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# There is More to Well-being than Health Data – Holistic Lifelogging through Memory Capture

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## Abstract

With the recent wave of commercial sensing devices such as *Fitbit* step counters, *Lark* sleep monitors, and the *Withings* scales, the quantified self movement gained quite some traction. With Electroencephalography (EEG), eye trackers and document retrieval algorithms it is even possible to track mental activities such as reading. The wide range of available sensing technologies and their increasing pervasiveness allow us to draw a holistic picture of a user's activities. In this paper we describe explicit and implicit approaches that we currently use to track physical and mental activities and to record memory. We conclude with a summary of open discussion points about the approach and feasibility of logging such holistic life data.

## Author Keywords

Memory; quantified self; capture

## ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

## Introduction

Thanks to the ubiquity of smartphones and the rise of available, wearable technologies, large-scale data collection has become very popular. People log their daily

steps with commercial products such as *Fitbit*<sup>1</sup> and keep track of their activities and locations using apps like *endomondo*<sup>2</sup>. Gordon Bell [1] went even further and made it his mission to attempt to record his entire life: images, sounds, videos as well as personal documents. He pioneered the trend towards lifelogging applications that has been supported by research projects such as Microsoft's *SenseCam* [2]. Whereas technologies such as *Fitbit* are aimed at collecting quantitative data about movement and health to set incentives for improvement, the *SenseCam* serves as memory aid by automatically capturing a digital record of the wearer's day.

Further, attempts have been made to recognize activities, such as walking, running or sleeping by making sense of smartphones' accelerometer data [3]. The quantified life is not limited to only physical activities though. Kunze *et al.* introduced a system that used eye tracking in combination with image retrieval techniques to track what and how much people read in their daily lives, thereby creating the *wordometer*[4]. Kunze describes this development of tracking such activities for the mind as the 'trend towards a cognitive quantified self'.

Taking together the logging of physical and mental activities and combining them with a life log of moments and memories we are getting closer to a holistic quantified self. In our work we investigate such a holistic approach to strengthen and augment human memory. In a recently started EU project called *RECALL – Augmented Human Memory* we aim to re-think and re-define the notion of memory augmentation. Therefore we are building tools for recording memories and enforcing them through technology.

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<sup>1</sup><http://www.fitbit.com/>

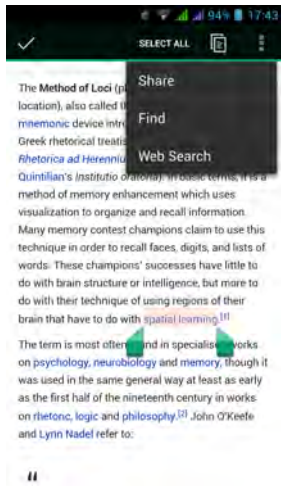
<sup>2</sup><http://www.endomondo.com/>

## Memory Recording

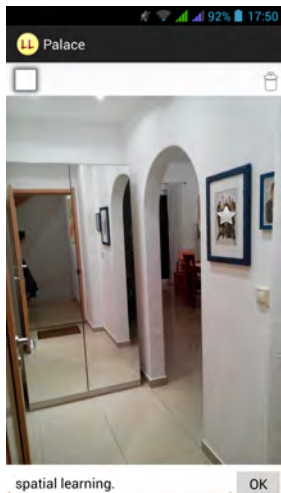
Recent developments in capture technology and information retrieval allow for continuous and automated recordings of many aspects of our everyday lives, both physically and mentally. We are currently creating concepts and building prototypes that attempt to harness these trends and develop a new paradigm for memory augmentation technologies that are technically feasible, desired by users, and beneficial to society.

### *Explicit Recording*

Whenever we stop to capture the moment by taking a picture or video, we explicitly take a snapshot of that moment. Hence, explicit recording entails the conscious attempt to record a memory. Posting on Twitter, Facebook or Instagram would be considered a conscious effort to communicate a thought, experience or feeling. When users make the conscious decision to record a moment or content item, they should have an appropriate tool at hand to do so. We have been experimenting with different approaches concerning user dialogues that are user-triggered and walk the user through a sequence of tasks to be completed in order to record a moment. Therefore, we built an Android app that allows users to capture moments by displaying a wizard asking the user to perform a sequence of actions, such as taking a picture, recording an audio snippet, video or composing a note. The app artificially limits the available time for conducting each step to avoid lengthy interactions. We are currently working on enhancing the app to include the user's momentary mood, song, place, surrounding people or feelings. The recorded memory is locally stored and can be retrieved later by searching or browsing. Additionally we are working on an automated quiz generator using these memories to attenuate memories and support long-term memory transitioning.



**Figure 1:** Copying website content into the user's *memory palace*.



**Figure 2:** Inserting content into a user's custom location

Further, we are looking at mnemonic techniques that are suited to be applied to a technologically supported application. The method of Loci, for example, is an efficient way to store data in the human long-term memory and is widely spread under memory competitors. It works by visually organizing information in imagined spaces of a mental environment - so called *memory palace* -, which makes it easier to recall items and keep them in order. We are currently developing a prototype that aims at making the method a valuable everyday tool by reducing the effort of building a *memory palace* anew, hence bringing down the mental overhead. It works by allowing users to take pictures of their favorite locations (e.g. living room, garden) and fill these places with custom content, such as text, pictures, links or documents. By extending the sharing capabilities of the browser, users can easily place items they come across online into one of their locations (Fig.1, 2). Again, we use a quiz format to prompt the user to recall contents from certain locations.

With explicit memory recording there is, however, a trade-off between enjoying a moment by being fully focused at it, and making the decision to record it by taking out a device and go through a designated sequence of steps. Between un-obtrusiveness and memorability there is a sweat spot, we believe, which we are aiming to find.

#### *Implicit Recording*

To make sure the focus of attention is where it is needed - the current moment, the currently read article - explicit tools for memory capture may not be the best solution as pointed out. The time required to take out the phone or camera, aim it at the object of interest and make that picture to retain that moment often times disrupts the

enjoyment of it. Other times we only realize that a moment or detail was worth capturing when it has passed. Therefore we are looking at implicit ways of logging data that can be automatically collected from the user or the environment. Aforementioned devices, such as *Fitbit*, allow a constant logging of movement data. We can further infer from smartphone and app usage who a person interacted with over the course of a day, what events went by recorded by the calendar, or which locations were visited during the day.

Additionally, services like Facebook, Foursquare or Twitter provide us with APIs to retrieve user activities. From this data we can construct a summary of distinct events a person experienced over the course of a day, week, month or year, thereby creating digital memories that can be indexed, searched or browsed later on. Context awareness is highly beneficial as it allows us to infer what state a person is in or which application is currently pre-dominant on the user's phone [5]. We are currently developing a modular technology platform that pulls information from all kinds of services and bundles them into a digital memory system.

### **Challenges of a Holistic Quantified Self**

Combining implicit and explicit data capture to end up with a life logging solution that comprises both physical and mental states of people requires tackling a number of challenges.

#### *Meaningful data*

Meaningful data heavily relies on the data quality and the legitimacy of conclusions we draw from them. This is especially true for implicitly collected data, where inferential conclusions may be ambiguous.

### *Technology constraints*

There are constraints on what we can track when it comes to physiological and psychological activities. Despite the progress made regarding tracking physical data, tracking mental activities is still suffering from numerous limitations: eye trackers are used to capture users' attention focus and Electroencephalography (EEG) is used to record the electrical activity along the scalp. Unfortunately, these techniques only give us a partial picture. Additionally, we still have to accept the fact that certain values are simply not attainable in a non-invasive way with current technologies (i.e. blood sugar levels, kidney values).

### *User acceptance*

We may design software as well as hardware in order to support human memory. In the end it is still up to the user and her willingness to actually use these technologies in order to decide whether they are feasible, effective, usable and fashionable. To reach user acceptance, these technologies will need to be unobtrusive, non-invasive and informative when it comes to the presentation of the data that they are logging.

### *Call to action*

Simply collecting data and inferring activities may not be enough. The way this data is processed and presented is crucial. Data alone is useless until we derive some meaning from it and give the user actual information about her state, progress and possible goals. Intelligent algorithms come into play when it comes to making meaning of data and deriving concrete user recommendations on how to change behavior regarding health practices, fitness or environmentally sustainable choices.

Concluding, there is always room for discussion whether

holistic logging is a good idea in general. The moment we leave it up to algorithms which moments we are actually going to remember, brings up a range of ethical questions. Which memories should be attenuated?; which ones should better tried to be forgotten?; and is there forgetting in a system that nearly never runs out of memory space? These are the issues we are trying to explore through both technological prototypes and active discussions.

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