range of applications (RtD), such as to support mourning the loss of a loved one, e.g. StoryShell (Moncur et al., 2015), to support oral storytelling for indigenous communities, e.g. StoryBeads (Reitsma et al., 2013), to support a social remembering experience, e.g. through Pipet (Meerbeek et al., 2010), but also to support sentimental remembering using audio for PLWD (Campbell et al., 2019). The experiential side of studying memory technologies now even has a bespoke method in HCI and design, which is called Memory probes (Tsai & van den Hoven, 2018), which allows participants to express their valuable memories by recording traces of use on their cherished objects. Designing for meaning includes remembering and memories as one of the main reasons to provide meaning to objects, which in turn can give insights into how to design objects to have a link with memories (Orth et al., 2018).

The next section will also include relevant examples about each of these types of motivations and in particular those studies focusing on the creation or use of memory cues.

The How: Remembering through cues

This section provides an overview of the different cues supported by memory technologies and their different modalities stimulating users' senses, primarily sight and hearing. It also discriminates between internal and external cues, as well as automatically or manually captured as well as crafted cues. Such cues are intended to support recall of episodic or autobiographical memories for both healthy adults and for memory impairment due to ageing or dementia, although emerging work has started to focus also on other impairments such as those experienced by people living with depression (Qu et al., 2019), or on other memory processes beside recall, namely forgetting, and how these can be also supported by novel forms of memory technologies.

Given the ability of technologies such as smartphones and lifelogging devices to capture "here and now" experiences, it is not surprising that much HCI research on memory has focused on how such technologies capture cues for episodic recall (Sellen et al., 2007). Such cues can be both external, capturing the external physical environment, but also internal when they capture people's emotional experiences (van den Hoven & Eggen, 2015). External cues reflect people, objects, places or activities and have been often captured through photos (Sellen et al., 2007) (see Entry Photography), audio recordings (Dib et al., 2010), as well as objects (Petrelli et al., 2008) such as memory boxes integrating sound and smart objects (Frohlich & Murphy, 2000). Consistent findings have shown powerful emotional recall from pictures and videos (Finley et al., 2018). A landmark example of memory technology capturing external cues is SenseCam (Harper et al., 2007), a wearable device for automatic caption of over 1000 photos per day, whose value for supporting episodic recall in dementia has been indicated by a rich body of work (Lee and Dey, 2007). We have also seen emerging work aiming to summarize the large number of photos captured through lifelogging devices such as wearable cameras, with findings showing that such video summaries are perceived as more attractive and valuable memory aids (Viet Le et al., 2016).

If external cues capture contextual details of the external environment, internal cues capture internal aspects of the experience such as emotional arousal whose importance for organizing episodic memories has been long acknowledged (see Entry Emotions). An example of such technology is AffectCam which integrates a wearable camera and a galvanic skin response sensor allowing the identification of photos taken at moments of high arousal which can be better recalled with richer details than memories associated with low emotional arousal (Sas et al., 2013).

Apart from automatically or manually captured cues, HCI research on memory technologies has explored to a lesser extent how people can actively generate or create such cues themselves, for example through drawings or doodles on mobile apps allowing for creative expression while representing emotions associated with specific events or for example through colors and shapes or emotionally evocative content such as rain (Sas et al., 2015). Such work is important as it marks a shift from the predominant focus on the recall stage being supported by lifelogging devices to memory technologies also supporting people's engagement in the generation of cues as quick drawings or doodles that people create at the encoding stage.

Most of HCI work on memory technologies has focused on episodic memories, whose emotional component has been much acknowledged. Nascent work has started to focus also on a specific type of episodic memories, namely self-defining memories. Given their role in the self-memory system (Conway & Pleydell-Pearce, 2000), self-defining memories which reflect enduring concerns (Singer & Blagov, 2004) are essential for maintaining the sense of self in old age and particularly in dementia.

Exploratory work on cues for such memories suggest the value of physical objects including the crafted ones made through embroidery, weaving or woodcraft, and reflecting loving relationships which are key for the relational self (Sas, 2018). Such objects however are hard to find and access for each self-defining memory, so novel technologies to support their recall are much needed. One such novel tool technology is the use of 3D food printing for generating personalized flavors for cuing recall of self-defining memories in old age with findings indicating that most of cued memories are recalled with intense feelings of being brought back in time (see Entry Mental Time Travel and Entry Odor Memory), strong positive affect, and sensorial richness (Gayler et al., 2021a, 2022a). This is an interesting research direction extending the traditional visual and audio modalities commonly used for both capturing experiences and for cuing their recall.

Flavor has therefore become a new cuing material that leverages taste, smell and touch and which despite its strong relationship with emotional experiences has been less explored in HCI work on memory technologies. Creating flavors as memory cues requires supporting people to become sensitized to their eating experiences for instance through novel design methods (Gayler et al., 2021b) and novel interfaces allowing people to capture multisensory food experiences and to craft such flavor cues for later recall (Gayler et al., 2022b).

Much HCI research on memory technologies has focused on augmenting memory in healthy adults, or addressing memory impairments in old age or dementia (see Entry Dementia) predominantly on touchscreen (Joddrell & Astell, 2016) and less so on large displays (Sas et al., 2020). Interestingly, other forms of memory impairment have been less explored. A noticeable exception is the exploration of negative bias, overgeneralization and reduced positivity as memory impairments characterizing affective disorders such as depression (Qu et al., 2019. Such work highlighted the limitations of traditional memory technologies focused exclusively on cue-based retrieval, and less so on the disruption of the generative retrieval processes characterizing depression, and which may benefit from support to access an episodic memory from the general events rather than cues for such episodic event which may be counterproductive (Qu et al., 2019).

Finally, while most HCI work on memory technologies has supported recall, the forgetting process has been much less explored (with notable exceptions, Bannon, 2006 and Ramos et al., 2016). This focus on supporting forgetting contrasts with the total recall paradigm of lifelogging technologies which, by large, aims to support exhaustive retrieval, but reflects situations where people may want to forget, and lifelogging devices become problematic. One such situation is digital break up when people's digital possessions such as photos, social networking sites contacts and relationships status, emails, music, or videos are pervasive and evocative, thus painful cues of problematic emotional experience related to past relationships (Herron et al., 2016; Sas et al., 2013). Further work has also extended this exploration of forgetting to the grief experiences and the value of digital disposal for ritualistic letting go to counterpart the limitations of the mere act of deletion (Sas et al., 2016).

F. Summary

This chapter provides an overview of Human-Computer Interaction work on memory technologies with a focus on personal or generic interactive devices or applications supporting remembering of autobiographical or episodic memories. The chapter unpacked the design rationale of these technologies and details the rich body of work on different cues that such memory technologies have focused on, both most common ones such as photos and videos, as well as novel directions such as 3D-printed food.

G. Cross-references

Autobiographical Memory

Dementia

Distributed Memory

Embodied Memory

Emotions

Odor Memory

Mental Time Travel

Photography

H. References

Bannon, L. (1991). From human factors to human actors: The role of psychology and human-computer interaction studies in system design. In: Greenbaum & Kyng (Eds.), Design at work: Cooperative Design of Computer Systems (pp. 25-44). Hillsdale: Lawrence Erlbaum Associates.

Bannon, L. (2006). Forgetting as a feature, not a bug: the duality of memory and implications for ubiquitous

computing. CoDesign, 2 (01), 3-15.

Bluck, S., Alea, N. (2002). Exploring the functions of autobiographical memory: Why do I remember the autumn?. In J. D. Webster & B. K. Haight (Eds.), Critical advances in reminiscence work: From theory to application (pp. 61-75). New York: Springer.

Bluck, S., Alea, N., Habermas, T., Rubin, D. C. (2005) A tale of three functions: The self–reported uses of autobiographical memory. Social Cognition, 23(1), 91-117. doi: https://doi.org/10.1521/ soco.23.1.91.59198.

Bødker, S. (2006). When second wave HCI meets third wave challenges. In Proc. of the 4th Nordic conference on Human-computer interaction: changing roles. ACM Press, New York, 1-8. doi: http://dx.doi. org/10.1145/1182475.1182476

Bødker, S. (2015). Third-Wave HCI, 10 years later-Participation and sharing. interactions, 22(5) (September-October 2015), 24-31. doi: https://doi.org/10.1145/2804405

Broekhuijsen, M., van den Hoven, E., Markopoulos, P. (2017). From PhotoWork to PhotoUse: exploring personal digital photo activities. Behaviour & Information Technology, 36(7), 754-767. doi: 10.1080/0144929X.2017.1288266

Bush, V. (1945) As we may think. Retrieved 31 March 2023, from the Atlantic Monthly Online's website: https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/

Campbell, S., Frohlich, D.M., Alm, N., Vaughan, A.W. (2019). Sentimental Audio Memories: Exploring the Emotion and Meaning of Everyday Sounds. Dementia Lab 2019. Making Design Work: Engaging with Dementia in Context, 73–81. doi: https://doi.org/10.1007/978-3-030-33540-3_7

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. Psychological review, 107(2), 261–288. https://doi.org/10.1037/0033-295x.107.2.261

Cosley, D., Schwanda, V., Schultz, J., Peesapati, S. T. and Lee, S. 2012. Experiences with Designing Tools for Everyday Reminiscing. Human–Computer Interaction, 27, 175–198.

Crete-Nishihata, M., Baecker, R. M., Massimi, M., Ptak, D., Campigotto, R., Kaufman, L. D., Brickman, A. M., Turner, G. R., Steinerman, J. R. and Black, S. E. (2012). Reconstructing the Past: Personal Memory Technologies are not just Personal and not just for Memory. Human–Computer Interaction, 27, 92–123.

Dib, L., Petrelli, D., Whittaker, S. (2010). Sonic souvenirs: exploring the paradoxes of recorded sound for family remembering. In Proc. of the 2010 ACM conference on Computer supported cooperative work (CSCW '10). ACM Press, New York, 391-400. doi: https://doi.org/10.1145/1718918.1718985.

Elsden, C., Kirk, D.S., Durrant, A.C. (2015). A Quantified Past: Toward Design for Remembering With Personal Informatics. Human–Computer Interaction, DOI: 10.1080/07370024.2015.1093422

Finley, R., Naaz, F., & Goh, F. W. (2018). Memory and technology: how we use information in the brain and the world. Springer. doi: https://doi.org/10.1007/978-3-319-99169-6

Frayling, C. (1993). Research in Art and Design. In Royal College of Art Research Papers 1, 1

Frohlich, D., Fennell, J. (2007). Sound, paper and memorabilia: resources for a simpler digital photography. Personal Ubiquitous Comput., 11 (2) (Feb 2007), 107–116. doi: https://doi.org/10.1007/s00779-006-0069-4.

Frohlich, D. & Murphy, R. (2000). The Memory Box. Personal Ubiquitous Comput. 4, 4:238-240.

Gayler, T., Sas, C. & Kalnikaitė, V. (2021a). Co-Designing Flavor-Based Memory Cues with Older Adults. In Companion Publication of the 2020 International Conference on Multimodal Interaction (ICMI '20 Companion). ACM, 287–291. https://doi.org/10.1145/3395035.3425644

Gayler, T., Sas, C. & Kalnikaitė, V. (2021b). Sensory Probes: An Exploratory Design Research Method for Human-Food Interaction. In Designing Interactive Systems Conference 2021 (DIS '21). ACM, 666–682. https://doi.org/10.1145/3461778.3462013

Gayler, T., Sas, C., Kalnikaitė, V. (2022a). "It took me back 25 years in one bound": self-generated flavor-based

cues for self-defining memories in later life, Human–Computer Interaction, DOI: 10.1080/07370024.2022.2107518

Gayler, T., Sas, C., Kalnikaitė, V. (2022b). FlavorDesigner App: Capturing Multisensory Experiences and Crafting Personalized Flavors for Cueing their Recall. In Designing Interactive Systems Conference (DIS '22). ACM, 1441–1456. https://doi.org/10.1145/3532106.3533474.

Harper, R., Randall, D., Smythe, N., Evans, C., Heledd, L., Moore, R. (2007). Thanks for the memory." In Proceedings of the 21st British HCI Conference Volume 2, 39-42.

Harrison, S., Sengers, P., Tatar, D. (2011). Making epistemological trouble: Third-paradigm HCI as successor science. Interacting with computers, 23, 385-392.

Harrison, S., Tatar, D., Sengers, P. (2007). The three paradigms of HCI. In Proceedings of SIGCHI Conference on Human Factors in Computing Systems (CHI'07), ACM Press, New York.

Herron, D., Moncur, W., van den Hoven, E. (2016). Digital possessions after a romantic break up. In Proceedings of the 9th Nordic Conference on Human-Computer Interaction (pp. 1-10).

Joddrell, P., Astell, A.J. (2016). Studies involving people with dementia and touchscreen technology: a literature review. JMIR Rehabilitation and Assistive Technologies 3, 2 (2016), e10

Kirk, D.S., Sellen, A. (2010). On human remains: Values and practice in the home archiving of cherished objects. ACM Trans. Comput.-Hum. Interact., 17 (3), Article 10 (July 2010), 43 pages. doi: https://doi.org/10.1145/1806923.1806924.

Lee, M. L., Dey, A.K. (2007). Providing good memory cues for people with episodic memory impairment. In Proc. Conference on computers and accessibility. ACM Press, New York, 131-138.

Lindley, S. E. 2012. Before I Forget: From Personal Memory to Family History. Human–Computer Interaction, 27, 13–36.

Meerbeek, B., Bingley, P., Rijnen, W., and van den Hoven, E. (2010). Pipet: a design concept supporting photo sharing. NordiCHI'10, 335-342. doi: https://doi.org/10.1145/1868914.1868954.

Mols, I., van den Hoven, E., and Eggen, B. (2014). Making memories: a cultural probe study into the remembering of everyday life. In Proc. of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational (NordiCHI '14). ACM, New York, 256-265. doi: https://doi.org/10.1145/2639189.2639209.

Mols, I., van den Hoven, E. and Eggen, B. (2016). Ritual Camera: Exploring domestic technology to remember everyday life. IEEE Pervasive Computing, 15(2), pp. 48-58.

Moncur, W., Julius, M., van den Hoven, E., and Kirk, D. (2015). Story Shell: The participatory design of a bespoke digital memorial. In Proc. of the Participatory Innovation Conference (PIN-C) 2015, 470-477.

Nielsen, J. (1994). 10 Usability heuristics for user interface design. Last retrieved 31 March 2023 from https://www.nngroup.com/articles/ten-usability-heuristics/

O'Hara, K., Helmes, J., Sellen, A., Harper, R., ten Bhömer, M., van den Hoven, E. (2012). Food for Talk: Phototalk in the Context of Sharing a Meal. Human–Computer Interaction, 27, 124–150.

O'Hara, K., Tuffield, M.M., Shadbolt, N. (2008). Lifelogging: Privacy and empowerment with memories for life. IDIS 1, 155–172. doi: https://doi.org/10.1007/s12394-009-0008-4.

Orth, D., Thurgood, C., van den Hoven, E. (2018). Designing objects with meaningful associations. International Journal of Design, 12(2), 91-104.

Pasupathi, M., Carstensen, L. L. (2003). Age and emotional experience during mutual reminiscing. Psychology and Aging, 18(3), 430 442.

Petrelli, D., Bowen, S., Whittaker, S. (2014). Photo mementos: designing digital media to represent ourselves at home. International Journal of Human-Computer Studies, 72 (3), 320-336. doi: https://doi.org/10.1016/j.ijhcs.2013.09.009.

Petrelli, D., Villar, N., Kalnikaite, V., Dib, L., Whittaker, S. (2010). FM radio: family interplay with sonic mementos. In Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10). ACM Press,

New York, 2371–2380. doi: https://doi.org/10.1145/1753326.1753683.

Petrelli, D., Whittaker, S. (2010). Family memories in the home: contrasting physical and digital mementos. Personal and Ubiquitous Computing, 14 (2), 153-169. doi: https://doi.org/10.1007/s00779-009-0279-7.

Petrelli, D., Whittaker, S., Brockmeier, J. (2008). AutoTopography: what can physical mementos tell us about digital memories? In Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08). ACM Press, New York, 53–62. doi: https://doi.org/10.1145/1357054.1357065.

Qu, C., Sas, C. & Doherty, G. (2019). Exploring and Designing for Memory Impairments in Depression. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). ACM, Paper 510, 1–15. https://doi.org/10.1145/3290605.3300740

Ramos, L., van den Hoven, E., Miller, L. (2016). Designing for the Other 'Hereafter': When Older Adults Remember about Forgetting. In Proc. of the 34th Annual ACM Conference on Human Factors in Computing Systems 2016 (CHI'16), 7-12 May 2016, San Jose, CA, USA.

Reitsma, L., Smith, A., van den Hoven, E. (2013). StoryBeads: Preserving Indigenous Knowledge through Tangible Interaction Design. In Proc. of the International Conference on Culture and Computing, 79–85. doi: http://doi. org/10.1109/CultureComputing.2013.22.

Sas, C. (2018). Exploring Self-Defining Memories in Old Age and their Digital Cues. In Proceedings of the 2018 Designing Interactive Systems Conference (DIS '18). ACM, 149–161. https://doi.org/10.1145/3196709.3196767

Sas, C., Whittaker, S. (2013, April). Design for forgetting: disposing of digital possessions after a breakup. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 1823-1832).

Sas, C., Challioner, S., Clarke, C., Wilson, R., Coman, A., Clinch, S., Harding, M., Davies, N. (2015). Self-Defining Memory Cues: Creative Expression and Emotional Meaning. In Proceedings of Extended Abstracts on Human Factors in Computing Systems (CHI EA '15). ACM, 2013–2018. https://doi.org/10.1145/2702613.2732842

Sas, C., Davies, N., Clinch, S., Shaw, P., Mikusz, M., Steeds, M., Nohrer, L. (2020). Supporting Stimulation Needs in Dementia Care through Wall-Sized Displays. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). ACM, 1–16. https://doi.org/10.1145/3313831.3376361

Sas, C., Fratczak, T., Rees, M., Gellersen, H., Kalnikaite, V., Coman, A., Höök, K. (2013). AffectCam: arousal-augmented sensecam for richer recall of episodic memories. In CHI'13 extended abstracts on human factors in computing systems (pp. 1041-1046).

Sas, C., Whittaker, S., Zimmerman, J. (2016). Design for Rituals of Letting Go: An Embodiment Perspective on Disposal Practices Informed by Grief Therapy. ACM Trans. Comput.-Hum. Interact. 23, 4, Article 21 (September 2016), 37 pages. https://doi.org/10.1145/2926714

Sellen, A., Fogg, A., Aitken, M., Hodges, S., Rother, C., Wood, K. (2007). Do life-logging technologies support memory for the past? In Proc. CHI '07, ACM Press, New York, 81-90.

Sellen, A., & Whittaker, S. (2010). Beyond total capture: A constructive critique of lifelogging. Communications of the ACM, 53 (5), 70-77.

Singer, J. A., & Blagov, P. (2004). The Integrative Function of Narrative Processing: Autobiographical Memory, Self-Defining Memories, and the Life Story of Identity. In D. R. Beike, J. M. Lampinen, & D. A. Behrend (Eds.), The self and memory (pp. 117–138). Psychology Press.

Stevens, M.M., Abowd, G.D., Truong, K.N., Vollmer, F. (2003). Getting into the Living Memory Box: Family archives & holistic design. Personal Ubiquitous Comput., 7 (3-4 July 2003), 210-216. doi: https://doi.org/10.1007/s00779-003-0220-4.

Tsai, W. -C., van den Hoven, E. (2018). Memory probes: Exploring retrospective user experience through traces of use on cherished objects. International Journal of Design, 12(3), 57-72.

Tulving, E., Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. Psychological Review, 80, 352–373.

Van den Hoven, E. (2014). A Future-proof past: Designing for remembering experiences. Memory Studies, 7(3),

370-384.

Van den Hoven, E., Eggen, B. (2008). Informing Augmented Memory System design through Autobiographical Memory theory. Personal and Ubiquitous Computing, 12(6), 433-443.

Van den Hoven, E., Eggen, B. (2014). The Cue is Key: Design for Real-Life Remembering. Zeitschrift für Psychologie, 222(2), 110-117.

Van den Hoven, E. & Eggen, B. (2015). The cue is key. Zeitschrift für Psychologie 222, 2: 110-117

Van den Hoven, E., Orth, D. and Zijlema, A. (2020). Possessions and memories. Current opinion in psychology, 39, 94-99. https://doi.org/10.1016/j.copsyc.2020.08.014.

Van Gennip, D., van den Hoven, E., Markopoulos, P. (2015). Things That Make Us Reminisce: Everyday Memory Cues as Opportunities for Interaction Design. In Proc. Conf. Human Factors in Computing Systems, 3443-3452.

Van Rijen, K., Cobbenhagen, T., Janssen, R., Olsen, M., Brankaert, R., Houben, M., Lu, Y. (2020). RelivRing: Reliving Social Activities for People with Dementia. In Proc. of the SIGCHI Conference on Human Factors in Computing Systems, ACM Press, New York, 1–8. doi: https://doi.org/10.1145/3334480.3383033.

Viet Le, H., Clinch, S., Sas, C., Dingler, T., Henze, N., & Davies, N. (2016). Impact of video summary viewing on episodic memory recall: design guidelines for video summarizations, In Proc. Human Factors in Computing Systems, 4793-4805.

Whittaker, S., Kalnikaite, V., Petrelli, D., Sellen, A., Villar, N., Bergman, O., Clough, P., Brockmeier, J. (2012). Socio-technical lifelogging: deriving design principles for a future proof digital past. Human-Computer Interaction, 27 (1-2), 37-62.

Williams, H. L., Conway, M. A., Cohen, G. (2008). Autobiographical memory. In G. Cohen & M. A. Conway (Eds.), Memory in the Real World (3rd ed), Psychology Press, 21-90.

Zijlema, A., van den Hoven, E., Eggen, B. (2019). A qualitative exploration of memory cuing by personal items in the home. Memory Studies, 12(4), 377–397. doi: https://doi.org/10.1177/1750698017709872.