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# Framing Design of Reminiscence Aids with Transactive Memory Theory

**Wenn-Chieh Tsai**

National Taiwan University  
No. 1, Sec. 4, Roosevelt Rd.  
Taipei, 10617 Taiwan  
d96944012@ntu.edu.tw

**Hung-Chi Lee**

National Taiwan University  
No. 1, Sec. 4, Roosevelt Rd.  
Taipei, 10617 Taiwan  
d99922020@csie.ntu.edu.tw

**Joey Chiao-Yin Hsiao**

National Taiwan University  
No. 1, Sec. 4, Roosevelt Rd.  
Taipei, 10617 Taiwan  
r99922012@csie.ntu.edu.tw

**Rung-Huei Liang**

National Taiwan University of  
Science and Technology  
No. 43, Sec. 4, Keelung Rd.  
Taipei, 10607 Taiwan  
liang@mail.ntust.edu.tw

**Jane Yung-jen Hsu**

National Taiwan University  
No. 1, Sec. 4, Roosevelt Rd.  
Taipei, 10617 Taiwan  
yjhsu@csie.ntu.edu.tw

**Abstract**

This work aims at designing reminiscence aids that help people remember meaningful events. With an epistemological stance of research through design, the framing of the Oblivescence Board was informed by theories in social psychology and psycholinguistics. We brought a neglected drawback (i.e. forgetting) of a transactive memory system to the center of a reminiscence dialogue, where an embodied negotiation of common grounds was constructed out of a visualization metaphor. The qualitative results from a field experimental were gathered to reframe our future direction. Several design implications are also addressed to identify the opportunities for the future work. We argue that a reminiscence aid should (1) evoke curiosity and empathy for shifting responsibility, (2) provide embodied metaphor to communicate personal significance and system's expression, and (3) interweave reminiscence activities into daily practice.

**Author Keywords**

Reminiscence aid; transactive memory; common ground; research through design

**ACM Classification Keywords**

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

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### Introduction

In everyday practices of individual and social reminiscence, our personal values and goals shape our autobiographical memory, which functions to construct and maintain our personal identity and self-concept [2]. From a constructivist viewpoint, reminiscence could be seen as a dialogue between the existing self and the past self. In this dialogical activity, digital mementos are often served as resources not only for remembrance but also for reflection and construction of new meanings [4]. At the same time, the responsibility of remembering has been gradually shifted from human onto external memory systems [10]. Indeed, the advantage of access to an enormous range of information does not encourage us to keep valuable memories on our own.

Nowadays abundance of captured digital media comes from well-designed tools with accessibility and usability. In addition, it is of less effort and cost to keep these data than to delete or organize them [5]. The consequence of storing everything “just in case” causes us much trouble at organization and retrieval when we depend more and more on external memory aids. Therefore, numbers of new technologies automatically provide meanings for levels of abstraction from signals and metadata of digital media in order to “mine” our collections [11]. Those objective meanings are indices and entries of factual data when we recollecting with memory aids. However, personal value plays a more important role in retrieving memories from the perspective of reminiscence. Pensieve, for instances, encompasses a dialogical emailing mechanism to elicit a conversation with users’ past selves represented on social media sites [8]. Lifelogging technologies actively

log users’ life and help users recollect their past, sometimes, with a different perspective [4].

In this paper we describe our research on how to design reminiscence aids not only to keep digital mementos being value-laden through interaction with users but also to help users keep meaningful memories in their own minds. Our epistemological stance in this research is research through design [13]. Firstly, our designed digital artifact was informed by the *transactive memory* theory in psychology [12] and *common ground* proposed in psycholinguistics [1]. We brought a neglected drawback (i.e. forgetting) of a collaborative memory system among humans and their external aids to the center of the interaction. The hypothesis is that the embodiment of system’s limited capacity could encourage humans to take the responsibility of remembering. Then, the results and experiences from an experimental field study and qualitative user interviews were gathered to reframe our future direction. Lastly, we output an example and several design implications for reminiscence aids.

### Theoretical Perspective

*Google effect* [10] reveals that information systems implicitly guide the performance of human acting and their mindset; on the other hand, users also actively have their own strategies of adopting their technologies [6]. Those studies remind us to focus on where interaction happens and exploit the meaningful actions people perform after they understand the system’s capacity. The following two theories informed us at anticipatory framing.

A dialogue is and needs to be built on common grounds. The common grounds dynamically reveal the understanding of each other’s knowing in the conversation.



**Figure 1:** The Oblivescence Board.

Grounding is an explicit informing process through language using [1]. It builds the shared knowledge among group members. Moreover, it is also an opportunity for negotiation on personal values and preferences. This perspective informed us that if a reminiscence aid would like to join a reminiscence dialogue, we should provide an explicit channel for communication and negotiation between human and reminiscence aid. For example, the level of significance of a digital memento stored in the reminiscence aid could be visualized as an understandable metaphor. Through the metaphor the level can be negotiated. On the one hand, we could provide our designed system with a “self-expressive” behavior on the metaphor represented. On the other hand, users can still alter this representation through interaction with the reminiscence aid to express their preferences.

We would like to elicit responsibility for remembering from users. Transactive memory theory gave us a pre-understanding of a phenomenon in a collaborative memory system and how it is constructed. The development of a transactive memory system begins with awareness of the relative expertise of self and partner in a group, especially in dyads. The shared awareness is negotiated through an interpersonal communication and updating of information about who knows what. Then, new information is encoded, stored, and retrieved by people who accept the responsibility [12]. We gained insight from this theory and translated it into our design. For instance, we would like our designed system to show some limitations on its “memory” through the dialogical process with its user partner. Our intention is to implicitly encourage the user to take the responsibility of remembering, at least, of meaningful events.

### The Oblivescence Board

We situated our design in specific phases in the lifecycle of mobile picture, which are *sharing* and *viewing* [9]. It is a stage just after those digital mementos being captured and before being archived. We assume this stage as a main stage of meaning making since the owners might pay much attention on deciding the destination of their new collections while sharing with others. Besides, the social interactions around photos in the viewing phase might catalyze those meaning-making processes. Therefore, we chose a situated memory board located in a shared living space among close friends as our form for design.

The Oblivescence Board is a situated photo display with touchscreen designed to serve as a digital memory board for photo sharing among close friends who are living together. It has two main features in addition to a regular digital frame. The first feature is the *self-expression* of the limitation on its “memory.” We gave it an expression of “forgetting”, which means the photos on the board could be gradually faded like human memory (Figure 1). Once a photo is uploaded and shared on the board by users, its opacity, the analogy of system’s memory retention on this photo, is calculated according to the Ebbinghaus forgetting function on human learning efficacy:  $b = 100k / ((\log t)^c + k)$ . Where  $b$  is percent of memory retained, i.e. the percent of opacity of a photo,  $t$  is time in minutes since learning, and  $c$  ( $=1.84$ ) and  $k$  ( $=1.25$ ) are constants [3].

The second feature is its participatory action that responds to human’s dialogical action. A forgotten photo can be revived, i.e. resets to its full opacity and restarts the fading, if users “remind” the system by

tapping the thumbnail to view the photo in full screen. The coordination of the two features above is a negotiation process where users can determine which photo to show and the system can also understand which photo to forget. It is an extemporaneous conversation between human and system.

### **Field Experiment**

We adopted a cognitive approach in this research to test our hypothesis. Our general hypothesis is that if the limitation of memory of a system is embodied in a reminiscence dialogue, transactive memory would be formed and encourage users to remember more. A field experiment was designed for testing the event memory retention under each of the interventions, the *expressive* and *regular* representations of pictures on the Oblivescence Board. The expressive photos will fade according to the forgetting function; on the contrary, the regular ones will stay clear all the time. The experiential prototyping also unfolded a snapshot of the participants' daily practice of reminiscence through qualitative interviews at the end of the field experiment.

#### *Participants*

We recruited two 22 years old female participants who live in a same college four-person dorm room. These two participants are close friends and had studied at the same department for nearly four years. They are both familiar with digital camera and camera phone usage and usually take and share their photos on social media. Collocated sharing is another common strategy for them to share intimate photos, which are stored only in their own mobile phones, with their close friends. In order to join participants' reminiscence activity, the Oblivescence Board was placed in their dormitory room.

#### *Procedure*

To control the retention period for each memory event, we deliberately divided the experiment into two phases: *private phase* and *shared phase*. Before the experiment, participants were invited to an interview with us for an introduction to the study and instruction on a note-taking application installed on a smartphone that is used to collect event records in their private phase as their diaries. In the two-day private phase, participants were encouraged to use the smartphone to complete 50 event records with personal significance in their daily life. An event record should be composed of one photo and event description text. Just after the private phase, the two participants were invited to the second interview where the Oblivescence Board was introduced, and all collected photos were uploaded onto it and randomly assigned as expressive or regular representation. Two participants would equally receive two interventions. In the following three-day shared phase, the two participants were free to view and share their photos with each other or the other two roommates when they were nearby. After the shared phase, an individual final interview was conducted to test each participant's episodic memory for events sampled from the personal collection. Qualitative accounts of their experiences with the Oblivescence Board were also obtained.

#### *Measures*

We quantitatively coded and scored the prior text description entered in smartphones and the retrieved version written by participants in the final interview. Keywords appearing in the event descriptions were coded into eight categories: *people*, *event*, *time*, *location*, *object*, *emotion*, *feeling*, and *thought*. If there was one or more than one keyword in a category, this



category was counted as one point. Each category was either counted as one point or zero (no keyword in this category). Therefore, each description was measured by a nine-point scale (0-8) to represent its richness. For each intervention, all the two (prior and post) scores from a same sampled event were paired and statistically analyzed to test participants' memory recall after the shared phase.

### Results

In this pilot experiment, a total of 98 photos were collected in the two-day private phase. In the final individual interviews, ten photos (five expressive and five regular) were sampled from the personal collection for each participant to test event memory recall. Thus, for each intervention, we had ten pairs of coded descriptions. The Wilcoxon Signed-rank test, a nonparametric hypothesis test, was used. Interestingly, the outcomes are slightly different between these two interventions of photo representations. For the intervention with regular photos, it shows a significant memory decay after using the Oblivescence Board ( $Z = -2.271$ ,  $p = .023 < .05$ ). In contrast, there is no significant difference between the original descriptions and the recalled memories for those expressive photos ( $Z = -1.890$ ,  $p = .059 > .05$ ). The participants still kept event details in their mind. The results marginally support our hypothesis framed by transactive memory theory.

#### *The development of transactive memory*

We put participants' retrospective accounts from interviews next to the findings from data to look back to the lived life where the designed system participated. Firstly, we would like to know if the two participants behave differently while reminiscing with expressive and regular photos. We find that participants spend

different amount of attention on two types of photos, that is, the number of tap-to-view on these two categories of photos are significantly different ( $t = -12.248$ ,  $p = .000 < .01$ ). An average of 16 tapping times ( $SD = 3.658$ ) on expressive photos comparing with an average of 2 ( $SD = .667$ ) on regular ones might have different effects on increasing the strength of memory. From participants' accounts from the interviews, we also notice a self-awareness of this partiality. It started with an individual interaction with the system to understand its "behavioral pattern," i.e. the forgetful expression we provided, like one said, "*I first thought the fading feature would shift to the other photos, but later I found out it wouldn't.*" (SH)

#### *The building of common ground*

The richness of description (in the original event record) shows a positive correlation with the number of tapping during the three-day reminiscence ( $r = .468$ ,  $p = .037 < .05$ ). Therefore, it is not only our intervention but also the meaning inherited from the creation of valuable memory triggers that have the capability of shaping participants' reminiscence behavior and then keep mementos being value-laden. The personal value was reflected on represented photos through an embodiment of negotiation on "remembering."

### Discussion and Future Work

The results of the experiment shows that the Oblivescence Board can trigger users' curiosity, invite them to actively engage in, and implicitly encourage them to take the responsibility of remembering more of its "forgotten memories." Through an embodied negotiation between the self-expression of the system and the meanings in situ brought by the users, the dyads of user and system are formed as transactive

memory systems. In short, the Oblivescence Board is not only an information provider but also an inviter who encourage people to involve in a transactive memory system. Besides, several design implications are addressed as follows to identify the opportunities for designing digital reminiscence aids: (1) Evoke curiosity and empathy for shifting responsibility. (2) Provide embodied metaphor to communicate personal significance and system's expression. (3) Interweave reminiscence activities into daily practice.

For controlling the experiment, we deliberately emphasized that the ownership of the system only belonged to the two participants, that is, only the two participants could operate the Oblivescence Board in the dorm room. We should keep in mind that the complex relationships and interactions among people in the real world are the most important venue of reminiscence and transactive memories. Our future work could adopt a situated approach as a complement to unfold the phenomenon and "felt experiences" [7] of using reminiscence aids in one's real life. In the future work, mechanisms of not only remembering but also forgetting should be considered in a reminiscence aid.

### References

- [1] Clark, H.H. and Brennan, S.E. Grounding in communication. In L.B. Resnick, J.M. Levine and S.D. Teasley, eds., *Perspectives on socially shared cognition*. American Psychological Association, 1991.
- [2] Cohen, G. *Memory in the Real World*. Psychology Press, 2008.
- [3] Ebbinghaus, H. *Memory: a contribution to experimental psychology*. Teachers College, Columbia University, 1913.
- [4] Harper, R., Randall, D., Smyth, N., Evans, C., Heledd, L., and Moore, R. The past is a different place: they do things differently there. *Proc. DIS 2008*, ACM Press (2008), 271–280.
- [5] Hoven, E. van den, Sas, C., and Whittaker, S. Introduction to this Special Issue on Designing for Personal Memories: Past, Present, and Future. *Human-Computer Interaction 27*, 1-2 (2012), 1–12.
- [6] Kalnikaitė, V. and Whittaker, S. Software or wetware? Discovering when and why people use digital prosthetic memory. *Proc. CHI 2007*, ACM Press (2007), 71–80.
- [7] McCarthy, J. and Wright, P. *Technology as Experience*. MIT Press, 2004.
- [8] Peesapati, S.T., Schwanda, V., Schultz, J., Lepage, M., Jeong, S., and Cosley, D. Pensieve: supporting everyday reminiscence. *Proc. CHI 2010*, ACM Press (2010), 2027–2036.
- [9] Sarvas, R., Oulasvirta, A., and Jacucci, G. Building social discourse around mobile photos. *Proc. MobileHCI 2005*, ACM Press (2005), 31–38.
- [10] Sparrow, B., Liu, J., and Wegner, D.M. Google effects on memory: cognitive consequences of having information at our fingertips. *Science 333*, 6043 (2011), 776–8.
- [11] Sundaram, H. and Campbell, M. Event Mining in Multimedia Streams. *Proc. of the IEEE 96*, 4 (2008), 623–647.
- [12] Wegner, D.M. Transactive memory: A contemporary analysis of the group mind. In B. Mullen and G.R. Goethals, eds., *Theories of group behavior*. New York: Springer-Verlag, 1986, 185–208.
- [13] Zimmerman, J., Forlizzi, J., and Evenson, S. Research through design as a method for interaction design research in HCI. *Proc. CHI 2007*, ACM Press (2007), 493–502.