Map – making: designing a mobile application for enhancing memories' retrieval

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MobileHCI '15 Adjunct, August 25-28, 2015, Copenhagen, Denmark
ACM 978-1-4503-3653-6/15/08.
http://dx.doi.org/10.1145/2786567.2794318.

Abstract
In this paper we aim to explore how memories can be tied to the context in which they take form and how the process of remembering can be triggered by spatial cues. Through two usage scenarios, we propose the concept of a mobile application that is able to enhance the reminiscence of past episodes, by mapping them on the places in which they happened. The final aim is to provide a "qualitative" representation of the user's spaces, where their physical properties, such as sizes and distances, are merged with user's personal experiences, emotions, values and priorities.

Author Keywords
Quantified Self; Personal Informatics; Cognitive Quantified Self; Memory; Cognitive Enhancement.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Nowadays, the diffusion of new digital devices able to gather, store and feed back personal data in an inexpensive and transparent way is opening new horizons for Quantified Self, i.e. the possibility of

monitoring one's own behaviors through technological means (also known as Personal Informatics). Self-tracking technologies can provide users with self-awareness potentially triggering processes of change in their attitudes or behaviors [2, 3]. The current spread of commercial wearable and mobile tools allows people to gather a plethora of data also related to private and "internal" states, such as thoughts, feelings and memories, which were previously hard to collect in the moment and in the place in which they were experienced. Now they can be recorded immediately and in the environment where they occurred [0].

Storing and retrieving these "cognitive data" is an interesting open issue for Human Computer Interaction (HCI) and Design research: many discussions are ongoing on the most effective ways for managing and presenting these pieces of information to enhance cognitive processes, such as attention [24] or memory [23]. If the chance to have a large set of personal data to be manipulated and exploited represents an unprecedented challenge and opportunity for the design of future Quantified Self services, it requires their management and organization in relevant and expressive ways to make them meaningful for users and to enhance their cognitive capabilities. Hollan [0] suggests to couple these advancements in the collection, management and visualization of personal data with the current theoretical shift, in cognitive sciences, toward a perspective that sees cognition as embodied [3, 5, 6] and situated in a context [7, 8, 9]. Developments in digital technology create potential for new tools to analyze how cognition is embedded in concrete contexts of human activity and how it extends beyond the skin and skull of the individual [0].

Building on top of these insights, we aim to explore how memories can be tied to the context in which they take form and, in particular, how the process of their reminiscence can be triggered by leveraging the connection that past events have with the spaces in which they have occurred. By discovering the cues that can enable the reminiscence process, we propose the concept of a mobile application to enhance human memory, allowing a more meaningful and vivid remembering of the users' past experiences.

Background

Recently, HCI researchers have tried to support the process of registration and recover of personal experiences, proposing interfaces and devices for recording and recollecting memories. To this aim, mobile and wearable technologies were designed (e.g. MyLifeBits [10], SenseCam [11] and Eyetap [12], Narrative Clips[1]). These works aimed to the complete recording of the experiences of a human being with the purpose of providing tools that could enable a "total recall" of the past. More recently, Van den Hoven et al. [13] reviewed how researchers explored the role of HCI in designing for personal memories, e.g. carrying out fieldworks for exploring the practices connected to the preservation of memories [15], developing novel devices for remembering [14] or tools that support recollection with memory aids [26].

Taking into account the previous studies we propose to investigate how HCI can support the episodic memory and the process of reminiscence that can favor the reliving of a specific episode happened in the past.

[1] http://getnarrative.com/

Episodic memory is an individual registration of past experiences, which stores episodes located in a time and in a space [17]. When retrieving this type of memory, individuals can experience a sort of mental time travel, in which they can vividly re-experience a past event [18]: this reminiscing experience includes contextual details, mainly connected with what, where and when [19].

We claim that in order to foster the reminiscence process through a QS system, an essential element is represented by the context in which the event to be remembered took place. In fact, memories are registered in connection with a context that must be part of the retrieval stimuli for a good recall [21, 27]. The importance of the context when designing for Quantified Self and Personal Informatics tools has been previously explored by Li [20]. The researcher has been highlighted that a tool, which allows users to associate contextual information with behavioral data, can better reveal factors that affect behavior, compared to systems that only show behavioral information.

We want to investigate how QS systems can exploit these contextual factors to support the remembering process favoring in this way the reliving of past experiences, stressing new forms of representation and visualization of these stored data. This perspective goes on the line of the idea that memory is not a repertory of well-defined and well-structured abstract symbols, but it is embodied and situated in a context [22].

Spatial cues to enhance memory retrieval

Our work proposes a system for helping people to retrieve their memories. Our efforts are focused on creating a link between contextual details and memories. Following Cosley et al. [16], we propose the idea that personal digital contents and social media contents can provide users with a way to stimulate the process of remembering. Cosley et al. suggest that contents coming from social networks, such as Facebook posts and status updates are able to activate memories retrieval. In particular, they underline that these posts are tied to three main components existing in people's everyday life: people, context and experience. These three parameters define the meaningfulness of a memory, by combining the value of important experiences, the elements that remind users of people they wanted to reminisce about, and the details that are specific enough to recall their context, in order to form a representation useful for remembering. Leveraging on the user's attitude to interact with digital applications in her everyday life it is possible to incorporate the gathering of these information into existing practices, as reading email [29], sending messages or, in general, editing textual documents [30].

We want to combine people, context and experience highlighting the elements that connect a specific episode with the surroundings spaces in which it took place. We think that spatial cues are extremely important to activate the process of remembering, as spaces are strongly tied with the personal experiences of the individuals that inhabit them. To this aim, we intend to exploit also the contents coming from user's social networks, such as Facebook, Instagram and Flickr, connecting them with additional data automatically gathered from her smartphone, or added by the user during the memory recording, especially the photos she has taken.

Figure 1: In this image, the user visualizes an overview on her personal map. The color of the path is defined according to the different emotional tags.

Investigating people and spaces

To investigate how spaces are related to people's memories and whether they can encourage reminiscing, we conducted semi-structured interviews. We recruited 16 participants between 20 and 50 years old [32]. The interviews focused on how personal experiences are tied to the participants' environments. During the interviews, we asked about e.g. their relation with their city, which kind of technology they use for interacting with their everyday surroundings, which are the thoughts and the emotions they feel when they return to a place in which a significant episode of their life happened in the past. Our scope was to understand how people relate to the spaces in which they live, which are the details that make them remember their past and how these spaces are connected with their emotions, in order to single out those spatial elements that could activate reminiscence and, by and large, understand which kind of relation tie the individuals to the spaces they inhabit.

Results showed the significant role that spaces cover in the individuals' lives and how they are able to trigger the remembering of a variety of personal experiences [32]. They highlight how spaces embody a number of meanings, thoughts and emotions connected with the people's past, so that they can appear as an extension of their identity and memory. Stressing this relation, we want to design a mobile application able to stimulate the remembering by encouraging the creation of an 'emotional cartography' [33], in which cognitive states, such as user's memories, are mapped on the physical spaces in which they took place, highlighting the emotional states that characterized those past experiences. To further stimulate the remembering process we propose to connect these maps with different contents, automatically collected by the user's device, self-reported by her and retrieved from her social networks, which can function as memory cues.

Mobile application: scenarios of usage

We aim at developing a mobile application for enhancing memories' retrieval exploiting spatial cues. The functions of the application can be described using two main interaction scenarios: storage and retrieval.

Storage scenario

Storing a memory occurs by using a mobile app. During the registration contextual data are added to the memory both automatically and through self-reporting: time, position [28], weather conditions of the external environment and additional information manually added by the user, such as notes, feelings, pictures, and other media (videos, music, etc.) related to the specific event to be recorded, also focusing on her mood and the social activities that she is doing (e.g. talking with friends, eating or drinking something). As an additional feature, the application has a sharing function that allows a user to communicate the memory recorded in order to create an open shared memory.

Thus, the memory becomes an instrument to create an uninterrupted exchange among different users and between people, places and personal experiences, through a continuous enriching dialogue (e.g. other users can comment the memory recorded or the place in which it happened). By storing these intertwined data it is possible to collect a complete and meaningful memory experience. The gathered data will then allow the user to relive her experiences in the future.

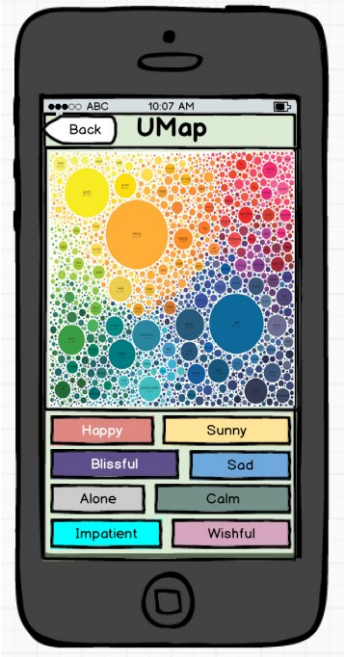

Figure 2: This image is an example how the user could visualize an emotional view about the spaces according to the colors established for the different emotional tags.

Retrieval scenario
When the user wants to retrieve her past experiences she can visualize them in aggregate forms, in which the memories stored are mapped onto the physical places in which they have happened. To enhance the retrieval process we propose to combine different perspectives in order to generate a new representation able to activate episodic memory [34].

Firstly, we analyze the power of geographical maps as tools to represent space in an objective way as showed in Figure 1. In particular, they provide a static visualization of the space, which constitutes a shared and objective perspective on the environment. However, we do not want that the spatial map of the user's memories is addressed to match the user's experiences with abstract or aseptic spatial coordinates (e.g. this memory happened on the 7th street); instead, it is aimed to provide meaningful cues able to trigger the reminiscence process as showed in Figure 2. In addition to the data automatically collected by the user's smartphone, the system provides the thoughts and the feelings that the user explicitly connected with that place during the memory recording process. The system further visualizes the contents she produced on her social networks in that specific day, in order to enrich the spatial context in which the memory is positioned.

Furthermore, the map itself is not designed as an abstract and "flat" one. Instead, it highlights the landmarks that characterize a particular space (e.g. the important buildings in a city, or the places that the user frequents more often), representing how they are bonded with the user's memories. For example, by applying specific visualization filters, it would be possible to visualize how much memories are recorded in different places, making the user aware of the role that they had in her life.

Alternatively, the system could represent how these significant places are tied to the user's emotions and moods, or to those of her significant others. In particular, the system can map the photos that users took in the past, superimposing them to the spaces in which a user moves. Unlike the maps, photos provide a subjective point of view on the spaces, focusing on some of its features depending on the subjective perspective of the photographer. The human point of view becomes then the compass to give coordinate and orientation of a single spatial element. In this way we can generate an innovative version of the emotional cartography [33], where the physical properties of the spaces (sizes, distances, etc.) are merged with the user's personal experiences, emotions, values and priorities.

The final aim is to provide a "qualitative" representation of the user's spaces, highlighting how they are deeply related to her memories. By interacting with these personal maps, people will be allowed to experience for the second time their past episodes, feeling the relationship that connect them with the places in which they happened.

Another possibility for the user of reliving her past is when she physically returns to a place where a memory was registered some time before. The mobile application pushes some brief indications about the memory she recorded in that specific place, connecting the virtual representation of the experience she lived in the past with the materiality of the space she is moving

through. From this access point the user is free to explore the information connected to that space, as other memories she recorded in a different time or the social network contents related to it. Finally, the user is also allowed to manipulate these memories and spaces in order to create detailed stories to be shared with friends or through social networks.

Conclusion

The aim of this work is to enhance the remembering process by connecting personal experiences with the spaces in which they took place. By stressing the emotional bond between people and spaces we wanted to highlight how memory is embodied in the surroundings in which people live.

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