

Cueing the Past: Designing Embodied Interaction for Everyday Remembering

Dirk van Erve¹, Gerrit-Willem Vos¹, Elise van den Hoven¹, David Frohlich²

¹Industrial Design department
Eindhoven University of Technology
P.O.Box 513
5600 MB Eindhoven, the Netherlands
e.v.d.hoven@tue.nl

²Digital World Research Centre
Faculty of Arts & Human Sciences
University of Surrey
Guildford GU2 7XH, UK
d.frohlich@surrey.ac.uk

ABSTRACT

Embodied interaction describes how meaning in interaction is created through engagement. With this approach as a source of inspiration for three exploratory design cases this paper explores the possibilities of embodied interaction in storing, retrieving and enriching everyday memories. Following the principles of designing for embodiment, all three design cases aim at cueing memories through visual modalities like photo and video. We discuss these case studies in light of the embodied interaction and memory theory. Our findings indicate that everyday remembering may be a suitable application area for combining it with embodied interaction, because of its abstract and personal nature.

Author Keywords

Everyday Remembering, Embodied Interaction, Interaction Design, Case Studies, Tangible Interaction, Autobiographical Memory

INTRODUCTION

Digital recording devices, such as mobile phones and cameras, make it possible to digitize every form of media we possess or future memories we create. But this trend of digitization proposes new questions on how interaction design can re-establish the physical interaction with media in the digital world. Do we want to replace physical actions in the world by virtual representations? As Klemmer et al. argue, “although the digital world can provide advantages, there is so much benefit in the physical world, that we should take great care before unreflectively replacing it”[17]. In that view they specifically state the room for improvisation in action that the physical world offers and cannot be neglected when integrating the physical and the digital world. Dourish [5] preceded this view with his

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approach on embodiment and embodied interaction where he states that “Embodiment is how these physical and social phenomena unfold in real time and space as part of the world in which we are situated.” Thus specifically focusing on the physical world we live in.

This paper works towards creating an understanding on how to combine principles of embodiment with interactive systems by exploring three design cases. These cases focus on combining the concept of everyday remembering with the design principles on embodied interaction as described by Dourish. The paper is subdivided in Related Work, Design Explorations and a Discussion on these results, where we will end with conclusions and opportunities for applying the design principles on design cases.

RELATED WORK

In this section we describe the approach on embodied interaction by introducing the foundations and related fields of research in Psychology, Philosophy, Engineering, HCI and Interaction Design. Furthermore we will show our understanding on the topic of everyday remembering through theory and examples of related projects and design cases.

Embodied Interaction

In his book “Where The Action Is”, Dourish [5] approaches embodiment as a phenomenon underlying the two trends that have been emerging in the field of human computer interaction (HCI): Tangible and Social computing. Tangible computing integrates physical representations and mechanisms for interactive control into graspable user interfaces [12], while social computing is put forward as an attempt to incorporate the understandings of the social world into interactive systems [5]. Dourish argues that embodiment is how these physical and social phenomena unfold in real time and space as a part of the world in which we are situated. In other words, embodied interaction is situated in real life, social context, revolves around technology, and is used over time [5]. The key to this approach is based on the understanding that the users themselves create and communicate meaning by interacting with the system, not the person that created it. So, as Dourish describes it, embodied interaction is “the creation,

manipulation and sharing of meaning through engaged interaction with artifacts.” [5]

This paradigm in human cognition resembles work in other cognitive areas where cognitive processes are approached as being “embedded”, “distributed” or “off-loaded” on to the social and material context [14, 16, 20], yet all share the idea that human cognition is hybrid in character: mind, body, and context are coupled. Recent work done seeks to apply these paradigms on more complex, real-world examples of especially the social distribution of cognition with the emphasis on memory [1]. Since memories frequently involve more than a single individual they argue that encoding, storage and retrieval of memories is largely distributed amongst social groups.

Everyday Remembering

The design cases described in this paper focus on creating products that are used to store and/or recollect personal experiences through various media, which in turn link to Autobiographical Memory (AM). This type of memory is used for “remembering the events in one’s life” [3], which has several functions, such as construction of self-concept, regulating moods, maintaining relationships and problem solving [13].

The topic of Remembering and how the human memory works has been studied extensively. One of the most well-known theories described, for instance by Plato, is how memory works like a library from which every memory of an event can be retrieved; later called the record-keeping approach [9]. A different theory on memory is the constructionist approach [9], which was put forward, amongst others, by Freud. The approach describes how the human memory is a constantly adapting system [13], which changes connections between how ideas, concepts, recent events and patterns are stored in the brain. Especially regularities and exceptions in that case, help us to remember by reconstructing them. For example, the period of going to the elementary school is mainly remembered by thinking about the regularities of that school. But exceptions, like your graduation, are also still vivid memories, which can be reconstructed.

The constructionist approach shows how these memories are not retrieved as a whole but how parts of it are cued. These cues are stimuli that can help someone to retrieve information from memory, but only if the cue is related to the to-be-retrieved memory. In principle anything could be such a cue (a spoken word, a color, an action or a person), as long as there is a link between the cue and the to-be-remembered event [13]. However the effectiveness of different modalities can differ. Scents are often linked to more emotional events, than memories triggered by visual and verbal cues [10], while visual cues like photo’s proved to be effective in reconstructing everyday events [15].

Here, reconstruction and remembering are part of five functions a cue, product, or system, can have over human

memory. According to [19] these are: recollecting, reminiscing, retrieving, reflecting, and remembering. While recollecting and retrieving bits of memory are described as activities of finding lost objects or filling in the gaps within your memory, reminiscing is a way of re-living past experiences for emotional or sentimental reasons. Reflecting and remembering, on the other hand, have a focus on the future, aiming at learning from past experiences or simply to remember which errands you needed to do today.

Within their paper, Sellen and Whittaker [19] further describe these five functions as benefits to the current LifeLogging culture, which takes everyday remembering to more extreme levels. Current technological tools make it possible for people to start capturing every moment in their lives both on the level of content and context. This activity is “effortless and all-encompassing in terms of data capture” [19], while deliberate activities like the capturing of personal data through digital photography are seen as effortful.

Related products and systems

Much of the current work done in designing products or services for memory capture and retrieval is based on using memory cues, which have a clear direct link with the to-be-remembered event, such as souvenirs, photo’s and artifacts from the event itself. Examples of such systems are: the Digital Photo Browser [11], which uses physical souvenirs as a shortcut to sets of photos on a digital interface; The AudioPhoto Desk [6] which is a desk that enables users to play back sounds associated with physical photographs, according to their arrangement on the desk itself. Or the Memory Shelf [7], which links physical objects and souvenirs to audio tracks of the event. Similar to these examples a recent study [13] asked participants to “create a time capsule for your (grand) children who will open it 25 years from now”. In this study the participants were able to log their life by inserting items in a box that could be used for later recollection. The study was not just about storing items, but also focused on how they would be retrieved in the future. The researchers found that people preferred to put in samples of everyday activities rather than complete daily records, making it difficult or “a puzzle” to recollect memories in the future.

With regards to LifeLogging, we can distinguish between capture and visualization tools. Sensecam [15] is an example of a capture tool specifically designed for LifeLogging purposes. The Sensecam captures series of still images of an individual’s everyday life that could aid in the retrieval of recent memories while hanging around the wearers neck. Each of these pictures is tagged with GPS coordinates making it possible to map them using visualization tools like Snaps, or Tracks. These tools combine the data from the Sensecam into computer visualizations.

Additionally to these examples, the History Tablecloth [8] is designed to cue memory by visualizing recent activity on the dinner table at home. The tablecloth illuminates at places where objects are and were placed, showing a glimpse of the very recent past. In this example the cue itself does not possess direct information, yet the users creates the meaning of the cue. Although this is not on the topic of AM, it shows an embodied way of retrieving recent memory, where the user, not the product, creates the meaning of the cue.

This last example shows an embodied way of dealing with recent memories, yet the examples and literature from psychology, HCI, philosophy, engineering and interaction design leave a lot of questions unanswered towards the application of principles from Embodied interaction to everyday remembering. Especially on a practical level about showing how one could apply those principles and showing case studies.

DESIGN EXPLORATIONS

As explained in the introduction, this paper works towards creating an understanding on how to combine principles of embodiment with interactive systems. Following principles of Dourish [5], these systems show how computation becomes a medium rather than the goal, fitting technology in the wider pattern of practice by the user, where meaning arises on multiple levels of interaction. Design insights are put forward because interaction design, in comparison to traditional sciences, is something, which happens in the world and context of the user.

Combining the principles on embodied interaction with the knowledge about AM and memory cueing, three concepts were developed at the faculty of Industrial Design, Eindhoven University of Technology. Each concept is developed by a different group of 3-4 recently graduated interaction designers; all exploring the possibilities of embodied interaction in storing, retrieving and enriching memories in a 4-day pressure cooker setting. In a pressure cooker, the design team is challenged to go through a full design process in a short time. This can help in quickly generating concepts and insights, which can inform the process and content of a longer design iteration later on. In the project described in this paper, the teams were challenged to take into account the principles of Dourish as much as possible.

In advance of this four day project, all designers were briefed through a series of presentations on the topics of embodied interaction, everyday remembering and the use of modalities like sound for storing and cueing memories. The briefing envisioned the use of multimodal, tangible interaction concepts to explore the opportunities for designing creative concepts for everyday remembering through the principles of embodied interaction. Because all designers were only available for the length of this four day project, we did not prototype or test the concepts with users.

Instead we stayed on a conceptual level to explore the interaction possibilities and interpretations of the principles.

Design Concept 1: 'Memory Stamps'

The first concept that combines autobiographical memories with the ideology of embodied interaction is Memory Stamps. This concept was developed to explore the possibilities of recollecting shared memories within a group through physical interaction with photos and sounds. Figure 1 shows a model used to illustrate the functionality in a Wizard-of-Oz setting.



Figure 1. Pressing a photo on the interaction screen with a memory stamp. Photo browsing along the border of the screen

Goal

After having studied the essence of autobiographical memory and the approach of embodied interaction, this concept was conceived with one goal in mind: to improve sharing memories between people who have been taking part in the same event, activity or have been at the same location. The concept facilitates the creation, storage and retrieval of a visualization of such an event, activity or location. It should also allow users to be creative with their photos and think “out of the box” by adding other photos and sounds. This activity of photo sharing takes more effort in the creation process, but that is supposed to result in richer memory artifacts with possibly higher emotional involvement.

Idea

The Memory Stamps concept consists of a multi-modal set of objects to add labels to photos. These labels have both visual and auditory properties for cueing memories and strengthening associations between photos and memories.

Group sessions around a big screen (Fig. 1) are meant to bring people together and to strengthen relationships. The concept is based on the fact that different people have different experiences of the same events, activities or locations. While sharing their experiences, the users enrich

each others' memories with different cues. At the same time they learn about each other and relationships grow.

When a photo from a previous session is readdressed on the screen, but this time with a different group, it can result in a new and refreshing session because unfamiliar visual cues can trigger different, new parts from memory.

Using the included digital photo frame separately results in a different context of use and a different meaning. At this point the photo frame also includes a soundscape to serve as a tool for storytelling. In this setting, a user who is familiar with the photo can share experiences with a person that knows nothing about the photo.

The sounds of a soundscape contribute to the emotional richness of the story [18]. Memory cues of other people trigger different elements of the specific memory related to the photo. These cues could be perceived as irrelevant by the user, so that is why the stamp can also be used to filter out these parts of the soundscape. Figure 2 shows the photo frame with a stamp inserted when controlling properties of the photo and soundscape.



Figure 2. Using a memory stamp on the separate photo frame (seen lying on the bigger screen in figure 1)

Concept Description

The concept consists of an intelligent interaction screen (approximately 50x50cm), a digital photo frame and a set of stamp objects.

The interaction screen is a central object that is used to create and manipulate the visualizations. It can be placed on a table for group sessions of recollecting memories together. When the photo frame is placed on the screen, it will extrapolate the lines and colors of the photo on display onto its surface; thus creating a virtual canvas that supports a more natural grouping of visuals in the visualization.

Every person participating in the recollecting memory session has a stamp of his/her own. This stamp is a container for memory cues (e.g. photos). While discussing the photo on the digital photo frame, the screen will

recognize keywords using speech-recognition. It will use a search engine to come up with an array of suitable photos to represent those keywords and display them along the edges.

Now the users can use their stamps to scroll through these arrays of visual cues. By sliding their stamps along the edges of the screen, scrolling is made possible through physical interaction. When the desired visual cue is found, the user is able to “suck” it into the stamp object. Colored lights indicate the primary characteristics of the loaded photo. By making a reverse movement, the user can now press his or her stamp onto the digital canvas. The interaction with the stamp allows scaling and sliding.

When the photo frame is removed from the interaction screen all visual cues and their position added to the digital photo are saved with the photo. When the same photo is displayed on the screen again, all previously saved cues will appear on the screen.

In addition to this functionality, the digital photo frame can be used separately too. When a photo, with visual cues stored with it, is on display on the digital photo frame, sounds will emerge from the photo frame. All visual cues are used to generate a soundscape. The sounds in this soundscape serve as audio memory cues. When a user's stamp object is inserted in the photo frame, it can be used as a sound filter and volume button. Only the memory cues added with that stamp object will remain in the soundscape.¹

Design Concept 2: 'What are the Odds'

This design concept focuses on cueing event specific knowledge (ESK), which is the most detailed level of autobiographical memory [13]. It functions as a platform for storytelling together with friends through sharing experiences.



Figure 3. Dice and oled screens displaying digital photos

¹ A video demonstration to clarify interaction with Memory Stamps can be found here: <http://youtu.be/rkywdXO8I4g>

Goal

The goal of this concept is to maintain existing relationships with friends by sharing experiences through storytelling. In that sense the concept focuses on memory retrieval rather than storage and enables browsing through photo and video collections by building upon the luck of the dice. Figure 3 shows a visual representation of what the product could look like; objects are paper prototypes.

Idea

Through interaction with a set of dice, photos can be tagged to make browsing more intuitive by adding categorized properties of memories (number of people, weather, time, location). Thus enriching the memory cues these photos provide to their users.

The concept facilitates actions, which resemble going through your old photo collections and enables marking and browsing. The interaction is based on the metaphor of flipping through photos. Both this interaction style and the use of dice are something the user can give personal meaning to and be creative with. The dice are used for both tagging and cueing of digital media, which over time will become an extension of one's memories in both retrieval and processing of these same memories. The dice have several different tag themes: the Who, What, Where, When and Weather themes. These are not factual tags, instead they represent information based on the users overall activity.

Finally, the reason for throwing dice is to enhance the fun of storytelling, and to create a new level in the experience of telling a story to friends and yourself. How it will actually be used over time is something that in this case would specifically be interesting. How will the system evolve, and how will it change the interaction patterns from the user is a question which should be further investigated.

Concept description

The concept proposes a set of small screens similar in size, shape and touch to photos printed out on paper. These flexible screens are linked to the user's personal home media archive, in which photos and videos from digital cameras are stored. The concept provides two types of memory cues: 1. Photos/Videos, 2. Personalized tags. These help the user to reconstruct their memories, for storytelling purposes.

A set of dice aids in tagging and browsing through your digital collections. Each of these dice is linked to a theme within the metadata of the media collection. These themes are Who, What, Where, When, and Weather. Since the majority of digital cameras have the ability to record time, location, and weather (think about smart phones), each uploaded photo is already tagged with that specific metadata concerning to where it is taken, and at what time, and current weather conditions. The user is asked to further define tags for their photo collections. By taking a dice that is themed What and Who, they can "stamp" a tag onto the

digital photos (by pressing it onto the photo with the concerning face of the cube downward), enabling more specific memory cueing in the future. Think of the information people used to write on the back and next to printed photos. Figure 4 illustrates a possible scenario of use using paper prototypes.



Figure 4. Dice on table during interaction with digital photographs

Although each dice is themed with icons, the user can define its meaning himself. The dice merely contain icons in a certain theme, how the users actually interpret these icons is up to their own imagination. Thus, multiple collections by different users can be tagged in a very different way depending on what the focus of the user was when making each photo and video. By placing the dice on the table the user is able to browse through their tagged collections, in which all displays on the table show the same images when not interacted with.

When picked up, each photo display represents a shared photo, which people can use to tell their stories to their friends and family. By flipping such a photo, the user can browse through the collections and look at each photo more individually. Thus the concept enables both private viewing with one display and group viewing when all displays are placed on the table or on everybody's lap. In this case the dice are there to provide a more playful but also explorative experience. By grabbing the dice and throwing them on the table, you will not know what will come up e.g. old photo collections or forgotten videos.

Since we see memory from the constructionist approach these memories change over time, or links to other memories start to occur, therefore tagging has to be dynamic. Thus the user can change the tags for each photo collections and can therefore link new collections to older collections by, for example, creating a dedicated dice or icon for that specific memory.

Design Concept 3: 'Momentum'

The last concept takes another approach by focusing on the capturing of autobiographical memories and providing richer memory cues to something in the recent past.

Goal

Intrigued by the technical possibility of storing and processing of continuously captured media from a users perspective, this concept aims at a unique way of capturing valuable moments.

Idea

Momentum is a new kind of camera which takes burst stills according to the manipulation of its handles. The concept should add value to a stored memory by not just facilitating recording a moment through one carefully chosen shot, but by adding the series of events that led up to this moment and followed afterwards.

Unlike video, a record made with the Momentum offers a way of looking at the context of the experience. E.g. all the things that happened before and after the photo was taken. Just like the Memory Stamps, this concepts allows saving of memory cues that would normally take place outside of the photo and possibly be forgotten.

Since it will take quite some effort to take a photo, the user is forced to think about what he or she wants to record. Taking a photo will no longer be something that can be done without paying close attention; it will become special again with Momentum. Just like the moment itself, capturing the moment creates more meaning and emotional value is subscribed to it.

The complex interaction is something that a user has to be trained in. As soon as the capturing of moments is mastered, the user can start using the concept for different purposes.

Concept Description

This concept consists of two objects: a wearable camera that is always capturing from the user's perspective, and a device that can be carried like a camera and used for capturing moments. A passive part of the concept is the wearable camera; it comes into play during the interaction with the capturing device.



Figure 5. Prototype demonstrating the physical interaction of taking a photo

The capturing device (Figure 5) can be used like a point-and-click-camera to initiate capture. To initiate a capture, the user has to pull out the handles on both sides of the

device. The user determines the time span of the capture by pulling the handles out far (long time span) or closer (shorter time span).

Next by pushing the handles back into the capturing device, the user sets the amount of snapshots taken in this time span. Pushing the handles in quickly creates a small amount of snapshots and a slow closing movement creates a lot of snapshots.

When a moment is captured, this means that images from the wearable camera are added before and after the shot made with the capturing device. Together, the two objects create a short movie that works towards the actual moment and then fades away afterwards. Figure 6 shows a graph showing the amount of pictures over time leading up to and following the main shot.

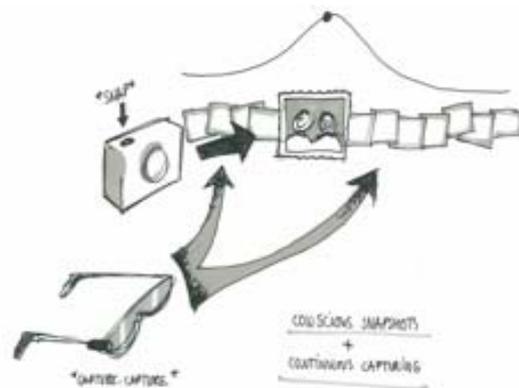


Figure 6. Illustration of the way a record will be captured with the Momentum: series of photos taken with a camera on the glasses are used to create a time-lapse record before and after the photo taken with the main camera

These moment souvenirs can then be stored in a home environment. A special library can be developed to store these memory records in for example a living room. There the user is able to play them back by a simple touch. Playing back the records wouldn't require the camera making the records standalone objects after they are made. The advantage of having such capture plates would be the ability to share the actual records with others.

When reviewing the captured moments, this can be done individually, but also in a group. A user could take one record and show it and talk about it to another person. But also multiple records could be reviewed at the same time enabling group activities of reminiscing.

DISCUSSION

The aim of the pressure cooker project was to reflect on the explorative concepts from the perspective of embodied interaction and everyday remembering. To what extent could these concepts be proper representations of embodied interaction systems and how should they be linked to everyday remembering.

Are These Design Concepts Good Examples of Embodied interaction?

When the design teams were designing for autobiographical memory using the principles of embodied interaction [5], they succeeded in implementing certain principles but had a hard time implementing others. Table 1 gives an overview of the qualities of each concept with regard to the principles of embodied interaction. The designers were asked to reflect on their decision-making and the result of the project.

Principles of Embodied interaction [5]	Memory Stamps	What are the Odds	Momentum
Computation is a medium	+	++	++
Meaning arises on multiple levels	++	++	++
Users, not designers, create and communicate meaning	++	++	++
Users, not designers, manage coupling	+	+	-
Embodied technologies participate in the world they represent	+	-	+
Embodied interaction turns action into meaning	++	+	++

Table 1. Assessing each concept by the principles of Embodied interaction (++ successful; + sufficient; -- unsuccessful)

The *Memory Stamps* concept uses a complex system to provide an interaction that allows the user to create meaning on multiple levels. This complexity however also makes it potentially harder for the users to manage couplings. The meaning a user gives to an action, determines the meaning of the computation and also the meaning of the technology. The stamps are a medium to create an object that users can give meaning to, but meanwhile the stamps themselves will get a meaning and even the event of interacting with the concept allows users to create meaning.

The *What are the Odds* concept creates meaning in a similar area as the *Memory Stamps*. Meaning can be created by the user over the media of photos through tangible objects (the dice and oled screens). Because the system is more straightforward, computation becomes more accessible as a medium. A weaker point of this concept is how the technology participates in the world of memory collection and retrieval. The dice and screens can be used to access a library. But it won't feel like working with the actual library of photos.

Even though functioning in a different area of memory, namely capturing memories, the *Momentum* concept also succeeded in implementing the majority of the principles of embodied interaction. Meaning arises in both capturing the memory, as in the action of determining when and how to capture it. Of all the concepts, this one gets closest to using

computation as a medium. The user gets control over the type of capture he or she will be making.

The interaction and tangible objects within this concept are in hardly any way coupled with the context of use. This makes it hard for users to manage coupling between the two, making that one of the weaker points of this concept.

Compatibility of Embodied Interaction with Designing for Autobiographical Memory

What principles of embodied interaction were easy to apply to a concept with autobiographical memory and what aspects were not?

Creating Meaning

From Table 1 it is clear that giving the users the opportunity to create meaning themselves is a very applicable principle of embodied interaction when working with memories. We believe this is due to the fact that memories are highly personal, which asks for an open interpretation of the objects and interaction in order to develop a concept that can be used by multiple different users. In autobiographical memory, people give meaning to one or several cues by linking them to a memory. That is exactly what *Memory Stamps* and *What are the Odds* experiment with as well.

Manage Coupling and Participate in the World they Represent

In order to be able to assess the concepts on this principle it is necessary to clarify our interpretation of the principle. In this paper we regard coupling of internal representation and the context of use as another way of advising designers to consider tangible artifacts to represent digital data or objects in the physical world. Ideally Dourish describes how he envisions the user doing the coupling.

The latter part of this principle proved to be the hardest. Creating tangible representations of digital data was a challenge, but proved feasible. However, in the concepts, the users can only give their personal meaning to the interpretation of the tangible artifacts. Coupling between the digital libraries and tangible artifacts is mostly predetermined by the designers.

Interaction designers are used to coupling digital libraries and physical artifacts in a clear way so it will be easy to understand for the user. If they would make this link between the representations and the context of use stronger but less clearly defined, a system could give the user more freedom to give his or her personal meaning to the interaction. It turned out very hard for the topic of autobiographical memory because it is difficult to create physical artifacts that represent something as impalpable as a memory in an abstract way.

The same goes for the difficulty all design teams had with making the embodied technologies participate in the world they represent. Often the structures of digital media libraries in which we store photos are organized in an inefficient or even inaccessible way [19]. To save the user

from this chaos, the first two concepts created ways of browsing through this library by putting the control somewhere else. Only Momentum approaches the problem differently. This concept tries to make the amount of memory artifacts smaller and thus the library less big and chaotic. By doing so the tangible artifacts need less functions and the interaction becomes stronger.

Design Related Decisions

All three design teams received the same design assignment, resulting in three different concepts. What do these designs have in common and why were certain design decisions made when designing for everyday remembering with embodied interaction?

Constructionist Approach to Everyday Remembering

Memory Stamps is a concept that focuses on the activity of recollecting, retrieving and reflecting on memories. By adding more information to a single memory artifact, cues become richer and enable more detailed remembering. Also What are the Odds aims at reminiscing and retrieving. By tagging photos, retrieval of memories becomes more intuitive and recollecting easier (since related memories will carry similar tags). Finally, Momentum approached the constructionist approach differently; namely by adding information to the memory cues during the storing process. This way Momentum aims at making the reminiscing experience richer.

All three design concepts worked with the constructionist approach to everyday remembering, because it gave more opportunity for the user to create meaning. Cues can be interpreted in many ways and are therefore personal. This way they enrich the explicit medium of photos in a more abstract way. We believe photos tend more towards the record-keeping approach, because they provide a lot of information presented as facts. E.g. a photo of a sunny holiday might make you think the complete holiday was sunny, whereas the photo was only taken at a given moment.

Use of Modalities in These Design Concepts

In the briefing all design teams were encouraged to explore multiple modalities and still, when regarding the three concepts described above, a similarity between each one of them is the use of photos as medium for storing memory cues. An important reason to choose photos was because photos cover much of the present past. Photos have been storing memory cues for some centuries already and are therefore an ideal medium to work with. In the distant future, other modalities might cover the past in ways photos do now. Other modalities can be media such as sound records or scent samples. Working with such modalities proved to be a big challenge to the design teams at this point.

Multiple or Single Users

The three design concepts are balanced when it comes to the quantity of users. Memory Stamps can be used to retrieve and store memory cues in a group session, but the photo frame can be used by individuals for storytelling. What are the Odds describes a product that preferably is used within a (small) group, whereas Momentum is an object that can only be used by a single user for capturing memories, but can be used for multiple users to reminisce.

Two concepts focused on reminiscing in a group in order to build and strengthen relationships. Users would be sharing their distinct views on an event, thus these concepts aim at an interesting area of autobiographical memory by providing different people with the same cues in order to build a story together.

The third concept tries to look at how a memory can be stored in a more complete sense. Taking a photo captures one moment, capturing memories with Momentum also records a series of events before and after the specific moment of capture. More cues are stored along with one memory thus creating a more complete and accurate record to remember by.

Since the design concepts support single and also multiple users, we may assume that the quantity of users does not have to be a difficulty when designing for everyday remembering. Reminiscing can be done individually, but when reminiscing in a group, relationships can be strengthened or memories enriched.

Pre-designed Artifacts

Both What are the Odds and Memory Stamps focus on cueing memories. However they both use predefined artifacts. Artifacts that are abstract and can mean different things, but still their appearance already suggests a meaning.

The visual cues that can be stamped onto a photo with the Memory Stamps are also images that do not have a personal value to the users. The users create a meaning of these visual cues by combining them with their own photo. The icons on the dice of What are the Odds are also predefined. Their meaning is left open, but they are already suggestive. The way users will interpret these icons or unfamiliar photos should determine how valuable these concepts are. If users prove incapable of expressing their memories through these cues, other methods will have to be explored in order to get the concepts to function as intended. On the other hand, Momentum uses very blank, abstract media to store personalized memories. The way memories can be stored makes use of a couple of different parameters (length of capture, speed of capture, main shot). Users can personalize the artifact through these parameters. Would this be enough personalization for users to express themselves?

When designing artifacts for concepts that support everyday remembering, it turns out to be hard to keep them clear of

any suggestive meaning. Momentum succeeded in leaving the medium to communicate meaning about memories completely blank. Both other concepts deal with media that already exist and function as a platform to interact with memory artifacts, thus limiting the ability to stay clear of pre-designed elements.

The Value of Embodied Interaction to Storing Memories

Embodied interaction can be used as an approach for giving the user the opportunity of subscribing value to tangible objects that are coupled with digital data. Each of the concepts show how the user is engaged in creating meaning between digital media and the physical artifacts through the interaction. Although each concept differs in how this is achieved we assume that their embodied approach gives meaning to these physical artifacts and strengthens the (emotional) link with the intangible digital media.

Digital cameras have made photography, and with it the storing of visual memory artifacts, easy and accessible and photos are being taken in high quantities. In all three concepts described, there is a decrease in this quantity of memory artifacts. This raises the question: does a decrease in quantity result in an increase of emotional value subscribed to these artifacts? By having fewer artifacts to retrieve a memory by, we believe these few artifacts automatically become more valuable. By working towards less memory cues, the cues left will have to become more effective in triggering memory.

Having to focus richer cues onto a single artifact increases the effort a user has to put into the activity of storing a memory. Contrasting today's digital photo abundance, fewer artifacts are synchronous to past printed photographs, which were expensive and rare. When users put more effort in such an artifact, they may also become more attached to it. We assume that because of a bigger effort in the creation process, the memory will be stronger connected to the artifact and thus easier to cue. The effort can be found in different phases of the memory related activities. E.g. an increased effort when capturing a memory may result in the user attributing more value to this capture. This is explored by the Momentum concept, which aims at making the storing activity more effortful, the moments to use the device will probably be chosen more carefully.

In both the other two concepts, memory cues are basically stored in the form of digital photographs. However, the way of browsing through these photographs and giving them labels adds value through effort. The strength of these two concepts lies in retrieving memories.

The Value of Embodied Interaction to Retrieving Memories

Two concepts in our case studies are especially focusing on retrieving memories. Through the ideology of embodied interaction, these concepts bring people together to recollect memories in a social and playful manner.

In the concept What are the Odds tangible artifacts are used to create an interface for browsing through photos. At the same time these artifacts can be used for playful interaction to retrieve memories in a game setting. Both functionalities of the dice can be used to give meaning to the photos when recollecting memories.

Memory Stamps is a concept that uses embodied interaction to give its users more opportunities for retrieving memories through one photograph. In a social setting, multiple users can collectively build on a complete photo of an experience around one item (combining all their memories).

From our explorations we believe that using principles of embodied interaction in developing an interaction to retrieve memories may increase the experience and involvement of the user with digital media. Through embodied interaction, the user would be able to add emotional value to items that are infeasible and therefore used to be hard to relate to.

Because memories are in their essence personal, embodied interaction seems suitable for dealing with memories. Users will start relating to tangible artifacts in a personal way, while these artifacts in their turn are closely linked to a digital world. Just like memories, digital media are often hard to catch without seeing. Embodied interaction and memory retrieval seem like a natural combination [e.g. 11].

How Embodied Interaction Adds Value to Records of Moments

Whether it is through evaluating a photo in different innovative ways, adding cues or capturing the moment in an innovative way; does this change the awareness around capturing the moment?

In the beginning it probably would not. But when users become familiar with the method of processing their photos, they can start taking this into account before it will be processed. This means that awareness will grow towards the moment of determining whether and how to capture a moment.

When one of the discussed concepts would be used over a longer period of time, one could imagine how user and concept grow together. The more experience the user has with the concept, the more personal the meaning the user will be able to give to both the concept and the records of memories collected through this concept.

Creative Freedom in Embodied Interaction

Overall we assume that by giving the users more control over the way they use memory artifacts, they get more engaged in the activity of remembering.

Because the users can be creative with stamps, tags and capturing in the concepts we discussed, they will probably take a more active part in remembering and also the social context of remembering. This way, applying principles of embodied interaction may contribute to a more active and creative way of reminiscing alone or in a group.

DESIGN RECOMMENDATIONS

When using the principles of Embodied interaction for designing for or with autobiographical memories, these are some aspects to pay attention to.

What is Graspable about Memories

Memories are not stored like photos or movies; they are merely recollections of an image triggered by several cues, which makes designing for, and with, memories hard. When designing for everyday remembering, it can help to look at the subjects you can grasp. Cueing of memories can be done in many different ways and offers a great design opportunity. Cues can be multi-modal and recording, modifying, collecting and recollecting is often possible through concepts such as the ones in our explorations.

Open for Interpretation

Most of the principles of embodied interaction point in this direction. Since memories and especially memory cues are so open to discussion and seem to alter all the time, it helps if a concept provides room for interpretation.

Ideally meaning can arise on multiple levels of the concept. This meaning can be provided by the designer, but if the user is able to create and communicate his or her own meaning, the concept will be a stronger way of working with personal memories.

Creating Meaning

Traditionally designers have been assigned to create meaning for users to work with. Embodied interaction challenges designers to rethink this strategy and consider giving the users the ability to create meaning themselves.

Our design explorations show how concepts can give the user the freedom to create and communicate meaning of (parts of) the products. When designing for everyday remembering, this freedom is what we assume to enable a strong relationship to grow between user and product. Because embodied interaction is also about coupling the digital and physical world, a good relationship between user and product may lower the threshold for users to trust digital storage of memories.

CONCLUSIONS

The focus of this paper was on designing for autobiographical memory whilst paying close attention to the principles of embodied interaction as described by Dourish [5]. Three case studies were created in order to study the potential of the combination of these two fields. We found that there are many opportunities for designing for everyday remembering. Some of the principles of embodied interaction are particularly suitable to apply on such design concepts. However, the major difficulty in designing for and with autobiographical memories lies in dealing with ungraspable objects. Memories are impossible to access directly, so when designing for the human memory, the only thing a designer can do is look at the opportunities to work with memory cues or create platforms

for users to express or store their memories. Making it possible for the user to be creative and express themselves through memory artifacts seems to be important when designing for memory.

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