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# Interactive Jewellery as Memory Cue: Designing a Sound Locket for Individual Reminiscence

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Figure 1. Memento: a sound locket  
for individual reminiscing

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## Abstract

In this paper we describe the design of Memento: an interactive sound locket for individual reminiscence that triggers a similar sense of intimacy and values as its non-technological predecessor. Jewellery often forms a cue for autobiographical memory. In this work we investigate the role that interactive technologies could play in this relationship. We first explore the way in which people record sound fragments and we present related work in the field of interactive jewellery and sonic memory cueing. The insights are used to inform the design process. The resulting concept, Memento, uses interaction scenarios inspired by the interaction with traditional lockets to activate recording and playback, and to browse through the recorded audio fragments. In order to connect object and content, Memento is a stand-alone single-purpose piece in which physical object and digital content are inseparable.

## Author Keywords

Interactive Jewellery; Reminiscing; Sonic Memory Cue; Memento; Tangible Interaction; Interaction Design.

## ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

Personal history and life events are stored in people's autobiographical memory. Autobiographical memory is known to support the construction and development of identity and to shape preferences [4]. It can be triggered by means of memory-cues. Principally everything can be a memory cue: think, for example, how a photo can remind you of a party or how the smell of cinnamon triggers memories of your grandmother. Recently, many HCI researchers have gained interest in actively designing memory cues in the shape of interactive objects [8]. We are particularly interested in the way interactive wearables can function as memory cue. Their availability and their proximity to the human body seem to fit with the often personal and intimate character of autobiographical memories. Interactive wearables can take many shapes: varying from smart watches and e-textiles to interactive jewellery. We are especially interested in the latter since it can build upon the rich social cultural history of traditional jewellery. Actually, one of the main motivations for people to wear traditional jewellery is its ability to function as a memento [15, p. 146]. We like to see how interactivity in jewellery can extend and enrich this function even further.

Jewellery is known to be a marker of life-events: think, for example, of wedding or engagement rings. One of the five motivations to wear jewellery is to remember one's background and loved ones [15]. In the recent decades electronics have miniaturised up to a level that it can be integrated in wearables, amongst which jewellery. However, most of the commercial wearables show an engineering background, focus on functionality, and a lack of intimacy [16]. In contrast, jewellery is associated with exquisite craftsmanship,

long lifespans, and high personal value. For interactive jewellery to hold this same value, we expect that a similar focus on materiality and intimacy is needed. Also, a large number of rich gestures and movements are related to traditional jewellery (e.g. the unaware fidgeting with a pendant, or the graceful stretching of fingers when showing a ring). When introducing technology to jewellery, it might be valuable to leverage people's experience with these movements and gestures: these gestures can be re-interpreted to form a tangible interaction with digital content. Lastly, the digital content on interactive jewellery needs to be designed and represented in a way that fits the jewel itself.

Adding microelectronics to traditional jewellery not only allows for interaction, but also introduces new modalities, such as sound. We would like to explore sonic memory cues for individual memory recollection for sentimental reasons (*reminiscence* [14]). Up-to-date there has been a limited focus on the use of audio as a memory cue [7], even though the research that has been done shows promise. Audio, for example, invites for more mundane and 'true to life' cues [5] than the often-researched visual cues.

So in this work-in-progress paper, we describe the design of a piece of interactive jewellery that: (1) functions as a sonic memory cue for individual reminiscence and (2) aims to create a similar sense of intimacy and value as its non-technological predecessor. In the remainder of this paper, we first discuss related work in the field of interactive jewellery and sonic cues, after which we describe an exploration in which we invited participants to record sound fragments. We present the results from the exploration



Figure 2. (a) *Farewell, Sweet Memories* [2]. (b) *Sonic Gems* [12]. (c) *Sound locket* [1]. (d) *Kapture* [9].

in relation to literature on sonic memory cues. We use related work and the insights of the exploration to identify requirements for our design of a sonic memory cue for reminiscing. After briefly explaining our process and design decisions, we present sound locket *Memento*. We conclude this paper with directions for further development of *Memento*.

### Related work

We collected a number of research endeavours and commercially available products that are in line with this research. In *Memory Box* [6], the metaphor of a jewellery box was used to associate a recorded narrative with a souvenirs. The *Sound Locket* (figure 2.c, [1]) stores a visual representation (the sound wave) of a certain audio fragment. While both of these works relate to sonic memory cues, they do not use the sound fragments as a cue on its own but either use the audio as a supporting narrative or translate the audio into a visual cue. *Sonic Gems* (figure 2.b, [11,12]) are small handheld objects that can be placed in a pendant to record sounds. By displaying the objects in a bowl the fragments can be retrieved. The gems present interesting recording mechanisms (both prospective and retrospective) but uses buttons as interaction style. Playback of the fragments seems more directed towards social than individual reminiscence. The same goes for the *FM radio* [13], which holds sonic souvenirs that can be played back with the family. *Kapture* (figure 2.d, [9]) is a bracelet that continuously records audio from its surroundings and saves the last 60 seconds of audio when being tapped. *Kapture* requires a mobile phone application to retrieve and playback the stored fragments. The locket *Voice of Blue* [3] and pendant *SoundGem* [10] can be used to playback an audio fragment, but need to be placed in a recorder or

require uploading: they both do not combine recording and playback in one device and they can both hold only one fragment. Also, *Sound Gems* is meant for gifting a sonic memory, rather than for personal recollection. Lastly, *Farewell, sweet Memories* (figure 2.a, [2]) is an installation that removes sound fragments from a tape by rubbing a magnet over it when it does not receive attention. This installation presents an interesting view on curating memories and on the notion of forgetting but is not directly related to jewellery.

### Exploring Sonic Memory Cues

We started with an exploration on sound recordings for reminiscing. We asked participants to record sound fragments that 'they would like to keep' during a period of two weeks. Participants (n=16, female=8) were recruited by acquaintance. They were asked to use their personal smartphone for the recordings and to send the fragments to the researchers via email. In informal interviews (over telephone or email) we asked participants about the fragments they recorded and their experiences in the two-week period. While similar studies have been performed ([5,11]), these studies involved limitations for the participants, specifying, e.g., the event [5] or number of fragments per day [11]. We are interested how the characteristics of sound as memory cue as identified in these studies compare to results from a freer setup. Therefore, in this study, we did not specify the number, length, or nature of the fragments.

### Insights

Eighteen sound fragments were returned during the two-week time period by nine of the sixteen participants (see table 1). All fragments fall within the categories identified by Oleksis and Brown [11]: natural

#	sex	age	fragment	category	time
1	F	24	Making coffee	Domestic	1:23
			Running bath water	Domestic	0:31
			Making a sandwich	Domestic	0:26
			Walking in the snow	Ambient	0:28
2	F	60	Airplane flying over	Ambient	0:16
3	F	30	Boyfriend's snore	Domestic / Voices	0:27
4	F	29	Orchestra practice	Event	2:18
5	F	24	Bar with friend	Ambient / Voices	0:23
6	F	26	Wedding toast	Event	0:09
7	F	23	Giggling	Voices	0:16
			Personal expletive	Voices	0:01
			Expletive friend 1	Voices	0:02
			Expletive friend 2	Voices	0:02
			Expletive roommate	Voices	0:02
Yawn	Voices	0:04			
8	M	30	Finger clicking	Ambient	0:06
9	M	20	Noises	Voices	0:31
			Dinner with family	Voices / Domestic	3:02

Table 1. Overview of all recorded sound fragments.

and ambient sounds (e.g., walking in the snow), voices (e.g., family dinner), phrases or spoken words (e.g., the expletives), everyday domestic sounds (e.g., making coffee), and sound related to special events (e.g., the wedding toast). Dib et al. [5] found that, in contrast to photos, most sound fragments are unpolished, mundane, and 'true to life'. We observed this in the fragment of the orchestra practice that contains an off-tune solo and in the wrangling that can be heard in the fragment of the family dinner. We also observed staged sounds, such as the yawn from subject 7 that she recorded as a representation of this in her words 'dull and boring' period in her life; or the toast from subject 6 to remind herself of the toast at her wedding two years ago. This underwrites [11], saying that the sound does not necessarily has to come from the event it reminds the listener of but that imagination can recreate a memory and evoke feelings in an equally strong way. The fragments have durations ranging from one second to 3,5 minute. We noticed, however, that the longer fragments are all either repetitive of nature (e.g., the coffee maker, walk in the snow and bath water) or more about the ambience rather than the actual recorded sound (e.g., the dinner conversation or the café fragment). While longer recordings can be interesting because of their more faithful duration and details [5] and their ability to really immerse listeners into the remembered moment [11], they restrain the listener to the pace of the sound. It seems that short but significant 'chunks' of sound are generally valued higher than longer recordings [11]. Seven out of the original sixteen participants did not send any fragments. Six out of the nine that did sent only one fragment. Most participants mentioned that they had forgotten to record sounds and still had events in mind that they would have liked to record.

Participants also mentioned that while capturing, audio is less intrusive than, e.g., photo or video capture. The same was also noticed by Oleksik and Brown [11], who state that audio recording appears to bring down and blur the boundaries between observer and participant. However, availability is important: the recording device should be easy to activate without interrupting the activity [11]. Interestingly, most participants did not listen back any of their recordings. While the short time frame makes it difficult to draw conclusions from this observation, it seems that the importance of a trigger and easy access to the fragments holds for both recording and the playback.

### Designing a Sound Locket

Looking at the results of the exploration and literature on interactive jewellery and sonic memories, we can identify several implications for the design of interactive jewellery that supports individual reminiscing through sound fragments. First of all, the piece of jewellery should be suitable for individual reminiscing. We decided to design a locket because of its secretive and intimate nature: only disclosing its private content to the wearer when being opened consciously. In terms of interaction, the locket should be ready to use for recording at any time and recording sounds should not be an intrusive or attention-consuming activity. Moreover, we aim to inspire the activation of recording and playback, as well as the action of browsing through the recordings on interaction scenarios with traditional jewellery. Since we found that playback needs to be triggered, we decided to combine the recording and playback into one single-purpose object. The locket should be able to capture more than one fragment, yet there should be a maximum number of fragments to assure selectivity (as described in [14]).

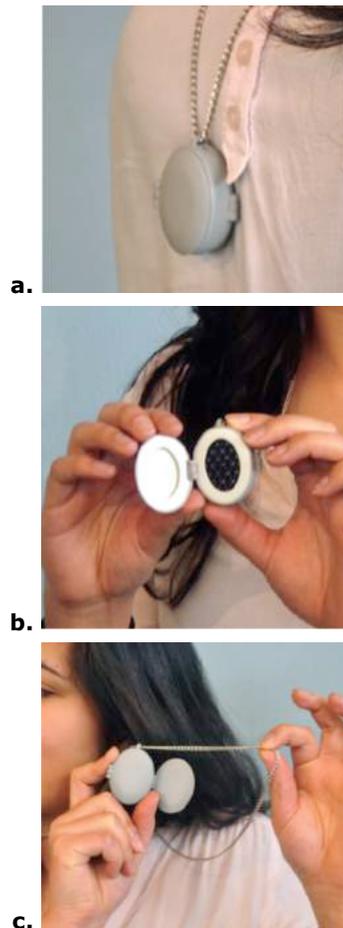


Figure 3. (a) Memento. (b) Open the front lid to record sound fragments. (c) Open the back lid to playback fragments. Browse through the fragments by pulling the chain through the pendant.

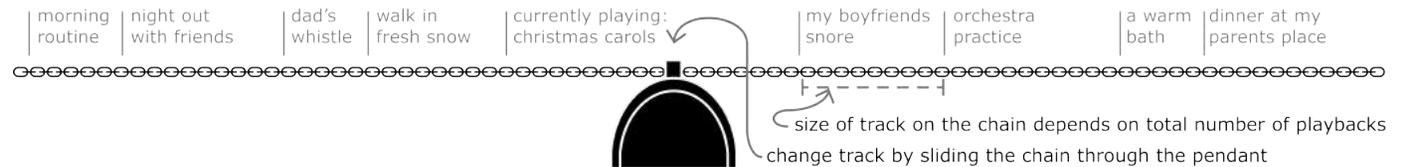


Figure 4. The sound fragments are positioned around the chain of the locket. The size of the track depends on the total number of playbacks. Users can change the track by sliding the chain through the pendant.

While the type of sound that is recorded should be left to the user, duration of the recorded fragments could be restrained in order to trigger selectivity. Since the value of memories can change over time, the locket should allow for infrequent playbacks and the revival of fragments. To make sure that the object and the content equally contribute to the value of the design, the locket should be a stand-alone object and the recordings should not be transferrable to other devices. This also prevents for privacy issue when sharing clips, as identified by Oleksis & Brown [11].

#### *Memento*

Memento (figure 3) combines both recording and playback of sound fragments in a single-purpose device. Recording is an interaction with the outer world where sounds of the surroundings are captured. Playback of the fragments is more personal and intimate. The locket has two lids to express these different values. By opening the front lid, the locket records sound fragments of maximum 10 seconds. Opening and closing of the lid is an interaction that requires little attention of the user and that is expected not to interfere with the moment. The lid on the back always faces the user and is not shown to others, which makes it an intimate and personal part. By opening the lid, fragments are played back with low volume so the locket needs to be brought close to the ear. This makes

Memento especially suitable for individual reminiscence. The difference between the two lids is shown in the convex-shaped back and concave-shaped front lid, so that the locket comfortably rests on the user's chest when worn correctly.

In memento, the recorded sound fragments are virtually positioned around the chain (figure 4). Users can scroll through the different sounds fragments on memento by pulling the chain through the loophole in the pendant, just like fidgeting with a pendant of traditional jewellery. The total number of playbacks of the fragment determines the space that a fragment takes in on the chain: the more a fragment is played back, the easier it is to locate again. Since the number of playbacks is continuously updated, the dominance of certain memories can evolve and vary over time. Memento can store up to fifty sound fragments, which requests some selectivity and contemplation of the user before recording but still allows for revival of almost forgotten memories. On the fifty-first recording, the locket automatically deletes the fragments with the lowest total number of playbacks to make space for the new recording. Sound fragments cannot be up- or downloaded from the locket. We expect that the sliding of the pendant through the chain will both be performed conscious on playback to search for a certain memory and unaware when the locket is not actively

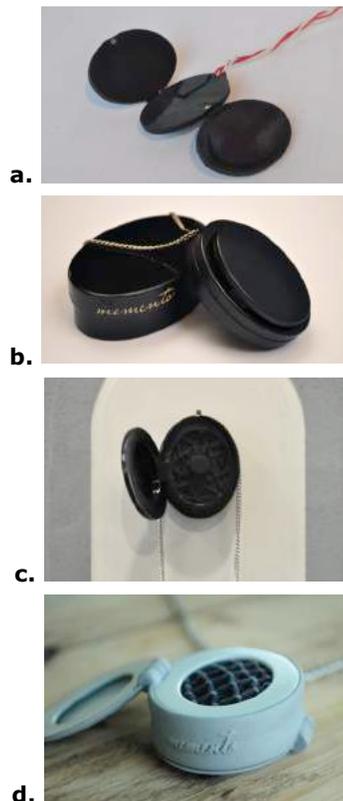


Figure 5. Four generations of Memento prototypes. (a) A prototype to test the two-sided interaction. (b) A wearable version that can only record one sound fragment. (c) A fully functional but not mobile prototype, connected to a laptop interface. (d) A 3D printed mockup to further explore the shape and finishing of Memento.

used. The unaware interaction will result in the revival of unexpected and forgotten sound fragments on playback. Since fragments cannot be backed-up, we expect the locket itself to become of value to people.

### Future steps

In order to deploy Memento in a real-life context, the prototype requires further development. We focus development towards three aspects: (1) materiality and finishing, (2) interaction, and (3) technical realization. While the main interaction with the locket has already received much attention in the design process so far, we would like to further explore subtleties in the feedback that the locket provides. The scrolling interaction, for example, could provide haptic feedback on the number of fragments and the importance of each fragment, by altering the resistance of the gearwheel. While the 3D-printed prototype (figure 5.d) makes a big improvement already, the finishing and materiality of the locket needs to be improved. We would like to make the locket from metal, to increase the link to traditional lockets. Also, the detailing on the inside and outside of the locket could be improved to give it a more valuable appearance and to increase the recognisability of the front- and backside. Lastly, none of the prototypes (figure 5) are both wearable and fully functional. Technically challenging is especially the size: the prototyping boards we used so far are not small enough; dedicated circuits are needed for a next prototype. While a challenging process, we do not foresee major issues in the technical development.

We plan to use the prototype in a longitudinal evaluation, where we deploy instances of Memento in a real-life context. The main objectives of the evaluation will be (1) to observe the use of the interactive jewel,

the value of the digital content, and the value of the object itself and (2) how these aspects develop or change over time.

### Conclusions

In this work, we aimed to design an interactive sound locket for individual reminiscence that triggers a similar sense of intimacy and value as its non-technological predecessor. We did so by:

- inspiring the interaction with Memento on the interactions with traditional lockets (e.g., the two-sided lids for recording and playback, and the movement of the chain through the pendant for scrolling through the sounds);
- creating a stand-alone, single-purpose piece in which recording and playback are combined, and in which the physical object and digital content are one, since fragments cannot be up- or downloaded;
- adjusting the dominance of each individual sound fragment so that often-listened (and apparently cherished) fragments are found more easily, without losing the opportunity to revive fragments that are less listened to.

While clearly in-progress, we perceive Memento as a relevant step towards designing valuable interactive jewellery for individual reminiscence.

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