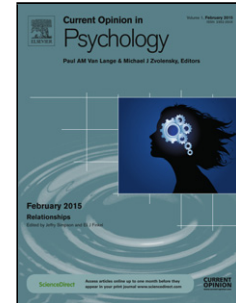


Journal Pre-proof

Possessions and Memories<!--<ForCover>van den Hoven E, Orth D, Zijlema A, Possessions and Memories, *Current Opinion in Psychology*, doi: 10.1016/j.copsyc.2020.08.014</ForCover>-->

Elise van den Hoven (Conceptualization) (Project administration) (Supervision) (Writing - original draft) (Writing - review and editing), Daniel Orth (Conceptualization) (Visualization) (Writing - original draft) (Writing - review and editing), Annemarie Zijlema (Conceptualization) (Writing - original draft) (Writing - review and editing)



PII: S2352-250X(20)30159-7
DOI: <https://doi.org/10.1016/j.copsyc.2020.08.014>
Reference: COPSYC 1075
To appear in: *Current Opinion in Psychology*

Please cite this article as: { doi: <https://doi.org/>

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2020 Published by Elsevier.

Possessions and Memories

Authors

Elise van den Hoven^{1,2,3} – corresponding author

Elise.vandenHoven@uts.edu.au

Room CB11.07.212

Faculty of Engineering & IT

University of Technology Sydney

81 Broadway Ultimo

NSW 2007 Australia

Daniel Orth¹

Annemarie Zijlema^{1,2,4}

Affiliations:

¹ Faculty of Engineering & IT, University of Technology Sydney, Australia

² Department of Industrial Design, Eindhoven University of Technology, the Netherlands

³ Duncan Jordanstone College of Art & Design, University of Dundee, UK

⁴ Faculty of Liberal Arts and Sciences, University of Greenwich, UK

Abstract

People often acquire souvenirs and photographs to facilitate remembering, but possessions and memories can relate to each other in a variety of ways. This review paper presents four different connection types found between meaningful things in our everyday lives and our personal memories. Each connection type either focuses on possessions *or* memories and the connection between the two is either active *or* lost. These perspectives will be detailed through examples of studies and design cases from different fields and research areas. More studies have been found focusing on existing connections between possessions and memories, such as in human-computer interaction, design, material culture, psychology, and marketing, than those lost, which were specifically focused around ageing, forgetting, heirlooms, identity and hoarding behaviour. Our review of connections between possessions and memories accumulate to suggest the attachment people ascribe to certain possessions is mirrored by the ability of objects to fulfil people's desire to preserve, embody, showcase and recollect certain memories.

Keywords: Possessions, autobiographical remembering, memories and meaning, ownership, associations, identity, objects that cue memories

Introduction

People often develop an attachment to a possession for its ability to embody and bring to mind personally significant memories. These memories include facts about the time and place the object became a possession (e.g., gifted by a grandmother to her 12-old grandchild) and personally experienced events (e.g., remembering the way your grandmother handed a gift to *you*, with a joyful smile as you tear away the wrapping paper).

In this review, we will first define key terms. We will then discuss how possessions and memories are related, detailed through examples of studies and design cases.

The term *possession* has been defined as “personal identification with the item as an extension of the self” and *possessions* as “things we call ours” [1]. Possession relates to ownership of things, or “psychological ownership”, which is defined as “the state in which individuals feel as though the target of ownership or a piece of that target is ‘theirs’” [2]. Ownership can be interpreted in many ways, in particular in the digital domain where having access and online sharing results in a range of ownership options (explored in detail in [3]).

When we talk about possessions in this paper, we aim to be inclusive, also with regards to these ownership options, such as created digital content and subscription-based services. In terms of materiality these things we call possessions can be pre-owned, newly produced or self-constructed and physical, digital, or hybrid in nature.

The term *memories* in this paper can refer to autobiographical or episodic memory [4,5], which are long-term memories of events that took place in a person’s life and relating to themselves. In the context of this paper, especially in product design research, memories can also be seen as loose associations to time periods (*childhood*) or places (*home*). Since personal media that are used by people to support memory are increasingly digital and online [6], this includes photos and videos, documents and social media; technology is becoming crucial for supporting remembering practices (e.g., [7,8]).

Studying possessions and memories is done in different fields as can be seen in the diverse examples later, but the emphasis in this paper is on perspectives including or relating to design and technology, such as in Interaction Design (IxD) and Human-Computer Interaction (HCI). These two multidisciplinary fields study people’s behaviour and experiences in relation to enhancing people’s lives with interactive technology in various areas, including remembering.

Connections between Possessions & Memories

When looking at the literature across different fields and research areas, we identify four different kinds of connections between possessions and memories (see Figure 1). We use the term connection to represent an ongoing bond between a person’s cognition and a representation in the physical world. The four connections might be best explained through a fictitious example around a personal possession:

Imagine visiting your grandparent and playing cards at the table together over many years. The beautifully crafted chair you always sat on was given to you by your grandparent and it is a valued addition to your dining room (*Connection type 1* in Figure 1). Sitting in the chair reminds you of times spent playing cards with your grandparent and cues personal memories of them (*Connection type 2*).

You might forget some or all of the memories that once were attached to the chair. This forgetting can happen gradually over time or because the chair was used in everyday life and gathered new memories (*Connection type 3*). When the chair is no longer in your possession, the memories it once cued may remain even though the cue itself is no longer present (*Connection type 4*).

These four types of connections can be distinguished through the connection status and perspective. The connection status can be *active*, as in Connection types 1 (C1) and 2 (C2), or can *loosen* or even be *lost*, just like in Connection types 3 (C3) and 4 (C4). The perspective could be focused on the *possessions*, as in C1 and C3, or on the *memories*, like in C2 and C4. Each of these types has been researched by different research fields and areas, which we will elaborate on in the following sections.

Connection type 1 (C1): Possessions can acquire memories

Through acquisition, usage, ownership or access, possessions form connections to experiences in a person's life that may form part of their autobiographical memory. Connections can be established by the possession's proximity, involvement or likeness to the memory it can bring to mind. These memories are not always episodic memories, but can also be summations of broader time periods (e.g., my childhood) or concepts (e.g., summer) as outlined further in C2.

The phenomena of possessions acting as memory cues has held implications in one form or another across a broad range of research areas, including marketing [9], consumer behaviour [8,10,11], psychology [12], material culture [13], Human-Computer Interaction [14,15,16,17,18,19,20] and design [21*,22,23,24,25,26*,27,28**), bearing relevance to both theoretical development and real-world applications. One of the most prominent examples of this can be seen in attachment literature that explores the value and meaning of possessions. Associating an object with personal memories has been found to be a primary determinant for attachment experiences [11,12,25,27,29] and has served as a source of inspiration for several design approaches to promoting object attachment [16,20,26*,30,31].

The qualities of possessions as external *things* that surround us throughout our day-to-day lives offer unique opportunities to exercise a level of control over our memories. Archiving, displaying or using possessions within the home that cue memories allows us to connect with the past, bringing it closer to the present or to store it away, giving us permission to forget [32,33].

As physical possessions age, they form patinas (a film, gloss or sheen) and traces of use that reinforce their shared history with the owner [28**),34]. These tangible qualities allow physical possessions to accumulate memory cues not only to episodic events, but also to time periods, places and felt experiences. Conversely, the intangible nature of digital possessions can hinder the process of forming connections with associative forms of memory, lacking ties to the surrounding material world [10,14,35,36]. Digital possessions do however provide new opportunities for sharing memories [37] and creating high-fidelity memory cues [38].

Connection type 2 (C2): Memories expressed through a possession

In this connection type, a relation between the possessions and memories has been established and the possession represents or can cue one or more memories. A strong connection to memories is known to be contributing to object attachment. Possessions that we keep for remembering purposes, such as souvenirs and personal photos fit this category. Research in this area, however, has shown that these 'cued responses' do not always fit the

classic definition of an episodic memory, but cover variations such as associations, or personal reflections [4,17,39*].

Researchers in Human-Computer Interaction have investigated the *nature of this relation*, such as the possession as 'cue' [40] and the resulting remembering experience [41] and the variety of responses possessions cue [39*]. Simultaneously, in consumer research, the relation between possessions and identity has been a topic of investigation [42,43*], not only for physical possessions, but also for digital possessions, or even not self-owned digital objects such as avatars [8,14,37].

The ability of possessions to cue memories has many advantages, but can also have an *adverse effect*. One of them is that persons with hoarding problems have difficulties letting go of possessions, because they are afraid of losing the associated memories [44,45]. Another situation where memory cuing is undesired is when experiencing grief, such as death and divorce, and researchers in HCI have studied these practices of disposal or representation, in particular for digital possessions [46,47].

Researchers have investigated current practices of *preserving memories or possessions*, now or in the future [18,48,49]. Also practices and self-defining memory cues among *older adults* have been investigated [50,51,52*].

Psychology researchers who investigated the *potential of social media as cues*, have mostly found positive effects on remembering [53,54]. However, the research on current practices discussed earlier, found that digital possessions are generally less valued and that its digital nature can hinder the ease of access [10]. In Design and Human-Computer Interaction, numerous research examples have been published presenting *research prototypes* that aim to facilitate current practices of preserving memories or to enhance the remembering experiences, as digitisation has simultaneously created new opportunities and impoverished cued remembering [55,56,57].

Connection type 3 (C3): Possessions lose memories

Just as possessions often acquire connections to memories, they also lose their ties with memories, consequentially diminishing the strength of the owner's attachment. This disconnection between possessions and memories can occur through dispossession, transformation, or inaccessibility of the memory such as forgetting. Key literature that explores this disconnect in various forms includes works related to family heirlooms [21*,50,58,59] and non-personal possessions [60].

While forgetting is an essential part of human memory [61], literature addressing the relationship between possessions and memories rarely acknowledges its occurrence, instead highlighting the ways in which possessions are used to actively prevent forgetting [38] or misremembering [62] and at times must be disposed of as a means to facilitate intentional forgetting [47].

As people grow older, they often engage in acts of posterity, including passing on their memories to younger family members [50]. Heirlooms often serve as vessels for which people pass on their autobiographical memories, becoming a source of attachment for their

ability to maintain connections to a past that extends beyond a single lifetime [21*,63]. Recent studies have explored the potential for technology to support the passing on of personal history through technological heirlooms [64] or more broadly in commercial applications such as tagging donated second-hand clothing with stories from its previous owner [60].

Connection type 4 (C4): Memories lose possessions

"For years, I searched for things that I 'couldn't find', only to realise that they were from the time before the blast, and therefore irretrievably lost"¹, says a man who lost his home and possessions after a firework warehouse exploded over twenty years ago. Victims of theft or natural disaster often go through a process of grief similar to that of losing a loved one. However, the original owner will still have the memories, sometimes including memories of the possessions, even though access to the memories might have become harder. Research in this connection type has focused on the effect of the loss or explored how an otherwise lost memory cue, the object we were attached to, can be replaced or transformed. For example, how objects once owned, but lost when moving into a care home, are still remembered [43*,51]. Other impairment of the possession-memory relation occurs when loved objects are broken or unused, causing a dilemma or guilt over keeping the object. Research in this area includes a design study which aimed to transform highly valued but broken objects [24], and an exploration of techniques to reduce object attachment by replacing cues for people's personal memories (e.g., by taking photos of the objects) to stimulate people to donate their unused possessions to a charity [65].

The distinctions we have drawn between *active* and *lost* connections between possessions and memories becomes blurred in the context of digital possessions such as music, texts or photos that are neither singular nor fixed in form. Cloud-based storage, hosted content, streaming services and subscription-based services reflect a transition to *access* rather than *ownership* of our possessions [3,37,66]. In this access-based model of possession, memories are not tied to one specific instantiation of a digital file but are instead tied to any instantiation and therefore live on when the original digital possession is lost or deleted [14,15].

Discussion

Possessions and memories can be connected to each other in various ways. The four connection types introduced in this paper are used to provide lenses onto the relevant research areas. These lenses are quite artificial in that the connections between possessions and memories is highly organic, they can change easily and quickly. One object or one memory might go through all four connection types during their lifetimes, which would be an interesting avenue for future research, seemingly unexplored.

As Human-Computer Interaction researchers, our focus and expertise is primarily framed within the scope of C1 and C2, instances in which there are active connections between

¹ Translated from Dutch: Marijnissen, H. (13 May 2020). Twintig jaar na de vuurwerkramp in Enschede zijn Jos en Herman vooral blij dat ze leven. Trouw. Retrieved from <https://www.trouw.nl/binnenland/twintig-jaar-na-de-vuurwerkramp-in-enschede-zijn-jos-en-herman-vooral-blij-dat-ze-leven~b4bd185e/>

possessions and memories. Our exposure to research addressing the loss of connection between possessions and memories (C3 and C4) is less prominent, however we believe those to be underrepresented.

From a Human-Computer Interaction perspective, there is a lot to be gained to study possessions and memories in collaboration with other disciplines. HCI can inform other fields through rich descriptions of all sorts, including real-world experiences of different groups of people, application areas, in-depth case studies, creative perspectives and solutions, interventions, design ideas and working prototypes. HCI can show the *current* role of technology in and it can provide and shape visions of the *future* of where developments might go and what they could look like.

Conclusions

People often become attached to an object because of the memories it brings to mind. This has led many researchers to focus their attention on various types of connections between possessions and memories as an avenue for exploring ways of influencing attachment experiences in real-world scenarios. The review presented in this paper shows a myriad of possible links and relations between possessions and memories, which can vary over time, context, use and across owners. The division of these possibilities in just four groups, shows how different the perspectives are and fields that study them across this multi-disciplinary research topic. Connection type 1 focuses on possessions that have acquired connections with memories, and the research is understandably dominated by artefact-focused fields, such as design and material culture. Connection type 2 focuses on memories and how they can be expressed through possessions, which is predominantly studied by behaviour-focused fields, such as psychology and marketing. For Connection type 3, where possessions have lost the connection with memories temporarily or permanently, the interest has come from gerontology-related fields, including topics such as ageing, forgetting and heirlooms. While for Connection type 4, where the possessions that once expressed memories have been lost, the interest comes from sociological and behaviour-focused fields. Some fields study several Connection types, including attachment, identity, consumer behaviour and Human-Computer Interaction.

The research presented in this paper is by no means exhaustive, but we have shown there is a lot of interest into possessions and memories from different fields. Storytelling and communicating our experiences have always been important for both survival and community building, and a long-standing topic of research. With ongoing technological developments and the move into the digital realm new fields have joined in studying these more recent possibilities and challenges, making research into possessions and memories more relevant than ever.

Credit Author Statement for Possessions and Memories - van den Hoven, Orth & Zijlema:

Elise van den Hoven: Conceptualization, Project Administration, Supervision, Writing - Original Draft, Writing - Review & Editing

Daniel Orth: Conceptualization, Visualization, Writing - Original Draft, Writing - Review & Editing

Annemarie Zijlema: Conceptualization, Writing - Original Draft, Writing - Review &

Editing

Conflict of interest statement

The authors declare no conflicts of interest relation to contents of this paper.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Journal Pre-proof

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- * of special interest
- ** of outstanding interest

References

1. Belk RW: **Possessions and the extended self**. Journal of Consumer Research 1988, **15**(2):139-168. <https://doi.org/10.1086/209154>
2. Pierce JL, Kostova T, Dirks KT: **The state of psychological ownership: Integrating and extending a century of research**. Review of General Psychology 2003, **7**:84–107. <https://doi.org/10.1037/1089-2680.7.1.84>
3. Watkins RD, Denegri-Knott J, Molesworth M: **The relationship between ownership and possession: Observations from the context of digital virtual goods**. Journal of Marketing Management 2016, **32**(1-2):44–70. <https://doi.org/10.1080/0267257X.2015.1089308>
4. Conway MA, Loveday C: **Remembering, imagining, false memories & personal meanings**. Consciousness and Cognition 2015, **33**:574–581. <https://doi.org/10.1016/j.concog.2014.12.002>
5. Conway MA, Pleydell-Pearce CW: **The construction of autobiographical memories in the self-memory system**. Psychological review 2000, **107**(2):261-288. <https://doi.org/10.1037/0033-295X.107.2.261>
6. Bergman O, Whittaker S: **The Science of Managing our Digital Stuff**. MIT Press; 2016 <https://doi.org/10.1002/asi.23870>
7. Van den Hoven E, Sas C, Whittaker S: **Introduction to this special issue on designing for personal memories: past, present, and future**. Human-Computer Interaction 2012, **27**(1-2):1-12. <https://doi.org/10.1080/07370024.2012.673451>
8. Belk RW: **Extended self in a digital world**. Journal of Consumer Research 2013, **40**(3):477–500. <https://doi.org/10.1086/671052>
9. Mardon R, Belk RW: **Materializing digital collecting: An extended view of digital materiality**. Marketing Theory 2018, **18**(4):543–570. <https://doi.org/10.1177/1470593118767725>
10. Atasoy O, Morewedge CK: **Digital goods are valued less than physical goods**. Journal of Consumer Research 2017, **44**(6):1343–1357. <https://doi.org/10.1093/jcr/ucx102>
11. Richins ML: **Valuing things: The public and private meanings of possessions**. Journal of Consumer Research 1994, **21**(3):504–521. <https://doi.org/10.1086/209414>
12. Csikszentmihalyi M, Rochberg-Halton E: **The meaning of things: Domestic symbols and the self**. Cambridge University Press; 1981. <https://doi.org/10.1017/CBO9781139167611>
13. Miller D: **The comfort of things**. Polity Press; 2008. ISBN: 978-0-745-64403-5. <https://doi.org/10.1558/prth.v2i2.290>
14. Denegri-Knott J, Watkins R, Wood J: **Transforming digital virtual goods into meaningful possessions**. In Digital Virtual Consumption. Edited by Molesworth M, Denegri-Knott J. Routledge; 2012:76–91. <https://doi.org/10.4324/9780203114834>

15. Feinberg M: **Beyond digital and physical objects: The intellectual work as a concept of interest for HCI.** CHI13: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2013, 3317-3326. <https://doi.org/10.1145/2470654.2466453>
16. Lee MH, Son O, Nam TJ: **Patina-inspired personalization: Personalizing products with traces of daily use.** DIS2016: Proceedings of the Conference on Designing Interactive Systems 2016, 251-263. <https://doi.org/10.1145/2901790.2901812>
17. Orth D, Thurgood C, van den Hoven E: **Designing meaningful products in the digital age: How users value their technological possessions.** Transactions on Computer-Human Interaction 2019, **26**(5):Article 34. <https://doi.org/10.1145/3341980>
18. Petrelli D, Whittaker S: **Family memories in the home: Contrasting physical and digital mementos.** Personal and Ubiquitous Computing 2010, **14**(2):153–169. <https://doi.org/10.1007/s00779-009-0279-7>
19. Tsai WC, Wang PH, Lee HC, Liang RH, Hsu, J: **The reflexive printer: Toward making sense of perceived drawbacks in technology-mediated reminiscence.** DIS2014: Proceedings of the Conference on Designing Interactive Systems 2014, 995-1004. <https://doi.org/10.1145/2598510.2598589>
20. Zimmerman J: **Designing for the self: Making products that help people become the person they desire to be.** CHI2009: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2009, 395-404. <https://doi.org/10.1145/1518701.1518765>
21. * Ahde-Deal P, Paavilainen H, Koskinen I: **'It's from my grandma.' How jewellery becomes singular.** The Design Journal 2017, **20**(1):29–43. <https://doi.org/10.1080/14606925.2017.1252564>. This work addresses the social aspects of heirlooms as containers of memories that maintain family history across generations.
22. Chapman J: **Meaningful stuff: Toward longer lasting products.** In Materials Experience: Fundamentals of Materials and Design. Edited by Karana E, Pedgley O, Rognoli V. Butterworth-Heinemann; 2014:135–143. <https://doi.org/10.1016/B978-0-08-099359-1.00010-2>
23. Hekkert P, Cila N: **Handle with care! Why and how designers make use of product metaphors.** Design Studies 2015, **40**:196–217. <https://doi.org/10.1016/j.destud.2015.06.007>
24. Keulemans G, Rubenis N, Marks A: **Object therapy: Critical design and methodologies of human research in transformative repair.** PLATE2017: Proceedings of the Conference on Product Lifetimes and the Environment 2017, 186-191. <https://doi.org/10.3233/978-1-61499-820-4-186>
25. Mugge R, Schoormans JPL, Schifferstein HNJ: **Product attachment: Design strategies to stimulate the emotional bonding to products.** In Product Experience, Edited by Schifferstein HNJ, Hekkert P. Elsevier; 2008:425–440. <https://doi.org/10.1016/B978-008045089-6.50020-4>
26. * Orth D, Thurgood C, van den Hoven E: **Designing objects with meaningful associations.** International Journal of Design 2018, **12**(2):91–104. <http://www.ijdesign.org/index.php/IJDesign/article/view/2916>. This work demonstrates how personal memories can be retroactively associated with new possessions to foster object attachment.

27. Page T: **Product attachment and replacement: Implications for sustainable design.** International Journal of Sustainable Design 2014, **2**(3):265–282.
<https://doi.org/10.1504/IJSDDES.2014.065057>
28. ** Tsai WC, van den Hoven E: **Memory probes: Exploring retrospective user experience through traces of use on cherished objects.** International Journal of Design 2018, **12**(3):57-72.
<http://www.ijdesign.org/index.php/IJDesign/article/view/2900>. Novel work addressing methodological considerations when studying retrospective user experiences and links between possessions and memory.
29. Niinimäki K, Koskinen I: **I love this dress, it makes me feel beautiful! Empathetic knowledge in sustainable design.** The Design Journal 2011, **14**(2):165–186.
<https://doi.org/10.2752/175630611X12984592779962>
30. Orth D, Thurgood C, van den Hoven E: **Embodying meaningful digital media: A strategy to design for product attachment in the digital age.** TEI2020: Proceedings of the Conference on Tangible, Embedded, and Embodied Interaction 2020, 81-94.
<https://doi.org/10.1145/3374920.3374921>
31. Petrelli D, Light A: **Memory baubles and history tinsels.** DOME2009: Proceedings of the Workshop on Digital Object Memories, Conference on Intelligent Environments 2009, 15-20. <https://doi.org/10.3233/978-1-60750-056-8-15>
32. Kirk D, Sellen A: **On human remains: Values and practice in the home archiving of cherished objects.** Transactions on Computer-Human Interaction 2010, **17**(3):Article 10. <https://doi.org/10.1145/1806923.1806924>
33. Van Gennip D, van den Hoven E, Markopoulos P: **Things that make us reminisce: Everyday memory cues as opportunities for interaction design.** CHI2015: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2015, 3443-3452. <https://doi.org/10.1145/2702123.2702460>
34. Zijlema A, van den Hoven E, Eggen B: **Preserving objects, preserving memories: Repair professionals and object owners on the relation between traces on personal possessions and memories.** PLATE2017: Proceedings of the Conference on Product Lifetimes and the Environment, 453-457. <http://dx.doi.org/10.3233/978-1-61499-820-4-453>
35. Odom W, Zimmerman J, Forlizzi J: **Placelessness, spacelessness, and formlessness: Experiential qualities of virtual possessions.** DIS2014: Proceedings of the Conference on Designing Interactive Systems 2014, 985-994.
<https://doi.org/10.1145/2598510.2598577>
36. Zijlema A, van den Hoven E, Eggen B: **Companions: Objects accruing Value and Memories by being a Part of our Lives.** OzCHI2016: Proceedings of the Australian Computer-Human Interaction Conference 2016, 170-174.
<https://doi.org/10.1145/3010915.3010958>
37. Belk RW: **You are what you can access: Sharing and collaborative consumption online.** Journal of Business Research 2014, **67**(8):1595-1600.
<https://doi.org/10.1016/j.jbusres.2013.10.001>
38. Elsdén C, Kirk DS, Durrant AC: **A quantified past: Toward design for remembering with personal informatics.** Human-Computer Interaction 2016, **31**(6):518-557.
<https://doi.org/10.1080/07370024.2015.1093422>
39. * Zijlema A, van den Hoven E, Eggen B: **A qualitative exploration of memory cuing by personal items in the home.** Memory Studies 2019 **12**(4):377-397.

- <https://doi.org/10.1177/1750698017709872>. Introduction of four categories of cued responses to personal possessions derived from home tour interviews: ‘no-memory’, ‘know’, ‘think or feel’ and ‘remember’ responses.
40. Van den Hoven E, Eggen B: **The cue is key: Design for real-life remembering.** Zeitschrift für Psychologie 2014, **222**(2):110-117. <https://doi.org/10.1027/2151-2604/a000172>
 41. Van den Hoven E: **A future-proof past: Designing for remembering experiences.** Memory Studies 2014, **7**(3):370-384. <https://doi.org/10.1177/1750698014530625>
 42. Boschetti MA: **Attachment to personal possessions: An interpretive study of the older person’s experience.** Journal of Interior Design 1995, **21**(1):1-12. <https://doi.org/10.1111/j.1939-1668.1995.tb00203.x>
 43. * Stevens D, Camic PM, Solway R: **Maintaining the self: Meanings of material objects after a residential transition later in life.** Educational Gerontechnology 2019, **45**(3):214-226. <https://doi.org/10.1080/03601277.2019.1601832>. Interview study with older adults resulting in a model of why material objects are important to them, one category was focused on memories and history.
 44. Hartl T, Frost R, Allen G, Deckersbach T, Steketee G, Duffany S, Savage C: **Actual and perceived memory deficits in individuals with compulsive hoarding.** Depression and Anxiety 2004, **20**(2):59–69. <http://doi.org/10.1002/da.20010>
 45. Kyrios M, Mogan C, Moulding R, Frost R, Yap K, Fassnacht D: **The cognitive-behavioural model of hoarding disorder: Evidence from clinical and non-clinical cohorts.** Clinical Psychology & Psychotherapy 2018, **25**(2):311–321. <https://doi.org/10.1002/cpp.2164>
 46. Herron D, Moncur W, van den Hoven E: **Digital Decoupling and Disentangling: Towards Design for Romantic Break Up.** DIS2017: Proceedings of the Conference on Designing Interactive Systems 2017, 1175-1185. <https://doi.org/10.1145/3064663.3064765>
 47. Sas C, Whittaker S, Zimmerman J: **Design for rituals of letting go: An embodiment perspective on disposal practices informed by grief therapy.** Transactions on Computer-Human Interaction 2016, **23**(4):Article 21. <https://doi.org/10.1145/2926714>
 48. Masset J, Decrop A: **Meanings of Tourist Souvenirs: From the Holiday Experience to Everyday Life.** Journal of Travel Research 2020, Online first. <https://doi.org/10.1177/0047287520915284>
 49. Petrelli D, van den Hoven E, Whittaker S: **Making history: Intentional capture of future memories.** CHI2009: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2009, 1723-1732. <https://doi.org/10.1145/1518701.1518966>
 50. Lindley SE: **Before I forget: From personal memory to family history.** Human-Computer Interaction 2012, **27**(1-2):13-36. <https://doi.org/10.1080/07370024.2012.656065>
 51. Phenice LA, Griffiore RJ: **The importance of object memories for older adults.** Educational Gerontechnology 2013, **39**(10):741-749. <https://doi.org/10.1080/03601277.2013.766536>
 52. * Sas C: **Exploring Self-Defining Memories in Old Age and their Digital Cues.** DIS2018: Proceedings of the Conference on Designing Interactive Systems 2018, 149-161. <https://doi.org/10.1145/3196709.3196767>. Presents the findings of a

qualitative study on self-defining memories among older people and the cues that represent these memories.

53. Thomas L, Briggs P: **Reminiscence through the Lens of Social Media**. *Frontiers in Psychology* 2016, **7**. <https://doi.org/10.3389/fpsyg.2016.00870>
54. Wang Q, Lee D, Hou Y: **Externalising the autobiographical self: sharing personal memories online facilitated memory retention**. *Memory* 2016, **25**(6):1-5. <https://doi.org/10.1080/09658211.2016.1221115>
55. Kalnikaitė V, Whittaker S: **A saunter down memory lane: Digital reflection on personal mementos**. *International Journal of Human-Computer Studies* 2011, **69**(5):298-310. <http://dx.doi.org/10.1016/j.ijhcs.2010.12.004>
56. Leret SC, Visch V: **From smells to stories: The design and evaluation of the smell memory kit**. *International Journal of Design* 2017, **11**(1):65-77. <http://www.ijdesign.org/index.php/IJDesign/article/view/2572>
57. Moncur W, van den Hoven E, Julius M, Kirk D: **Storyshell: The participatory design of a bespoke digital memorial**. *PIC2015: Proceedings of the Conference on Participatory Innovation 2015*, 470-477. <http://dx.doi.org/10.13140/RG.2.1.2802.4489>
58. Banks R, Kirk D, Sellen A: **A design perspective on three technology heirlooms**. *Human-Computer Interaction* 2012, **27**(1-2):63-91. <https://doi.org/10.1080/07370024.2012.656042>
59. Odom W, Banks R, Harper R, Kirk D, Lindley S, Sellen A: **Technology heirlooms? Considerations for passing down and inhering digital materials**. *CHI2012: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2012*, 337-346. <https://doi.org/10.1145/2207676.2207723>
60. Jode MD, Barthel R, Rogers J, Karpovich A, Hudson-Smith A, Quigley M, Speed C: **Enhancing the 'second-hand' retail experience with digital object memories**. *UbiCom2012: Proceedings of the Conference on Ubiquitous Computing 2012*, 451-460. <https://doi.org/10.1145/2370216.2370284>
61. Bannon LJ: **Forgetting as a feature, not a bug: The duality of memory and implication for ubiquitous computing**. *CoDesign* 2006, **2**(1):3-15. <https://doi.org/10.1080/15710880600608230>
62. Bate D: **The Memory of Photography**. *Photographies* 2010, **3**(2):243-257. <https://doi.org/10.1080/17540763.2010.499609>
63. Kelly L: **The Memory Code**. Allen & Unwin; 2016. ISBN: 9781760291327.
64. Baytaş MA, Coşkun A, Yantaç AE, Fjeld M: **Towards materials for computational heirlooms: Blockchains and wristwatches**. *DIS2018: Proceedings of the Conference on Designing Interactive Systems 2018*, 703-717. <https://doi.org/10.1145/3196709.3196778>
65. Winterich KP, Walker R, Irwin JR: **Keeping the memory but not the possession: Memory preservation mitigates identity loss from product disposition**. *Journal of Marketing* 2017, **81**:104-120. <https://doi.org/10.1509/jm.16.0311>
66. Denegri-Knott J, Jenkins R, Lindley S: **What is digital possession and how to study it: A conversation with Russell Belk, Rebecca Mardon, Giana M. Eckhardt, Varala Maraj, Will Odom, Massimo Airoidi, Allesandro Caliandro, Mike Molesworth and Alessandro Gandini**. *Journal of Marketing Management* 2020. <https://doi.org/10.1080/0267257X.2020.1761864>

Connection Types Between Possessions and Memories

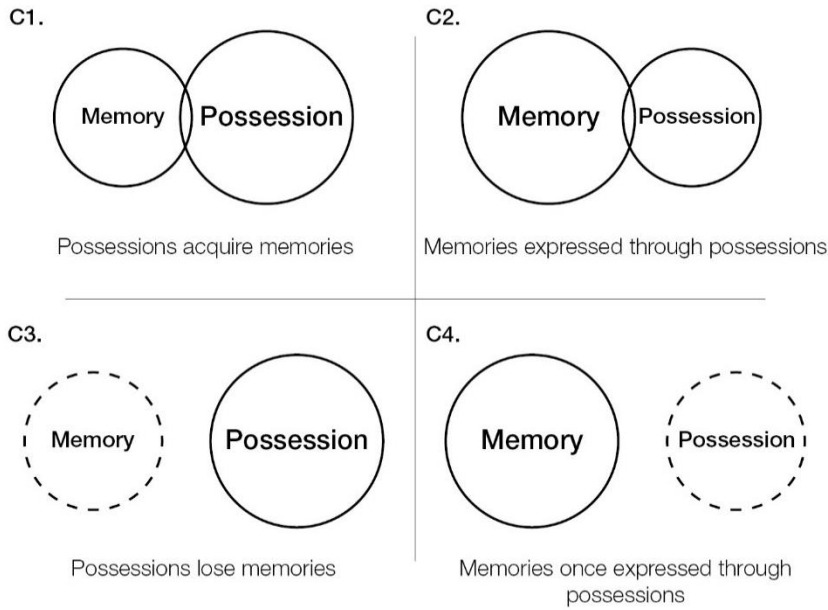


Figure 1. Visual of the four different kinds of relations between possessions and memories, C1 and C2 represent a connection between possession and memory that still exists, from an object or memory perspective respectively. C3 and C4 have lost the connection (temporarily or permanently) between possession and memory, and either the object or the memory remains.