How to continue sustainable user engagement with perpetual photo archives through wearable camera

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Abstract
Sustaining user engagement is an important criterion for a success of life-log devices. However, wearable camera seems have not extended out beyond its initial adoption due to its voluminous photo data collected. This paper presents a brief overview of challenges and opportunities of photo archives from wearable camera, by which highlights what would be the key to design personal archives for wearable camera users.

Author Keywords
Episodic memory, sustainable user engagement, wearable camera, personal photo archive, sense-making

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

Introduction
Although technically significant advances have been made on wearable devices, they still face significant challenges to sustain users' engagement for a long term. Recently, a technical paper reported that one third of fitness tracker (i.e., Fitbit™, Jawbone Up™) users in the US stopped using the device within six

months [10]. This implies that technical innovation does not often warrant user's long-term adoption [8, 10], and an innovative service such as a personal information management (PIM) tool should be followed to reach out to the next level of value creation from the user.

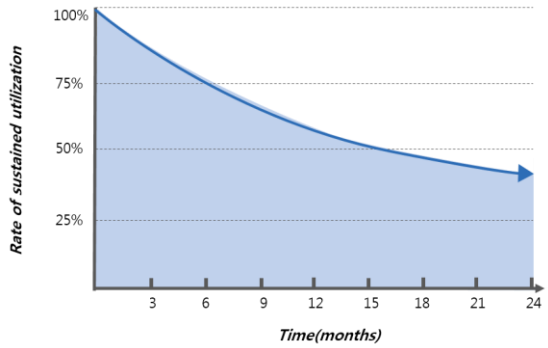

Figure 1 Declining rate of sustained fitness tracker use over ownership (from Endeavour Partners, 2013 [10])

Wearable camera such as SenseCam™, Narrative Clip™ captures the user's surroundings every few seconds. It generates voluminous data that could vividly and continuously collect one's daily life. This technology initially attracted many early adopters, however, the management (or service) of the voluminous photos was difficult (note that most wearable cameras do not provide proper photo viewer systems which could effectively assist the user's navigation of the bulk data) [4, 9, 12, 14, 16]. Crete-Nishihata *et al* [5]. claimed that personal memory technologies should not be a medium for recording and delivering the "*facts of a life*", but for supporting one's meaning making for their past. In this regard, understanding one's hermeneutics of the photo collected is a key to developing a PIM tool for wearable cameras. We, in this paper, are interested in what users specially reminiscence among the whole set of collected data and how the PIM tool could then meet the differently forming individual's needs.

What is the meaningful photo for the user?

The current target users of the wearable camera are those who want to reminiscence their meaningful moments from their picture data. This is not a new research topic. There are several research studies that try to integrate wearable camera and physiological sensors such as EEG (i.e., NeuroCam™) and GSR [11] to capture user's emotional moments at the time of picture-taking. Moreover, with 'Deep Learning' techniques, several research studies suggest computational algorithms that could filter out the special moments [1, 3] by analyzing the superficial features of the photos (e.g., kinship or friendship detection is newly suggested). However, Whittaker *et al*. [15] argued that the photo is a '*very high subjective value'*, which pointed out one's personal episodic memory is very subjective and tends to be reinterpreted by sense-making whenever they review the photos. Therefore, simply technology-oriented approaches do not seem to satisfy the user's needs in reviewing their photo archives. A qualitative approach to understand the user's sense-making of their meaningful photos should be considered.

Our previous study [9] found that people are likely to determine their meaningful photo with implicit meaning (i.e., subjective information, mood, social relationship, etc.) rather than explicit meaning (i.e., scenery, location, aesthetic of photos, etc.). Further, the way users are trying to sense-make their meaningful photos is gradually changed as time goes by. That is, when

they instantly recall their photos and choose their meaningful photos, most of them choose the photo by its explicit meaning. However, as time passes (e.g., one year later), only 7% of them consider the same explicit meaning, compared to 60% of them used implicit meaning.

How PIM could meet the wearable camera users' needs as time passes?

Personal Information Management activities assist to "*establish, use, and maintain a mapping between information and need* [7]" which could be required to sustain user engagements for long. However, many photo archive systems of wearable cameras are mainly focused on 'ease-of-use' and 'simple and intuitive' interface design rather than a user's subjective sense-making context [2]. In effect, most of them simply serve as a passive photo viewer which can sort the photos periodically or (if it is advanced) categorize the photos depending on the location or the objects they were taken.

The trace of the artist' changed mind in a painting is called '*pentimento*'. This term could also represent our episodic memory process. We often reinterpret and reconstruct our past experience with the current thoughts and status [13]. For instance, the hard experiences of the past becomes confidence creators depending on their current context, by which sometimes reminiscing about the past becomes a catalyst for resilient well-being [6].

We believe that the personal photo archives for wearable cameras can be a *reflection* channel, which gives users opportunities to look back on their meaningful time with vividly recorded memory supports. To empirically validate this, we actually tracked down a one-year reminiscence process on the data collected from twenty people, and confirmed that their sense-making process is changed over time, but some qualitative features of the photos (e.g., social relationship with people in photo, rare events, related to the past-self/future-self) would be more strongly sustaining than the others for this sense-making process.

Conclusions

The voluminous collected data is problematic if PIM effectively and efficiently control user engagement. Delivering the entire captured data becomes more burdensome than what it can provide for user's value.

With these concerns, we conducted a one-year longitudinal user study to understand user's sense-making of photos as time passed. Based on this finding, we tried to develop several design guidelines for the photo archives from wearable cameras with both qualitative and quantitative pathways. Some of the answers have been revealed on what makes meaningful photos, how the meaningfulness of the photos changed over time (but limited to one year), and whether the meaningful photo affected the user's reminiscence outcomes.

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Personal Biography

Ahreum Lee is a Ph.D candidate in Imagine Lab, Hanyang University, Seoul, South Korea. Her thesis is about how to figure out one's meaningful photos among the whole captured data from wearable camera. With a one-year tracking data, she has been building up a dynamic taxonomy of one's meaningful photos as time passes.

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